New York State Climate Action Council

Initial Draft Scoping Plan

NOT YET APPROVED BY

CLIMATE ACTION COUNCIL

FOR PUBLIC COMMENT

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Acronyms and Abbreviations

AEM	Agricultural Environmental Management
AGM	New York State Department of Agriculture and Markets
AgNPS	Agricultural Nonpoint Source Abatement and Control
ASHP	Air-source heat pump
AR6	Sixth Assessment Report
AV	Automated vehicles
BIPOC	Black, Indigenous, and People of Color
BMP	Best management practices
BOA	Brownfield Opportunity Area
BSM	Buyer-side mitigation
CALS	Cornell University College of Agriculture and Life Sciences
CCA	Community Choice Aggregation
CCE	Cornell Cooperative Extension
CDR	Carbon dioxide removal
CFCs	Chlorofluorocarbons
CJWG	Climate Justice Working Group
Climate Act	Climate Leadership and Community Protection Act
CO_2	Carbon dioxide
CPP	Conservation Partnership Program
CRF	Climate Resilient Farming
CRRA	Community Risk and Resiliency Act
CSRO	Chief state resilience officer
DASNY	Dormitory Authority of the State of New York
DEC	Department of Environmental Conservation
DER	Distributed energy resource
DG	Distributed generation
DHSES	Division of Homeland Security and Emergency Services
DOH	New York State Department of Health
DOS	New York State Department of State
DOT	New York State Department of Transportation
DPS	New York State Department of Public Service
DRI	Downtown Revitalization Initiative
EAM	Earnings adjustment mechanisms
ECL	Environmental Conservation Law
EFC	Environmental Facilities Corporation
EITE	Energy-intensive and trade-exposed
EPA	U.S. Environmental Protection Agency

EPF	Environmental Protection Fund
EPR	Extended Producer Responsibility
EQIP	Environmental Quality Incentives program
ESD	Empire State Development
ESF	College of Environmental Science and Forestry
E-TOD	Equitable transit-oriented development
GSHP	Ground-source heat pump
EV	Electric vehicle
FERC	Federal Energy Regulatory Commission
GEIS	Generic Environmental Impact Statement
GHG	Greenhouse gas
GSP	Gross state product
GW	Gigawatt
GWh	Gigawatt-hour
GWP	Global warming potential
HCFCs	Hydrochlorofluorocarbons
HCR	New York State Homes and Community Renewal
HFC	Hydrofluorocarbons
HVAC	Heating, ventilation, and air conditioning
IPCC	Intergovernmental Panel on Climate Change
ISCMP	New York State Invasive Species Comprehensive Management Plan
ITS	Intelligent transportation systems
JTWG	Just Transition Working Group
LDV	Light-duty vehicle
LGBTQIA+	Lesbian, gay, bisexual, transgender, intersex, queer/questioning, asexual, and other
LMI	Low and moderate income
mgd	million gallons per day
MHD	Medium- and heavy-duty
MMT CO_2e	Million metric tons of carbon dioxide equivalent
MOD	Mobility-oriented development
MPO	Metropolitan planning organizations
MSW	Municipal solid waste
MTA	Metropolitan Transportation Authority
MW	Megawatt
MWBE	Minority- and women-owned businesses
NGO	Non-governmental organization
NO_X	Nitrogen oxides
NPV	Net present value

NRCS	Natural Resources Conservation Service
NYCRR	Compilation of the Rules and Regulations of the State of New York
NYISO	New York Independent System Operator
NYPA	New York Power Authority
NYSERDA	New York State Energy Research and Development Authority
OPRHP	New York State Office of Parks, Recreation, and Historic Preservation
ORES	Office of Renewable Energy Siting
OTDA	New York State Office of Temporary and Disability Assistance
PANYNJ	Port Authority of New York and New Jersey
PES	Payment for ecosystem services
PSC	Public Service Commission
PV	Photovoltaics
RD&D	Research, development, and demonstration
REDC	Regional economic development council
RGGI	Regional Greenhouse Gas Initiative
RNG	Renewable natural gas
SDVOB	Service-disabled veteran-owned businesses
SEQRA	New York's State Environmental Quality Review Act
SO_2	Sulfur dioxide
SUNY	State University of New York
SWCC	Soil and Water Conservation Committee
SWCD	Soil and Water Conservation Districts
TCI	Transportation and Climate Initiative
The Council	Climate Action Council
TOD	Transit-oriented development
USCA	United States Climate Alliance
USDA	U.S. Department of Agriculture
VMT	Vehicle miles traveled
VOC	Volatile organic compound
WPDC	Wood Products Development Council
WRRF	Water resource recovery facilities
ZEV	Zero emission vehicle

Executive Summary (PLACEHOLDER)

Overview

Chapter 1. Letter from the Governor (or Co-Chairs)

PLACEHOLDER

Chapter 2. The Time is Now to Decarbonize Our Economy

2.1 Scientific Evidence of Our Changing Climate

The consequences of a changing climate are not just a future concern, they are here. The effects of compounding disasters resonate across the globe. The realities faced domestically and internationally, and the impacts of those realities—which can be felt around worldwide—are inextricably linked.

- Historic flooding from Hurricane Ida not only left lasting damage to the Gulf Coast, but also devasted the Northeast. The National Weather Service issued its first flash flood emergency warning for parts of northeastern New Jersey and its second ever flash flood emergency for New York City.[1]
- The Parana River, the second longest river in South America, is under pressure from severe drought that is expected to last well into 2022. This river provides drinking water to 40 million people, and is a vital commercial shipping, hydropower, and fishing resource.[2]
- The heat dome that struck Canada and the northwestern United States peaked in June, when Portland recorded a temperature of 46.1°C (115°F). The village of Lytton, British Columbia breached 49.6°C (121.3°F) and suffered catastrophic damage from wildfires. As a result, many could not escape the heat in this region where air conditioning is a rarity, roads buckled under intense heat, and vital public services had to be shut down.[3]
- In mid-July, parts of Europe were hit by devastating floods that led to more than 200 people losing their lives and caused billions of dollars in damage. Extreme weather in Europe will continue to have profound impacts on vital crops and cropland.[4]

[1] https://www.eenews.net/articles/ida-smashes-rain-records-in-glimpse-of-future-warming/

[2] https://www.bbc.com/news/world-latin-america-58408791

[3] https://www.bbc.com/news/world-us-canada-57665715

[4] https://fortune.com/2021/09/11/fires-frost-floods-europe-wine-2021-harvest-climate-change/

- The 2021 California wildfire season is estimated to have increased by 75 days in 2021[5] and contributed to severe air quality as far away as New York City.[6]
- Severe heat waves in the Mediterranean region led to more severe wildfires than normally witnessed and is expected to take years to recover from vital ecosystem losses.[7] In Greece, thousands were forced to flee their homes, and incredible scenes echoed across social media of Greek coast guard evacuations.[8]
- Parts of China witnessed one year's worth of rain in just three days, and notable flooding captured by satellite affected millions of people.[9]
- According to the latest World Meteorological Organization's *WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019)*, the number of disasters has increased by a factor of five over the 50-year period between 1970 and 2019.[10]

Scientific consensus is represented by the works of notable international, national, and local scientific institutions. Through their assessments, they determine the current state of knowledge on climate change, identify consensus, and outline knowledge gaps where further research is necessary to understand the full ramifications of impacts.

Climate Change Globally

The Intergovernmental Panel on Climate Change (IPCC)—a body established by the World Meteorological Organization and the United Nations to assess scientific, technical, and socioeconomic information relevant for understanding climate change, its potential impacts, and options for adaptation and mitigation—is undergoing its Sixth Assessment cycle, with the recent release of the Working Group 1 report *Climate Change 2021: The Physical Science Basis.* The entirety of the Sixth Assessment Report (AR6) will be released in 2022. Since the IPCC's Fifth Assessment Report, released in 2014, the scientific community has made enormous strides in simulation modeling, analyses, and understanding.

The U.S. Global Change Research Program is currently developing its fifth National Climate Assessment, with an anticipated delivery in 2023. The fourth assessment, released in 2017, states, "thousands of

[5] https://www.fire.ca.gov/incidents/

[6] https://www.theguardian.com/us-news/2021/jul/21/new-york-air-quality-plunges-smoke-west-coast-wildfires

[7] https://reliefweb.int/report/turkey/europe-wildfires-information-bulletin-2-13-august-2021

[8] https://www.nbcnews.com/news/world/greek-wildfires-are-harsh-reality-climate-change-experts-warn-n1276311

[9] https://earthobservatory.nasa.gov/images/148623/flooding-in-central-china

[10] https://library.wmo.int/doc_num.php?explnum_id=10769

studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor."

According to the U.S. Global Change Research Program and the IPCC, substantial reductions in greenhouse gas (GHG) emissions will be required by mid-century in order to limit global warming to no more than 2°C (and ideally 1.5°C), thus minimizing the risk of severe impacts from climate change. According to the IPCC report, it is likely that every 1,000 gigatons of cumulative carbon dioxide (CO_2) emissions will result in 0.27°C to 0.63°C of increased global surface temperature.

Climate Change in New York

Climate change is already significantly impacting all regions of New York, directly and indirectly. New York's geographic and socioeconomic diversity will lead to a wide range of experienced impacts. Warming trends and incidences of intense heat waves will contribute to greater localized heat stresses; heavy rainfall events that exacerbate localized flooding will continue to impact food production, natural ecosystems, and water resources; and sea-level rise threatens sensitive coastal communities and ecosystems. Climate-driven impacts are magnified when accounting for New York's most vulnerable populations, who are often disproportionately affected and on the frontline of change.

2.2 Climate Projections

Global Climate Projections

AR6 applies new methods that greatly reduce uncertainty and can clearly attribute ongoing climate change and its effects to continuing man-made emissions of climate pollutants. It considers five scenarios to illustrate the range of possible futures based on trends in anthropogenic drivers of climate change. In summary, the report states several factors:

- The global mean surface temperature will continue to increase until at least the mid-century under all GHG emission scenarios considered by the IPCC.
- Between 1.5°C and 2°C warming will be exceeded this century unless deep reductions in CO_2 and other GHG emissions occur in the coming decades.
- Changes in precipitation show:
    - Strengthened evidence since AR5 that the global water cycle will continue to intensify, leading to more variability in precipitation and surface water flows over most land regions (both seasonally and year over year);

    - The portion of global land experiencing detectable increases or decreases in seasonal mean precipitation is projected to increase;
    - There will continue to be earlier onset of spring snowmelt; and
    - It is likely that heavy precipitation events will intensify and become more frequent in most regions with additional global warming.
- Many changes due to past and future GHG emissions are irreversible for centuries to millennia, especially changes in the ocean, ice sheets, and global sea level.
- Over the longer term, there is high confidence that the sea level will continue to rise for centuries to millennia due to ongoing deep ocean warming and ice sheet melt, and will remain elevated for thousands of years.
- It is virtually certain that the global mean sea level will continue to rise over the 21st century. Even under the very low GHG emissions scenario (SSP1-1.9), it is likely that the global mean sea-level rise by 2100 will be 0.28 to 0.55 meters (0.9 to 1.8 feet).

Although no single entity can solve this global problem on its own, the Climate Leadership and Community Protection Act (Climate Act) established New York as a leader in the critical effort to maintain a livable planet. AR6 makes the critical nature of this work clearer. The report notes that, while many of the changes observed in the climate are unprecedented, strong, and sustained reductions in the emissions of GHGs would limit climate change. This information underscores the critical need to invest in resiliency measures, but there are limits to what resiliency effort can provide, and we are fast approaching those limits. It is imperative that we take immediate action to aggressively reduce GHG emissions.

New York Climate Projections

New York has undertaken research to better understand what a changing climate means for the state. A New York State Energy Research and Development Authority (NYSERDA) technical report, ClimAID, discusses the New York–specific climate risks and projections. The ClimAID report, originally released in 2011, was subsequently updated in 2014 based on newer datasets, improved baseline scenarios, and the latest generation of climate models and emissions projections.

Both the original 2011 ClimAID report and the 2014 update provide projections of mean annual changes in precipitation, temperature, and sea-level rise through the year 2100, as well as the frequency and duration of extreme temperature and precipitation events through the 2080s for each of the seven regions of the state. The ClimAID projections for sea-level rise served as the basis for the Department of

Environmental Conservation's (DEC) adoption of sea-level rise projection regulations pursuant to the Community Risk and Resiliency Act (CRRA), 6 Compilation of the Rules and Regulations of the State of New York (NYCRR) Part 490.

2.3 Impacts of Climate Change to New York

Climate change is here, and the related impacts in New York are projected to grow. NYSERDA's ClimAID report discusses these impacts in detail and articulates, by sector, the likely effects of these changes across the state. NYSERDA is developing an update to this report, which will include:

- Updated projections and methodologies;
- In-depth economic analysis;
- New regions;
- More diverse perspectives and stakeholder engagement;
- Adaptable formats to drive wider usage;
- Technical workgroups that cover eight sectors, including agriculture, buildings, ecosystems, energy, human health and safety, society and economy (including finance and insurance), transportation, and water resources; and
- Cross-cutting topics such as the impact on disadvantaged communities, municipal perspectives, and the effect on marine and Great Lakes coastal zones.

Use of the term "Disadvantaged Communities"

This Plan uses the term "Disadvantaged Communities" in order to be consistent with the language in the Climate Act. In this context, Disadvantaged Communities is defined as "communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate-income households."

The Climate Act requires that Disadvantaged Communities shall be identified by the CJWG based on geographic, public health, environmental hazard, and socioeconomic criteria, which shall include but are not limited to:

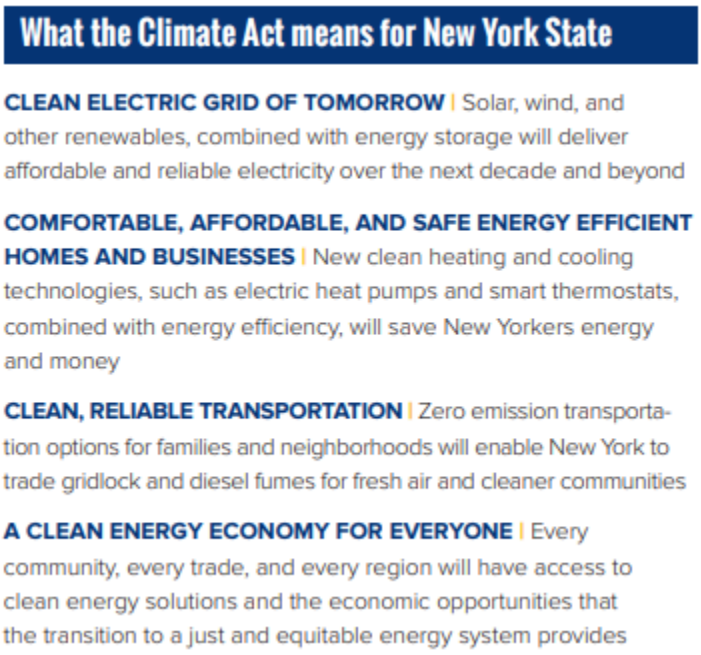
- Areas burdened by cumulative environmental pollution and other hazards that can lead to negative public health effects.
- Areas with concentrations of people that are of low income, high unemployment, high rent burden, low levels of home ownership, low level of educational attainment, or members of groups that have historically experienced discrimination on the basis of race or ethnicity.
- Areas vulnerable to the impacts of climate change such as flooding, storm surges, and urban heat island effect.

The Council recognizes, however, that this growing body of literature often uses other terms that more appropriately describe these populations, such as "frontline communities," "overburdened communities," and "environmental justice communities," among others. This Plan often uses these terms to describe communities that have been disproportionately impacted by historic environmental policy and the effects of climate change, but uses Disadvantaged Communities when referring directly to actions or requirements that are contained in the Climate Act. Furthermore, at the time of writing, the Climate Justice Working Group is currently in the process of developing a more specific definition for the term "Disadvantaged Communities."
For more information on Disadvantaged Communities, see Chapter 6. Achieving Climate Justice.

Draft core projections for the updated climate assessment have been completed, including for average and extreme temperatures and precipitation. The final work is expected to be released in 2022.

2.4 Benefits of Climate Action

Climate change is adversely affecting economic well-being, public health, natural resources, and the environment of New York. The severity of current climate change and the threat of additional and more severe change will be affected by the actions undertaken in New York and other jurisdictions to reduce GHG emissions: such actions will have an impact on global GHG emissions and will encourage other jurisdictions to implement complementary GHG reduction strategies by providing an example of how such strategies can be implemented. Climate change especially heightens the vulnerability of disadvantaged communities, which often bear disproportionately greater environmental and socioeconomic burdens as well as legacies of racial and ethnic discrimination. Although substantial GHG emissions reductions are necessary to avoid the most severe impacts of climate change, complementary adaptation measures will also be needed to address those risks that cannot be avoided.



Recognizing the scale of change necessary to avoid the most severe impacts of climate change, New Yorkers will realize the extraordinary benefits of climate action extending across all sectors of society. The investments made today will continue to drive value creation into the future, spurring a cleaner, more competitive economy. The Climate Act means that the electric grid of tomorrow will be cleaner, more affordable, and more reliable. New York homes and businesses will be more energy efficient, leveraging the latest clean heating and cooling technologies. Transportation will be clean and reliable, with zero emissions, and New York will be transformed into a clean energy economy that benefits everyone. These investments will support new jobs, new businesses, and new opportunities for all New Yorkers. From clean, renewable energy generation to advanced recycling and reuse programs, New York will witness a scale of change that has not been seen before.

The Climate Act recognizes communities that have historically witnessed and continue to bear the disproportionate health and socioeconomic burdens of environmental pollution and climate change. These

frontline communities, by law, will benefit from the transition New York is undertaking. Foundational to the Climate Act and to this Scoping Plan is marrying climate action with equity.

As sectoral progress rapidly increases, additional co-benefits and compounding benefits[11] will be realized.

Benefits of GHG Emission Mitigation

Mitigating GHG emissions and adapting to a changing climate will provide many direct and indirect benefits, including improved public health. Direct benefits will result from reducing the many public health impacts associated with climate change, such as heat-related morbidity and mortality; food-, water-, and vector-borne diseases, and injury and death following flooding. Indirect health benefits will occur when initiatives to mitigate GHG emissions also result in other beneficial outcomes such as reducing hazardous air pollutants produced by GHG emissions sources ("co-pollutants"), encouraging active transport (such as walking and cycling), and reducing home health risks through building energy-efficiency retrofit interventions. In addition to these public health benefits, GHG emissions mitigation will result in improvements to the overall economy through avoided costs and stimulus, social community and labor, social inclusion and social justice, housing security, accessibility and quality of mobility services, and resources efficiency.

Benefits of Adaptation and Resilience

Adaptation and resilience planning is about protecting people and ecosystems from the changes that are brought by a changing climate. Individuals, communities, and regions have come to recognize the need to prepare for the risks posed to their quality of life, infrastructure and physical safety by climate change. These risks are disproportionately high for disadvantaged communities. Investment in adaptation and resilience can improve quality of life, stimulate local economies, and protect the environment. The benefits of adaptation and resilience actions include improved economic opportunities, infrastructure, and equity in our rural and urban communities. New York will promote the integration of climate change adaptation and resilience planning into all relevant policies and programs using the best available science.

[11] https://www.cdp.net/en/reports/downloads/5329

2.5 Technology Advancement and Trends

Technology advancement will continue to be vital in determining the trajectory of climate change mitigation and adaptation success. Current projections rely on certain assumptions of technology adoption, prioritization, and acceptance. Technology advancements include several components:

- Better science, data collection technologies, modeling, and understanding the complex relationship of natural systems
- Advancement in mitigation, such as the continued development of renewable energy technologies, energy efficiency improvements, new and emerging technologies (like energy storage, carbon capture and removal, and potential geoengineering), and mass timber building materials
- Advancement in adaptation and resilience, such as technologies that can mitigate impacts like wave breaking, structural advancements in the built environment, and advancements in understanding nature-based solutions
- Accessibility, supply chains, funding, and prioritization needs to realize potential

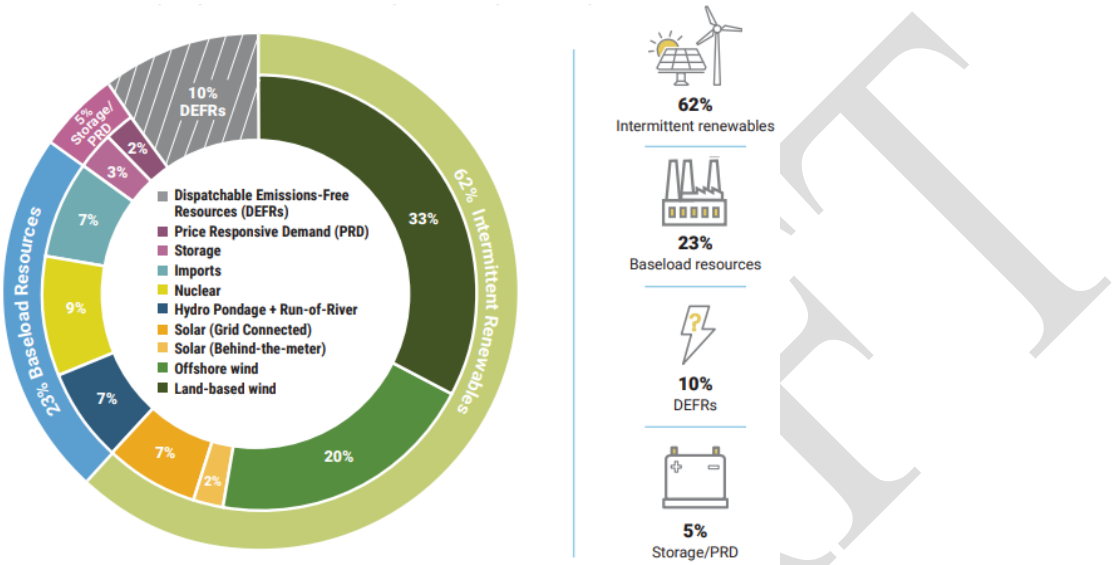
As science and technology continue to advance, the understanding of complex climate and environmental forces evolves and new progress is incorporated into existing knowledge. Methodological advances and new datasets have contributed approximately 0.1°C to the updated estimate of warming per AR6, which states in the Summary for Policymakers, "Since AR5, methodological advances and new datasets have provided a more complete spatial representation of changes in surface temperature, including in the Arctic. These and other improvements have additionally increased the estimate of global surface temperature change by approximately 0.1 ºC, but this increase does not represent additional physical warming since the AR5."[12]

To achieve a more resilient, efficient, and balanced grid, new technologies will be required to replace the phase down of fossil fuel resources that are currently relied upon. The New York Independent System Operator (NYISO) has been evaluating potential impacts to system reliability and resource availability associated with climate change and extreme weather events. Through its *Climate Study*, NYISO has made

[12] IPCC. (2021). Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press. Accessed at: https://www.ipcc.ch/report/ar6/wg1/#SPM

it clear that innovation is critical to accelerating the development of new flexible and dispatchable resources to replace the existing reliability service capabilities of fossil fuel resources.

Figure 1. NYISO Climate Study: Projected CLCPA Winter Energy Production by Resource Type



Source: https://www.nyiso.com/power-trends

2.6 The Global and National Context for Climate Action

The United Nations Framework Convention on Climate Change was founded in 1992 to serve as the international forum for multilateral climate action. The original convention was supported by the Kyoto Protocol of 1997 and the 2015 Paris Climate Agreement. Under the Paris Agreement, signatories agree to nationally determined contributions for GHG reductions within a specified timeframe. The goal of the Agreement is to keep global warming below 2°C compared to preindustrial levels, with the recognition of scientific consensus that warming at or below 1.5°C is preferable to mitigate the worst effects of climate change.[13] In 2015, the United Nations Framework Convention on Climate Change invited the IPCC to generate Special Report 1.5 to improve our scientific understanding of a 2°C and 1.5°C warmer earth, as well as GHG emission pathways that would result in these temperature changes. Special Report 1.5 was published in 2018 and its conclusions support the necessity of swift climate action in accordance with Paris Agreement goals.

[13] IPCC. (2018). Summary for Policymakers. In: Global Warming of 1.5 °C. An IPCC Special Report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global GHG emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Accessed at: https://www.ipcc.ch/sr15/download/

Special Report 1.5 included several major conclusions:

- GHG emissions associated with human activity are estimated to have caused 1°C of warming above preindustrial levels, with a likely increase to 1.5°C of warming between 2030 and 2052.
- Climate change impacts will be more devastating and the human and earth systems' ability to adapt will be decreased at 2°C compared to 1.5°C.
- GHG model pathways associated with 1.5°C of warming show global net anthropogenic CO_2 emissions declining by 45% from 2010 levels by 2030 and reaching net zero by 2050. These reductions will need to be achieved globally to mitigate the worst effects of climate change.

In June 2017, the Trump administration signaled its intention to withdraw the United States from the Paris Agreement. Responding to this federal abdication, New York and other states took up the mantle of climate action. In response to federal withdrawal from the Paris Agreement, the Governors of New York, California, and Washington formed the United States Climate Alliance (USCA) with the aim of advancing policies that would help each state meet the Paris Agreement goals. There are currently 25 states that have joined the USCA. Each Member State commits to:

- Implement policies that advance the goals of the Paris Agreement, aiming to reduce GHG emissions by at least 26% to 28% below 2005 levels by 2025;
- Track and report progress to the global community in appropriate settings, including when the world convenes to take stock of the Paris Agreement; and
- Accelerate new and existing policies to reduce carbon pollution and promote clean energy deployment at the state and federal levels.[14]

Under the Biden Administration, the United States rejoined the Paris Agreement just three months after the formal withdrawal and the new nationally determined contributions were announced in April 2021 at the U.S. Department of State Leader's Summit on Climate.[15] In consultation with Special Presidential Envoy for Climate John Kerry, United States National Climate Advisor Gina McCarthy developed and committed to an economy-wide target of a 50% to 52% net reduction in GHG emissions by 2030

[14] USCA. (2019). Frequently Asked Questions.

[15] USA. (2021). The United States of America Nationally Determined Contribution. Reducing Greenhouse Gases in the United States: a 2030 emissions target. Accessed at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/United%20States%20of%20America%20First/United%20States%20NDC%20April%2021%202021%20Final.pdf

compared to 2005 levels, and President Biden has informally committed to reaching economy-wide "carbon neutrality" by 2050.

Chapter 3. New York's Climate Leadership

3.1 High-Level Overview of Past and Current Policies

New York continues to set an international precedent for addressing climate change. This is only possible because so many diverse minds and tireless leaders united in a common cause. Climate change is a "wicked problem" that requires a holistic approach and collaborative reasoning.[16] Recognizing the complexity of the energy transition and the imperatives to mitigate the worst scenario projections of a warming global climate, New York stands ready to continue its legacy of climate leadership.

This Scoping Plan incorporates new, innovative strategies and expands upon existing efforts to combat the systemic risks associated with the impacts of a changing climate while addressing the disproportionate impacts on frontline communities.

Climate Action

The development and purpose of this Scoping Plan builds upon decades of New York's climate leadership at all levels, including executive, regulatory, legislative, and programmatic. The following sections provide an overview of this leadership.

Executive Leadership

The Health Across All Policies Initiative (Executive Order 190, 2018) developed the necessary network and communications between agencies to address and improve public and individual health through collaborative efforts to address social determinants of health, like air quality, housing, and access to affordable energy.

Build Smart NY (Executive Order 88, 2012) was issued to improve energy efficiency in state buildings by 20% by 2020, accomplished by measuring building energy performance in all state buildings larger than 20,000 square feet and targeting the largest and poorest performing buildings for energy audits, efficiency upgrades, and best operations and maintenance practices.

[16] https://www.stonybrook.edu/commcms/wicked-problem/about/What-is-a-wicked-problem

The State Green Procurement and Agency Sustainability Program (Executive Order 4, 2008) promotes the state purchase of environmentally friendly commodities, services, and technologies, as well as agency sustainability and stewardship programs.

New York signed a medium- and heavy-duty (MHD) zero-emission vehicles Memorandum of Understanding (MOU) on July 14, 2020 along with 14 other states and Washington D.C. committing to work collaboratively to advance and accelerate the market for electric MHD vehicles. The mutual goal is to ensure that 100% of all new MHD vehicle sales will be zero-emission vehicles (ZEVs) by 2050, with an interim target of 30% MHD ZEV sales by 2030. This MOU builds off the success of the 2013 light-duty ZEV Memorandum of Understanding and the Multi-State ZEV Taskforce and Action Plans.

DEC Commissioner's Policy 49 (2010) recognizes climate change as a threat to the state's "air and water quality, forests, fish and wildlife habitats, and people and communities" and provide guidance on how DEC must incorporate climate change considerations into "all aspects of its activities."

Regulatory Action

Oil and Natural Gas Sector regulations (DEC Proposed Part 203 Regulations), proposed in 2021, would lower methane and volatile organic compound (VOC) emissions for sources in New York's oil and natural gas sector.

Hydrofluorocarbon Standards and Reporting (DEC Part 494 Regulations) prohibits specific hydrofluorocarbons (HFCs), potent GHGs in certain refrigerants, aerosol propellants, and foam-blowing agent end-uses that represent avoidable HFC emissions where safer alternatives are available.

Projected Sea-Level Rise (DEC Part 490 Regulations), finalized in early 2017, establish statewide sea-level rise projections for use in the consideration of permits and other decision-making processes specified under CRRA.[17] Under CRRA, DEC is required to update these sea-level rise projection regulations at least every five years.

Regional Greenhouse Gas Initiative (RGGI) (DEC Part 242 Regulations) is the first mandatory market-based emissions trading program in the United States to reduce CO_2 emissions, and the first anywhere to

[17] https://www.dec.ny.gov/regulations/103877.html

use the cap-and-invest model for reducing pollution. New York and 10 other RGGI participating states set a cap for total emissions of CO_2 from electric generation facilities in the region. Each state implements the program through its own regulations, which include emissions budgets in individual RGGI participating states that are equal to shares of the regionwide cap. The RGGI cap declines over time, gradually lowering CO_2 emission limits.

Legislation

Chapter 423 of the Laws of 2021 related to ZEV sales outlines that new off-road vehicles and equipment sold in New York are targeted to be zero-emissions by 2035, and new MHD vehicles sold in New York are targeted to be zero-emissions by 2045.

Chapter 58 of the Laws of 2020 established the Accelerated Renewable Energy Growth and Community Benefit Act as part the State Fiscal Year 2020-2021 budget to dramatically speed up the siting and construction of clean energy projects to combat climate change and help jump-start the state's economic recovery from the COVID-19 health crisis. This law created a first in the nation Office of Renewable Energy Siting (ORES) to improve and streamline the process for environmentally responsible and cost-effective siting of large-scale renewable energy projects across New York, while delivering significant benefits to local communities. This law, which is being implemented by the New York State Department of State (DOS), NYSERDA, New York State Department of Public Service (DPS), DEC, the New York Power Authority (NYPA), and Empire State Development (ESD), will accelerate progress toward New York's nation-leading clean energy and climate mitigation requirements, including the mandate to obtain 70% of the state's electricity from renewable sources, as identified under the Climate Act.

Chapter 59 of the Laws of 2019 established the Metropolitan Transportation Authority (MTA) Reform & Traffic Mobility Act (Congestion Pricing) that directs MTA to design, develop, build, and run a toll program that applies to vehicles that enter or remain in Manhattan's Central Business District. The purpose of the program is to reduce congestion and enhance mobility in Manhattan's Central Business District. By reducing traffic and helping improve mass transit, the program would improve air quality and enhance equity by providing expanded access. MTA held public hearings on the proposal in fall 2021 and is undergoing an environmental assessment pursuant to the National Environmental Policy Act.

Chapter 355 of the Laws of 2014 established New York CRRA to build New York's resilience to rising sea levels and extreme flooding. The Climate Act made modifications to CRRA, expanding the scope of climate hazards and projects for consideration. These modifications became effective January 1, 2020. As

part of the implementation of CRRA, DEC, in consultation with DOS and other stakeholders, developed the *New York State Flood Risk Management Guidance 1* to help ensure the health, safety, and well-being of New Yorkers now and in the future.[18]

Chapter 388 of the Laws of 2011 established the Power NY Act which directed DEC to promulgate rules and regulations limiting emissions of CO_2 by newly constructed major generating facilities. DEC adopted 6 NYCRR Part 251 in 2012, setting CO_2 emission limits that effectively prohibited new coal-fired power plants. In 2018, DEC adopted further revisions to this regulation applicable to existing facilities, effectively phasing out all remaining coal-fired power plants in the state. The last coal-fired power plant in the state was closed in 2020.

Chapter 433 of the Laws of 2010 established the State Smart Growth Public Infrastructure Policy Act, Article 6 of the Environmental Conservation Law (ECL), that prohibits a state infrastructure agency from approving, undertaking, supporting, or financing a "public infrastructure project" unless, to the extent practicable, the project is consistent with 11 smart growth criteria.

Chapter 433 of the Laws of 2009 related to the State Energy Planning Board reauthorizes Article Six of the Energy Law, regarding energy planning requiring comprehensive studies of the state's energy needs.

Programmatic Action

Several agencies have existing programs related to renewable energy, climate resilience and adaptation, and overall climate change mitigation. New York's Reforming the Energy Vision, including the NY-Sun program, the Clean Energy Standard, EVolve NY, Drive Clean Rebates, Clean Energy Communities, and the Clean Energy Fund are all examples of existing climate leadership. In addition, Climate Smart Communities is a multi-agency program that helps local governments take action to reduce GHG emissions and adapt to a changing climate, including grants for climate mitigation and adaptation projects, ZEV vehicles, and ZEV infrastructure. Charge NY is a multi-agency initiative aiming to create a statewide network of up to 3,000 public and workplace charging stations and to put up to 40,000 plug-in vehicles on the road. And, in an example of multi-state cooperation, the Engineering Department of the Port Authority of New York and New Jersey (PANYNJ) Climate Resilience Design Guidelines, produced in 2015, ensure that new port authority infrastructure and buildings are designed to account for projected

[18] https://www.dec.ny.gov/docs/administration_pdf/crraestelevguidelines.pdf

changes in temperature, precipitation, and sea level. The guidelines provide PANYNJ architects and engineers with a framework for evaluating the vulnerability of projects to future climate impacts and addressing those impacts in the design of port authority infrastructure and buildings.[19]

New York stands ready to deliver the results necessary to avoid the most catastrophic impacts of climate change while providing the necessary resources for New York to be more resilient and adaptable to the irreversible changes already embedded.

3.2 Landmark Accomplishment of the Climate Act and Key Components of the Legislation

On July 18, 2019, the Climate Act was signed into law.[20] This historic legislation cements the state's position as a leader in combating climate change. The Climate Act, which became effective on January 1, 2020,[21] builds upon the state's clean energy and GHG emission reduction policies described above, codifying critical goals as statutory requirements. The Climate Act will have far-reaching effects across all areas of the environment and economy.

New York's Nation-Leading Climate Targets

- 85% Reduction in GHG Emissions by 2050
- 100% Zero-emission Electricity by 2040
- 70% Renewable Energy by 2030
- 9,000 MW of Offshore Wind by 2035
- 3,000 MW of Energy Storage by 2030
- 6,000 MW of Solar by 2025
- 22 Million Tons of Carbon Reduction through Energy Efficiency and Electrification

The implementation of the Climate Act requires a significant regulatory undertaking by DEC as well as substantial action by NYSERDA, the Public Service Commission (PSC), and other state agencies and authorities. These efforts will be informed by the Climate Action Council (the Council), this Scoping Plan, and, recognizing the importance of ensuring a just transition, other essential groups that are focused on environmental justice issues.

[19] https://www1.nyc.gov/assets/orr/pdf/NYC_Climate_Resiliency_Design_Guidelines_v4-0.pdf

[20] Chapter 106 of the Laws of 2019.

[21] Climate Act § 14; Chapter 735 of the Laws of 2019.

For the next several years and beyond, the implementation of the Climate Act necessitates an all-hands-on-deck approach across state government, with input from a broad array of stakeholders, technical advisors, and experts. This section provides a summary of key provisions of the Climate Act as well as an outline of the key milestones and implementation steps thus far.

Summary of Key Provisions

GHG Emission Reduction Requirements

The heart of the Climate Act is the addition of Article 75 to the ECL, which, among other things, directs DEC to establish statewide GHG emission limits, requiring a 40% reduction in statewide GHG emissions from 1990 levels by 2030 and an 85% reduction by 2050.[22] The Climate Act also establishes a goal of net zero emissions across all sectors of the economy by 2050.[23] Within four years of the effective date, the Climate Act requires DEC to promulgate regulations to ensure compliance with such statewide GHG emission limits.[24]

Clean Energy Generation Requirements

In addition to ECL Article 75 and its essential GHG emission reduction requirements, the Climate Act adds a new Section 66-p to the Public Service Law, which requires the PSC to establish a program to decarbonize the electric sector. Specifically, the program must have two targets: 70% of the state's electricity deriving from renewable energy by 2030 (70x30) and 100% carbon-free energy by 2040 (100x40).[25] The Public Service Law provisions also codify previously existing ambitious clean energy goals, including a requirement for the procurement of at least 9,000 MW of offshore wind by 2035, 6,000 MW of distributed solar generation by 2025, and 3,000 MW of energy storage by 2030.[26]

[22] ECL § 75-0107(1). As set forth in the Climate Act, statewide GHG emissions include all emissions of GHGs from sources within the state, as well as GHGs produced outside the state but associated with either the generation of electricity imported into the state or the extraction and transmission of fossil fuels imported into the state. ECL § 75-0101(13).

[23] ECL § 75-0103(11).

[24] ECL § 75-0109.

[25] PSL § 66-p(2).

[26] PSL § 66-p(5).

Council and Advisory Panels

Critical to the implementation of the Climate Act is the 22 member Council,[27] made up of the heads of various state agencies, as well as other members appointed by the governor and Legislature.[28] The co-chairs of the Council are the DEC commissioner and the NYSERDA president.[29] The Council includes advisory panels for particular subject areas, including waste, transportation, energy-intensive and trade-exposed (EITE) industries, land-use and local government, energy efficiency and housing, power generation, and agriculture and forestry.[30]

The Council is charged with developing this Scoping Plan, which provides recommendations for achieving the statewide GHG emission limits, including regulatory measures.[31] The Council consulted with the advisory panels for subject-matter expertise when developing recommendations in this Scoping Plan.[32] This Scoping Plan will be reviewed and updated at least every five years.[33]

Environmental and Climate Justice Provisions

Notably, the Climate Act recognizes historically Disadvantaged Communities and the fact that these communities suffer disproportionate and inequitable impacts from climate change, and therefore establishes mechanisms to ensure that these communities benefit from the Climate Act. This includes a goal that Disadvantaged Communities receive 40% of the overall benefits of spending on clean energy and energy efficiency programs, and a requirement that such communities receive at least 35% of the benefits of such state investments.[34] The Climate Act also creates the Climate Justice Working Group (CJWG) within DEC, which is comprised of representatives from environmental justice communities and state agencies.[35] The CJWG is currently establishing criteria to define Disadvantaged Communities. The CJWG has also advised the Council during the development of this Scoping Plan to ensure that

[27] ECL § 75-0103.
[28] ECL § 75-0103(1).
[29] ECL § 75-0103(4).
[30] ECL § 75-0103(7).
[31] ECL §§ 75-0103(11)-(14).
[32] ECL § 75-0103(7).
[33] ECL § 75-0103(15).
[34] ECL § 75-0117.
[35] ECL § 75-0111.

Disadvantaged Communities are considered in the implementation of the Climate Act.[36] This is in addition to input from the Just Transition Working Group (JTWG) within the Council.[37]

The Climate Act establishes a community air monitoring program to identify locations to deploy community air monitoring systems, to develop a strategy to reduce toxic and criteria air pollutant emissions in Disadvantaged Communities, and to select communities around the state to implement emissions reduction programs.[38] The Climate Act also requires state agencies to ensure that permitting, licensing, contracting, and other approvals and decisions will not disproportionately burden Disadvantaged Communities and to prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities.[39]

Other Provisions

As previously noted, the Climate Act requires an all-hands-on-deck approach across state government, and various provisions affect all state agencies and their decision-making. Further, the Climate Act directs all state agencies to reduce their GHG emissions and provides state agencies with the authority to promulgate GHG emissions regulations to help achieve the statewide GHG emission limits.[40] The Climate Act also requires state agencies to consider GHG emissions and limits in permitting, licensing, contracting, and other approvals and decisions, and that wherever such decisions are deemed inconsistent with the statewide GHG emission limits, state agencies must identify alternatives or GHG mitigation measures.[41] The Climate Act also expands the scope of the existing CRRA,[42] including by covering additional DEC permitting programs such as State Pollutant Discharge Elimination System permitting and Air Pollution Control permitting, and by allowing state agencies to require mitigation of climate risks.[43]

[36] ECL § 75-0111; ECL §§ 75-0103(10), (12).

[37] ECL §§ 75-0103(8), (12).

[38] ECL § 75-0115.

[39] Climate Act § 7(3).

[40] Climate Act §§ 7(1) and 8.

[41] Climate Act § 7(2).

[42] Chapter 355 of the Laws of 2014.

[43] Climate Act § 9.

Key Milestones and Implementation Steps To-Date

This Scoping Plan and recommendations outline measures and other state actions to ensure attainment of the statewide GHG emission limits and net zero emission goal. The statewide GHG emission limit rulemaking is the first regulatory action to implement the Climate Act, the foundation for multiple components of the Climate Act, and critically important for successful implementation of the Climate Act. DEC promulgated 6 NYCRR Part 496 that established the two statewide GHG emission limits called for in the Climate Act: a limit for 2030 that is equal to 60% of 1990 GHG emission levels and a limit for 2050 that is equal to 15% of 1990 emission levels. Specifically, using a 20-year global warming potential (GWP) as required by the Climate Act, the statewide GHG emission limit for 2030 is 245.87 million metric tons of CO_2 equivalent (MMT CO_2e), and the statewide GHG emission limits for 2050 is 61.47 MMT CO_2e.[44] DEC, in consultation with NYSERDA, continues to update the inventory of GHGs and will publish the annual statewide GHG emissions report that reflects these updates.

Further, DEC, in consultation with NYSERDA, established the Value of Carbon guidance to help state agency decision-making by placing a monetary value for the avoided emissions of GHGs.[45] The Value of Carbon guidance provides metrics that may be broadly applicable to all state agencies' and authorities' actions—such as benefit/cost analyses, rulemaking processes, environmental assessments, and demonstrations of the benefits of climate change policies—to demonstrate the global societal value of actions to reduce GHG emissions. The guidance provides a recommended procedure for using a damages-based value of carbon along with a general review of the marginal abatement cost approach and recommends the use of a central discount rate of 2%, which should be reported alongside a 1% and 3% discount rate for informational purposes. For example, use of the 2% central discount rate translates into a 2020 central value of CO_2 of $121 per ton, methane of $2,700 per ton, and nitrous oxide of $42,000 per ton.

The Climate Act solidifies New York's status as a climate leader. It establishes the country's—and perhaps even the planet's—strongest GHG emission reduction and clean energy requirements. While the scale of the effort to implement the Climate Act is enormous, so is the challenge it is meant to address. Successful implementation of the Climate Act will not only provide direct environmental and economic benefits for the state, it will also serve as a model for other jurisdictions in combatting climate change.

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[44] 6 NYCRR § 496.4.

[45] ECL § 75-0103; https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf

Chapter 4. Current Emissions (Draft Data)

DEC is required to release an annual report on emissions as a measure of progress towards reaching the Climate Act's emission limits and net-zero goal. The first annual report will be released in 2021 and cover the years 1990 through 2019. Additional details on data, methods, and historical trends will be provided in that report. In addition, some of the co-pollutants discussed in this Scoping Plan affect both human health and climate change, even if they are not included in the suite of GHGs listed in the Climate Act. For example, actions to address particulate matter (also known as black carbon) also contribute to the State's broader climate strategy.

The Climate Act requirements for emissions accounting deviate from the standard protocols[46] used by other governments in a few key ways. First, emissions must be measured in terms of carbon dioxide equivalent (CO2e) using a 20-year rather than a 100-year time interval. This results in an apparently higher numeric value for some gases, such as methane, even if the emission rate was the same. Secondly, "statewide" emissions under the Climate Act include out-of-state emissions associated with imported electricity and the extraction and transmission of imported fossil fuels. This greatly expands the scope of emission sources typically included in governmental GHG reduction goals and inventories. Addressing some of these emission sources may also require actions at the national level. Finally, the emission values provided here include CO2 associated with the combustion of biogenic fuels, although this comprises a very small portion of emissions (less than 4%). Therefore, the emission values provided here are not comparable to those reported by other governments, nor are they comparable to values reported by New York State in the past. The economic sectors described here may not represent the same emission sources as presented in other GHG reports.

Based on this assessment, emission reductions are needed from all sectors of the economy to achieve the goals and requirements of the Climate Act. Based on this assessment, emission reductions are needed from all sectors of the economy to achieve the goals and requirements of the Climate Act. For the purposes of the Scoping Plan, emissions are broken down according to the economic sectors covered in sectoral strategy chapters (Chapters 11 through 16), Gas System Transition chapter (Chapter 18) and the Land Use chapter (Chapter 19). The transportation, buildings, and electricity chapters include not only GHG emissions from fuel use, but also GHG emissions associated with imported fuels. In summary, the transportation (Chapter 11) includes GHG emissions associated with road transportation, non-road

[46] Per the IPCC Taskforce on National GHG Inventories.

transportation such as aviation, rail, and marine, other mobile equipment, as well as HFCs used for mobile heating, ventilation, and air conditioning (HVAC) and refrigeration. Buildings (Chapter 12) includes fuels used in residential and commercial buildings and HFCs used in HVAC and refrigeration. Electricity (Chapter 13) includes fuels used for the generation of electricity within the State, imported electricity, and the transmission and distribution of electricity. The remaining economic sectors include industry, agriculture and forestry, and waste. Industrial emission sources include fuels used in industrial buildings and for industrial processes as well as emissions from the oil and gas industry in the State. The waste sector includes emissions associated with solid waste management, wastewater management, and waste combustion. GHG emissions from the agriculture and forestry sector are from livestock and soil management practices. These practices, as well as land use in general, also contribute to carbon removals.

Figure 2 provides an estimate of statewide GHG emissions across these major economic sectors. Gross total emissions for 2019 were 379.4 MMT CO2e (GWP-20). Figure 3 is an estimate of annual emission removals, or carbon sequestration. Net total emissions, or gross emissions minus emission removals and biogenic CO2, were 338.1 MMT CO2e (GWP-20) in 2019.[47]

Importantly, emission removals were equivalent to less than 8% of gross emissions in 2019, suggesting that all emission sources from every segment of the economy must be addressed to achieve net zero emissions. More than half of current emissions are related to emission sources covered in the Building and Transportation chapters (approximately 60%). These sources include the direct use of fossil fuels, "upstream" emissions from the fuel system, and HFCs.

[47] If measured using the standard protocols, gross emissions were 194.6 MMT CO2e (GWP-100) and net emissions were 165.1 MMT CO2e (GWP-100) in 2019.

Figure 2. 2019 New York State GHG Emissions by Scoping Plan Sector

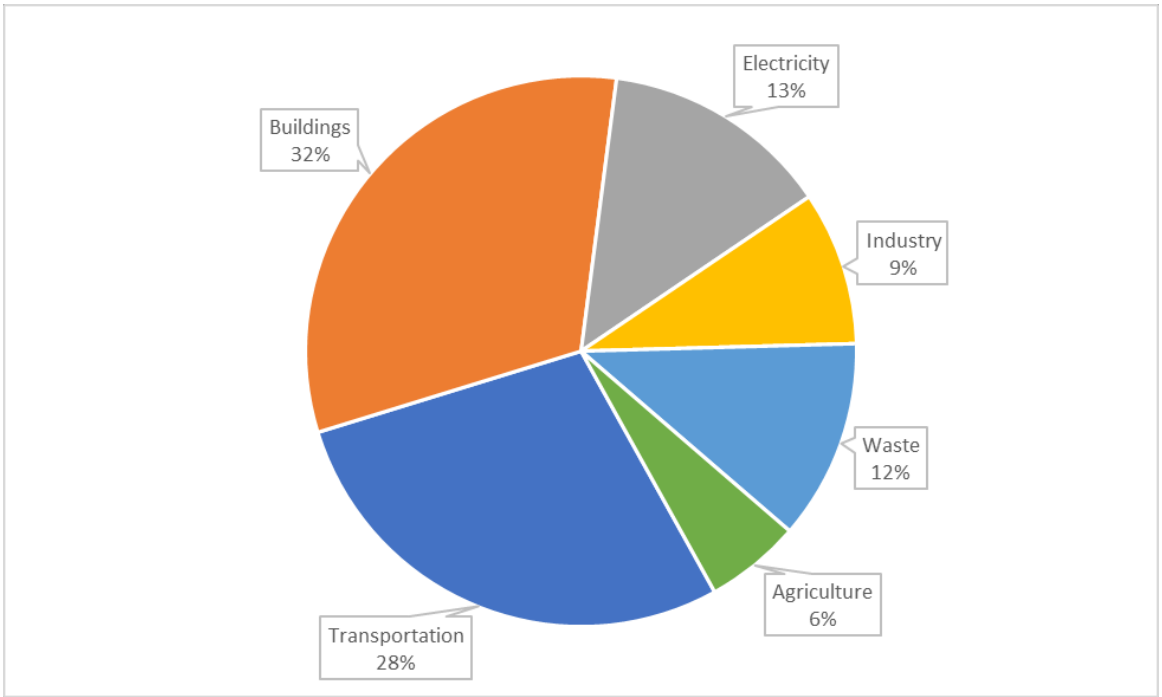
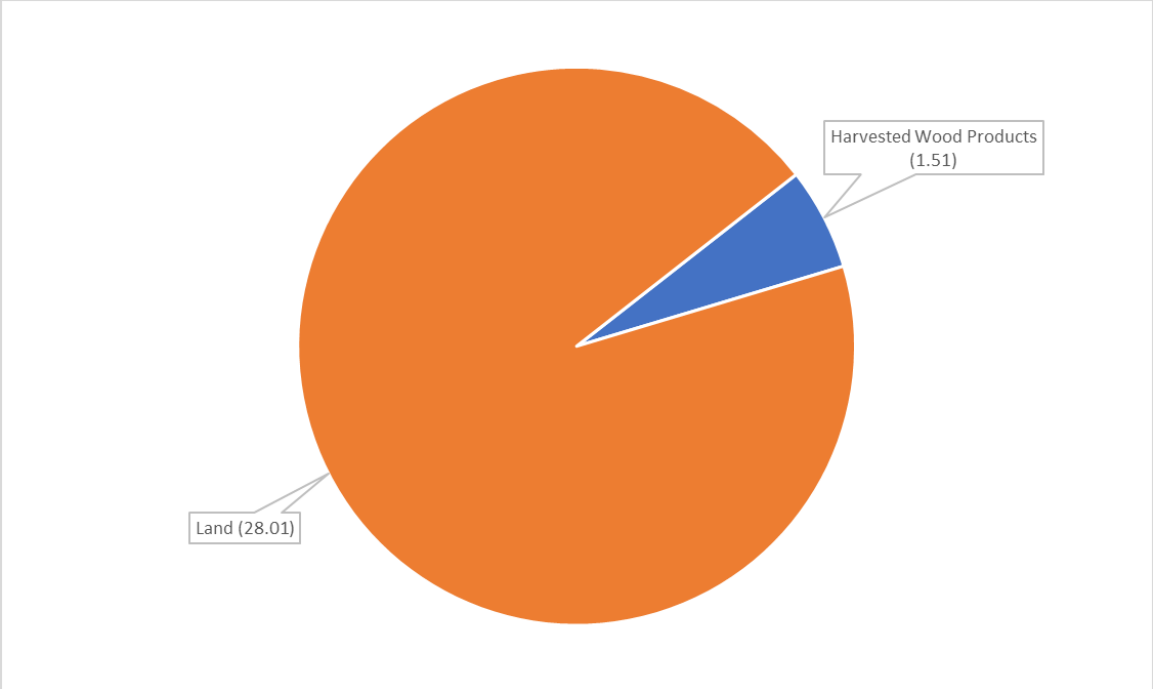


Figure 3. 2019 New York State GHG Emissions Removals by Sector (in MMT CO2)



Summary of Sectoral Emissions

Transportation

The transportation sector was responsible for approximately 28% of the state's emissions in 2019, which includes road transportation (59%), non-road such as aviation (12%), emissions from imported fuels (26%), and HFCs used in vehicle air-conditioning and refrigeration (3%). Transportation sector emissions are about 16% higher today than they were in 1990. The transportation sector today is largely dependent on petroleum-based fuels such as gasoline, diesel, and jet fuel, but the state has made strong progress in transitioning from petroleum-based fuels to zero-emission technologies.

Buildings

The buildings sector was the largest source of emissions in 2019 and responsible for 32% of emissions, which includes the combustion of fossil fuels in residential (34%) and commercial buildings (19%), emissions from imported fuels (33%), and HFCs released from building equipment and foam insulation (14%). The fuels used in buildings today include natural gas, distillate fuel (heating fuel #2), wood, propane, kerosene, and residual fuel.

Electricity

The electricity sector comprised 13% of emissions in 2019, including electricity generation within the state (44%), imported electricity (15%), emissions from imported fuels (41%), and the SF6 used in electricity distribution and transmission (<1%). Electricity sector emissions have declined 46% since 1990.

Industry

Industrial emissions made up 9% of emissions in 2019, including emissions from methane leaks and combustion from the oil and gas system in New York (45%), the direct combustion of on-site fuel (27%), emissions from imported fuels (20%), and non-combustion industrial processes (6%).

Agriculture and Forestry

Agricultural emissions represented approximately 6% of the statewide emissions in 2019 from livestock (92%) and soil management practices (8%). However, agriculture and forestry also provide carbon sequestration benefits and can provide significant contribution towards achieving net zero total emissions from all sectors in the state. For example, the long-term storage of carbon in Harvested Wood Products

alone provided 5% of the State's GHG emissions removals in 2019. These benefits are also described in the Land Use chapter.

Waste

GHG emissions from the waste sector represent about 12% of statewide emissions, including landfills (78%), waste combustion (7%), and wastewater treatment (15%). Most of these emissions represent the long-term decay of organic materials buried in a landfill, which will continue to emit methane at a significant rate for more than 30 years. It also represents both the landfilling of waste in NY and the exporting of waste to landfills in other states.

Emissions Removals

The only current method for removing emissions from the atmosphere is through the process of natural carbon sequestration, which is a service provided by our forests, croplands, and wetlands. In 2019, these lands removed an amount of CO2 equal to 8% of the State's GHG emissions.

Pillars of New York's Planned Climate Action to Realize Net Zero Emissions

Chapter 5. Overarching Purpose and Objectives of the Scoping Plan

This Scoping Plan, prepared and approved by the Council, is designed to be a pathway, or pathways, the State should take to meet the requirements of the statewide GHG emissions limits and achieve statewide net zero emissions in accordance with the schedule established by the Climate Act. It discusses economy-wide strategies and strategies by economic sector. This Plan shall also inform the state energy planning board's adoption of an updated State Energy Plan in accordance with section 6-104 of the energy law.[48] The State Energy Plan is a comprehensive roadmap to build a clean, resilient, and affordable energy system for all New Yorkers. The State Energy Plan establishes how the state can ensure adequate supplies of power, reduce demand through new technologies and energy efficiency, preserve the environment, reduce dependence on imported gas and oil, stimulate economic growth, and preserve the individual welfare of New York citizens and energy users. The most recent plan was adopted in 2015 and amended in 2020. The first State Energy Plan issued after the completion of this Scoping Plan shall incorporate the recommendations of the Council and the strategies presented will guide the implementation of policies statewide.[49]

5.1 New York's Climate Vision

New York will undertake a sweeping set of measures to reduce the State's carbon footprint, transform electricity generation in the state, and drive innovative solutions through technology advancement. This Scoping Plan establishes the path forward for New York to achieve 70% renewable energy by 2030, 100% zero-emission electricity by 2040, a 40% reduction in statewide GHG emissions by 2030, an 85% reduction in statewide GHG emissions by 2050, and net zero emissions statewide by 2050. The paths to 2030 and 2050 require a comprehensive vision and integrated approach to build new programs while significantly expanding existing efforts. Each economic sector discussed in this Plan establishes a vision for 2030 and 2050 in an effort to paint the picture of the future and show the direction the state must head.

[48] ECL § 75-0103(11).

[49] *Id.*

Successful implementation of this Plan requires one cohesive voice across all state agencies and authorities, but state government action alone will not be enough. The state can set the stage for action, but engagement from all New Yorkers in the decisions they make each and every day will impact the ability of New York to make progress toward its goals. This Scoping Plan is the foundation of extensive collaboration. Not only is it a synthesis of sector-specific strategies, it is also designed as overarching strategic initiatives intended to work in parallel to achieve the requirements of the Climate Act. Successful implementation will also require rapid integration and assimilation of strategies designed to achieve real results across the State.

Inform Agency Actions

As discussed, this Scoping Plan is a pathway, or pathways, for New York and is intended to act as a guidebook for state agencies, authorities, and other entities that are responsible for implementing new policies and programs. Many of the sector-specific chapters are organized by policy themes, and each of those themes include several strategies that are intended to mitigate GHG emissions or enable the mitigation of GHG emissions. Each of these chapters acknowledge the existing work that the key stakeholders, including state agencies, in those economic sectors have done or are currently doing to address climate change, and when appropriate builds on those policies and programs. Beyond that, the sector-specific chapters include new strategies to guide New York in meeting the requirements of the Climate Act. It continues to be important that New York operate unilaterally, leveraging action with coordination within and between agencies and authorities. Linkages between programmatic actions across agencies should be highlighted.

5.2 Process for Development

Shortly after the Governor and the Legislature completed their appointments, the Council convened its first meeting in March of 2020. Since that time, and all throughout the COVID-19 pandemic, the Council continued its important work of developing a draft scoping plan of strategies to reduce New York's GHG emissions to meet the emissions limits and social justice requirements set forth in the Climate Act. The Council has held sixteen meetings in which they, among other work, appointed the advisory panels, approved their work plans, received progress reports, received their final recommendations, received feedback from CJWG on the benefits and impacts to disadvantaged communities of the advisory panels' recommendations and received data on costs and benefits of the mitigation strategies from the integration analysis.

The Council convened seven advisory panels: Agriculture and Forestry, Energy Efficiency and Housing, EITE Industries, Land Use and Local Government, Power Generation, Transportation, and Waste and the JTWG. These groups are comprised of professionals from all across the state who are providing their expertise in developing strategies that reduce GHG emissions in New York while benefiting New York's workers and disadvantaged communities. The Advisory Panels and JTWG held over 90 public meetings throughout the course of their recommendation development process. At the direction of the Council, the panels sought the perspective of other panels, additional experts, and other stakeholders in the development of the recommendations. The advisory panels also engaged with the CJWG for feedback on the recommendations under development. The advisory panels delivered their GHG mitigation recommendations for Council consideration at the April and May 2021 Council meetings. The Council also received adaptation and resilience recommendations from the Land Use and Local Government advisory panel and recommendations on workforce opportunities and busines impacts from the JTWG. The delivery of the advisory panel recommendations was a major milestone in the development of the draft scoping plan.

In September and October 2021 the Council was presented with results from an integration analysis on a suite of mitigation strategy scenarios, which were built off the recommendations provided by the advisory panels. This analysis provided data on the emission reductions and societal costs and benefits that can be expected from differing options of strategy sets that could be included in the scoping plan. Additional information on the integration analysis is provided in Chapters 9 and 10. The culmination of all of this work is this initial draft Scoping Plan.

The Council will consider the advisory panels' recommendations along with information from the integration analysis, the CJWG, public feedback on the draft Plan and their further deliberations in developing the Scoping Plan for achieving the requirements of the Climate Act.

Stakeholder Engagement

This initial draft Scoping Plan considers inputs from many stakeholders, as well as critical feedback during consultation with the CJWG established pursuant to Section 75-0111 of the ECL. The Council's advisory panels were committed to a public process in the development of their recommendations, holding public engagement sessions, conducting public surveys, and accepting and incorporating public comment throughout. This stakeholder input is reflected in the recommendations that were delivered to the Council. Additionally, the Council has accepted written feedback throughout the development of the draft Scoping Plan. Agencies and other stakeholders representing many different perspectives were

critical in developing this Plan and feedback was gathered at several different public webinars and workshops, including outreach on the upcoming annual GHG emissions report, a technical conference on oil and gas emissions accounting, and outreach on net emissions accounting. Additionally, NYSERDA held a Reliability Speaker Session to engage experts, including the NYISO and the Utility Intervention Unit of DOS, on electric system reliability planning for the purposes of informing the development of the scoping plan. The Council welcomes feedback from the public on its work at any time during the process. After the draft Scoping Plan is issued, the Council will hold at least six public hearings and accept written comments on the Draft for at least 120 days. Feedback received during the public comment period will be accounted for in the Final Scoping Plan. The public comment process will be designed to ensure that all New Yorkers have opportunities to provide input on the draft Scoping Plan.

Continued engagement on anything that has been previously discussed is encouraged as this Plan and other reports required by the Climate Act are updated over the years. Additional opportunity for stakeholder outreach and engagement will be required to continue moving New York forward on climate action.

Integration Analysis

The Climate Act requires that the Council, in developing this draft Plan, evaluate the total potential costs and potential economic and non-economic benefits, taking into account the Value of Carbon established by DEC under the Climate Act, of the draft Plan for reducing GHGs. An integration analysis was developed to estimate the economy-wide benefits, costs, and GHG emissions reductions associated with pathways that achieve the Climate Act GHG limits and carbon neutrality goal. This integration analysis incorporates and builds from Advisory Panel and Working Group recommendations, as well as inputs and insights from complementary analyses, to model and assess multiple mitigation scenarios. Key assumptions, drivers, and results of the analysis have been made publicly available throughout the analytic process, and feedback from Advisory Panels, State agency staff, CJWG, and the Council has been incorporated as part of the analytic process. In addition, a Technical Advisory Group of experts from academia and national labs were also consulted throughout the analytic process. The results from the integration analysis were presented to the Council in September and October of 2021 and are available to the public on the Climate Act website.

5.3 Summary of Strategies

Through the process of the developing this draft Scoping Plan to this stage, the Council recognized several key strategies that are fundamental to achieving the GHG emission limits and net zero GHG emissions:

- Energy efficiency measures that achieve the Climate Act energy efficiency goal
- Transition from fossil gas to electrification in buildings
- Zero emissions electricity
- Transportation electrification and low-carbon fuels
- Smart growth and reduce vehicle miles traveled (VMT)
- Net zero emissions solutions
- Maximizing carbon sequestration in New York's lands and forests

These fundamental strategies and the development of this Plan is one of the pillars of New York's planned climate action. Climate justice, a just transition, and the benefits to public health are the remaining pillars and are discussed in the following chapters.

Reliability and resiliency of energy systems is critical to providing robust systems that respond to changing demand in real-time and withstand unexpected events. The strategies to implement and achieve the goals of the Climate Act must support the high reliability standards in place in the state by implementing improvements and enhancements where needed and sustaining the practices that provide high quality electric service. If reliability is properly integrated, the additional clean distributed generation (DG), storage and large-scale renewables developed under the Climate Act will provide a more flexible and resilient grid to address and mitigate the impacts of climate change.

Chapter 6. Achieving Climate Justice

6.1 Climate Justice and the Climate Act

A fundamental objective of the Climate Act is to ensure that New York's transition to low carbon economy results in beneficial outcomes for traditionally underserved communities. In New York, as in the rest of the nation, frontline communities such as Black, Indigenous, and People of Color (BIPOC), as well as low-income communities, bear the largest burden of climate change impacts and associated pollution. Additionally, these frontline communities have historically been excluded from the environmental decision-making process and had limited opportunities for participation.

The Climate Act seeks to address the disproportionate burdensome communities have borne from past and current emissions in many ways. By creating the CJWG, the Climate Act ensures that these communities are consulted and will benefit from New York's climate action. The knowledge these groups provide will support the development of climate policies and investment programs designed to deliver meaningful and equitable benefits to disadvantaged communities.

The Climate Justice Working Group

As required by the Climate Act, DEC created the CJWG, which is comprised of representatives from environmental justice communities statewide, including three members from New York City communities, three members from rural communities, and three members from urban communities in upstate New York, as well as representatives from the State Departments of Environmental Conservation, Health, Labor, and from NYSERDA. Among other responsibilities, the CJWG is tasked with developing the definition of disadvantaged communities and has an important advisory role, providing strategic advice to the Council for incorporating the needs of disadvantaged communities in the Scoping Plan. The CJWG was formed in June 2020 and has held 19 public meetings to date.

Identifying New York's Disadvantaged Communities

A primary task of the CJWG is to develop the criteria by which a community in New York can be designated as a Disadvantaged Community under the Climate Act. The Climate Act defines Disadvantaged Communities as "communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate- income households . . ."[50] The establishment of the Disadvantaged Communities criteria is fundamental to many provisions of the Climate Act and key to successful implementation of the Scoping Plan. Disadvantaged Communities are being identified by the CJWG based on geographic, public health, environmental hazard, and socioeconomic criteria that include, but are not limited to:

- Areas burdened by cumulative environmental pollution and other hazards that can lead to negative public health effects;
- Areas with concentrations of people that are of low income, high unemployment, high rent burden, low levels of homeownership, low levels of educational attainment, and/or members of groups that have historically experienced discrimination based on race or ethnicity; and

[50] ECL § 75-0101(5).

- Areas vulnerable to the impacts of climate change such as flooding, storm surges, and the urban heat island effects.

The CJWG is in the process of finalizing a draft list of criteria for determining Disadvantaged Communities in New York. These criteria expand beyond pollution burden, which is central to many existing environmental justice definitions and frameworks, to include broader considerations of burdens, risks, and vulnerabilities within communities. The draft criteria developed by the CJWG are subject to public comment and refinement prior to finalization. The Climate Act requires the CJWG to meet annually at a minimum to review the criteria and methods used to identify Disadvantaged Communities for the purpose of modifying methods or incorporating new data and scientific findings.[51]

Until the final Disadvantaged Communities criteria are established, New York has identified the following interim criteria for Disadvantaged Communities: located within census block groups that meet the U.S. Department of Housing and Urban Development 50% area median income threshold and that are also located within the DEC Potential Environmental Justice Areas or within New York State Opportunity Zones.[52]

Directing Benefits to Disadvantaged Communities

In transforming New York's energy economy and mitigating climate change, the Climate Act mandates an investment of certain benefits of state agencies, authorities, and entities to Disadvantaged Communities. Disadvantaged Communities must receive a minimum of 35%, with a goal of 40%, of benefits of spending on clean energy and energy efficiency programs, projects, or investments in the areas of housing, workforce development, pollution reduction, low-income energy assistance, energy, transportation, and economic development.[53]

DEC, in consultation with the CJWG and other relevant stakeholders, is developing a methodology for defining these benefits.

In demonstrating a commitment to meeting or exceeding the benefits requirements of the Climate Act, the state has already begun adapting clean energy and energy efficiency investments to include prioritization

[51] ECL § 75-0111(3).

[52] https://www.nyserda.ny.gov/ny/disadvantaged-communities

[53] ECL § 75-0117.

of disadvantaged communities based on the interim definition described above. Examples of these actions are:

- **Clean Green Schools**- $59 million (RGGI) to serve more than 500 P-12 schools in underserved/ disadvantaged communities with clean energy and energy efficiency solutions, creating a healthier learning environment in schools across New York State. In addition, a minimum of $3 million will be provided to schools in disadvantaged communities participating in the Clean Green Schools program to support education, career awareness and training related to clean energy and energy efficiency retrofit projects, careers and jobs.
- **NY Sun Solar Equity Framework** - $200 million (CEF) directed to increase access to solar energy for low- to moderate-income (LMI) households, affordable housing, and disadvantaged and environmental justice communities
- **EmPower New York**- (CEF/RGGI) incorporated a geo-eligibility component, streamlining eligibility determinations for households located in communities with more than 50% of residents at or below 150% of the federal poverty level.
- **Regional Clean Energy Hubs**- $36 million (CEF) to establish clean energy hubs in each of the 10 economic development regions of the state and to build capacity at the local level to position disadvantaged communities to benefit from the emerging clean energy economy. Initiatives will include outreach and education, increasing access to clean energy programs and resources, conducting equitable stakeholder engagement, and connecting residents and small businesses with workforce or business development opportunities.
- **Climate Justice Fellowships** - $6 million (CEF) to support individuals residing in disadvantaged communities or from priority populations to gain experience working in clean energy or climate justice through organizations such as community-based organizations, universities, municipalities, climate tech innovators/start-ups and clean energy businesses to advance climate justice and clean energy priorities for disadvantaged communities, including assisting with community engagement activities (e.g., plan, policy, or project) or clean energy project development and implementation.
- **New York Clean Transportation Prizes**- $85 million (CEF) to fund innovative electric transportation approaches that improve air quality and expand access to mobility in disadvantaged communities.
- **Large Scale Renewables and Clean Energy Standard**- In October 15, 2020 Order, the PSC directed NYSERDA to take measures to ensure that interests of disadvantaged communities are valued in all future CES procurements.

Community Air Monitoring in Disadvantaged Communities

The Climate Act created a program to measure and record air pollutant concentrations in the ambient air at or near places like hospitals, schools, and day care centers in disadvantaged communities and to use this information to create a strategy to reduce emissions of toxic air contaminants and criteria air pollutants in disadvantaged communities with high exposure burdens. DEC administers the community air monitoring program and will develop the strategy in consultation with the CJWG and community members. The strategy will include methods for assessing and identifying the emissions sources, estimating their relative contribution to elevated exposure to air pollution, and assessing measures to reduce emissions from these sources. DEC will use the strategy to design community emissions reduction programs in disadvantaged communities.

6.2 Engagement in the Draft Scoping Plan

Integral to developing the draft Scoping Plan was considering the benefits and impacts to disadvantaged communities of the draft Plan strategies. The Council sought robust engagement with environmental justice organizations throughout the process to ensure these perspectives were prioritized in the draft Plan. The Council's Advisory Panels and the JTWG all contained members of environmental justice organizations, which was vital to ensuring that the perspective of disadvantaged communities was included in the development of their respective recommendations. Additionally, the Advisory Panels and JTWG consulted with the CJWG as they were developing their recommendations. These bodies delivered their recommendations to the Council in the spring of 2021. The Council consulted with the CJWG on the Advisory Panel and JTWG recommendations. The CJWG provided feedback on all Advisory Panel and JTWG recommendations at Council meetings in the summer of 2021, with slides and recorded presentations available on the Climate Act website. The sectoral strategies in this draft Plan incorporate CJWG feedback and note where the group provided feedback on specific strategies. Table 1 represents a high-level overview of general feedback, organized by Advisory Panel. A compilation of the feedback provided by the CJWG is provided in Appendix XYZ. Consideration of Disadvantaged Communities is woven throughout the draft Scoping Plan.

Table 1. Climate Justice Working Group Feedback by Advisory Panel

Advisory Panel	Feedback
Transportation	• Ensure that VMT reduction strategies are equitable • Oppose Transportation and Climate Initiative (TCI) cap-and-invest program • Support electrification; avoid reliance on biofuels • Prioritize communities facing barriers • Expand public transportation including high-speed rail and long-range bus service
Energy Efficiency and Housing	• Supportive of the Panel's recommendations • Ensure that strategies enhance consumer protection and place emphasis on a just transition
Power Generation	• Support strategies to retire fossil fuel infrastructure and a moratorium on new fossil fuel infrastructure • Develop behind-the-meter microgrids in Disadvantaged Communities • Limit the use of hydrogen, nuclear, and biofuels to strategic applications • Place greater focus on public power
Energy-Intensive and Trade-Exposed Industries	• Support the emphasis on green job creation for members of DACs, data collection and reporting requirements on industrial facilities' impact on DACs, and state procurement of low-carbon materials • Ensure that climate and environmental justice objectives are equal to the business development objectives
Agriculture and Forestry	• Adopt the climate goals in the Federal Agriculture Resiliency Act, which requires cutting agricultural GHG emissions in half from 2010 levels by 2030 and to net zero by 2040 • Ensure that strategies address equity in the agricultural sector • Prioritize the use of on-site biogas over strategies that use Anaerobic Digesters for biogas or biomass for energy to mitigate GHG emissions on farms • Eliminate synthetic fertilizers and encourage organic farming • Ensure that strategies include regulatory or mandatory actions and rely less on voluntary programs
Land Use and Local Government	• Incorporate stakeholders from Disadvantaged Communities in adaptation and resilience planning and fund nature-based infrastructure • Engage communities in smart growth and consider a grant program to fund capacity building in Disadvantaged Communities • Avoid gentrification through transit-oriented development (TOD) and adopt explicit land use strategies in Disadvantaged Communities • Remove barriers to community choice aggregation (CCA) in Disadvantaged Communities • Prioritize benefits and investments in conservation in Disadvantaged Communities
Waste	• Support strategies focused on waste reduction, materials reuse, and composting • Support zero-emissions waste trucking • Reduce food waste through programs that transfer excess edible foods to feed the hungry • Ensure that biogas from the waste sector does not result in new gas transmission infrastructure; prioritize the on-site use of biogas

Advisory Panel	Feedback
Just Transition Working Group	• Ensure that impacted workers can contribute to workforce assessment planning and include retirement planning that facilitates a dignified retirement • Ensure that community benefit agreements between manufacturers, union groups, and impacted communities are legally binding • Reuse shuttered power plants for clean energy and sustainable manufacturing • Eliminate implicit bias in searching for and hiring workers

6.3 Measures to Reduce Greenhouse Gas Emissions and Co-Pollutants in Disadvantaged Communities

The Climate Act requires that the Scoping Plan include strategies that maximize reductions of GHGs and co-pollutants in Disadvantaged Communities. Strategies that reduce New York's reliance on fossil fuels not only reduce GHGs but also reduce co-pollutants which leads to corresponding benefits to Disadvantaged Communities. As New York approaches full decarbonization by 2050, emissions of unhealthy pollutants like fine particulate matter, nitrogen oxides (NO_X), which contribute to ozone formation), and various toxic pollutants will see commensurate declines statewide, including in Disadvantaged Communities.

In the interim, this draft Plan includes many strategies to target GHG emissions reductions in Disadvantaged Communities, as described in more detail in the sector chapters below. There are several examples:

- Incentives for electrification of trucks and buses will be targeted in the first instance to vehicles operating in areas overburdened by air pollution, and fleet electrification requirements will drive the electrification of fleets operating in and through these Disadvantaged Communities, including drayage fleets serving port areas. In addition, until the trucking sector is fully electrified by midcentury, the replacement of diesel with renewable diesel and green hydrogen will reduce harmful fine particulate matter emissions in Disadvantaged Communities.
- In the power sector, incentives for distributed energy resources (DERs) and energy storage will be targeted to Disadvantaged Communities, reducing GHG emissions from peaking power plants in those locations.
- Incentives for energy efficiency, including heat pumps, will be targeted to LMI and Disadvantaged Communities, reducing both costs and emissions in those communities. Reducing fossil gas combustion in buildings results in improved indoor air quality and healthier living spaces.

- Diverting organics and capturing methane from landfill facilities in disadvantaged communities reduces landfill odors that significantly impact the quality of life and pose potential health impacts for those communities. Waste reduction and increased recycling will reduce waste hauling and related emissions.
- Alternative manure management strategies in the agricultural sector can help prevent excessive ammonia, hydrogen sulfide, methane, and nitrous oxide emissions in rural disadvantaged communities.

Collectively, implementation of these and other recommendations will ensure substantial reductions of GHGs and harmful co-pollutants in communities overburdened with harmful pollution. In addition, state agencies will vigorously apply Section 7(3) of the Climate Act to prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities in their programs and policies. State agencies will also prioritize compliance with the Climate Act's investment provision, Section 75-0117 of the ECL, which establishes a requirement to invest 35%, with a goal of 40%, of clean energy and energy efficiency investments for the benefit of Disadvantaged Communities.

6.4 Barriers and Opportunities Report

Pursuant to Section 6 of the Climate Act, to ensure that the material benefits of mitigating and adapting to climate change are realized in Disadvantaged Communities, DEC is working with NYSERDA, NYPA, other state agencies, the Council, and the CJWG to prepare a report on barriers to and opportunities for access to and/or community ownership of several services and commodities in Disadvantaged Communities:

- Distributed renewable energy generation
- Energy efficiency and weatherization investments
- Zero-emission and low-emission transportation options
- Other services and infrastructure that can reduce risks associated with climate-related hazards including but not limited to shelters and cool rooms during extreme heat events, shelters during flooding events, and medical treatment for asthma and other conditions that could be exacerbated by climate-related events

The report framework was developed through agency input and secondary research on barriers and opportunities related to these services and commodities. The report team is using the knowledge, experience, and networks of the interagency team to refine examples of services, commodities, and models to explore within the research. Robust public input is essential to ensure that the report is

responsive and reflects the needs all New Yorkers, particularity those who live or work in historically overburdened and under-resourced communities. Public input has been gathered through eight small group discussions focused on specific topic areas covered by the report. Public input on the development of the report will also be gathered at two public hearings scheduled in early November 2021. The report is expected to be released by January 1, 2022. The final Scoping Plan will incorporate the report's recommendations. Climate Act implementation reporting will include an assessment of disadvantaged communities' access to the services and commodities covered by this report.

Chapter 7. Just Transition

As the state continues the implementation of the Climate Act, which demands a transition away from traditional energy sources and industries, New York will ensure this is a just transition. A just transition is one that builds connections, creates opportunity, and ensures a good quality of life for New Yorkers from all different walks of life. The JTWG was convened by the Council, as required by Section 75-0103(8) of the ECL. The Climate Act specifically requires the JTWG to advise the Council on various issues related to workforce development and opportunities, advise on potential impacts of carbon leakage risk to New York industries and communities, identify sector specific impacts, and identify electric generating sites that may be closed as a result of a transition to a clean energy sector, including the issues and opportunities that are presented by reuse of those sites.[54] The JTWG presented this information to the Council on April 12, 2021, and it is published on the state's Climate Act website. Additional materials are included in Appendices X, Y, and Z. The Climate Act requires this Plan to include recommendations to aid in the transition of the state workforce and rapidly emerging clean energy industry, which is discussed below.

7.1 Just Transition Principles

The JTWG's just transition principles were developed to serve as a guide for Advisory Panel recommendations with the acknowledgement that each may have different applicability depending on economic sector. The principles have been developed to support a fair and equitable movement from fossil fuel-based economies toward the achievement of the carbon neutral future envisioned by the Climate Act.

[54] ECL § 75-0103(8)(a)-(f).

Table 2. Just Transition Principles

Category	Principle Language
Stakeholder-Engaged Transition Planning	Engage a diverse range of stakeholders via early, inclusive engagement in communities' transitions to local low-carbon economies, including New York's workforce and the state's disadvantaged communities.
Collaborative Planning for a Measured Transition Toward Long-Term Goals	Encourage collaborative state and community-based long-term planning, capacity building, and robust social dialogue in order to ensure a gradual and supported transition.
Preservation of Culture and Tradition	Ensure that transition plans, policies, and programs reflect and respect local wisdoms, cultures, and traditions, including recognition of indigenous sovereignty.
Realize Vibrant, Healthy Communities Through Repair of Structural Inequalities	Seek to lift up New Yorkers in the transition to a low-carbon economy by implementing transition policies and programs that promote cross-generational prosperity and gender and racial equity, in recognition of the disproportionate burden of environmental pollution and climate change on disadvantaged communities.
Equitable Access to High Quality, Family-Sustaining Jobs	Promote the creation of high-quality, family-sustaining jobs, including union jobs, and ensure that new jobs are created in transitioning and disadvantaged communities, connecting workers to employment opportunities through career services, skills training, and infrastructure investments.
Redevelopment of Industrial Communities	Promote diversified, strengthened economies in the transition to a low-carbon economy, examine opportunities for community-centered ownership structures, and promote industry recovery, retention, and growth for regions and sectors in transition.
Development of Robust In-State Low-Carbon Energy and Manufacturing Supply Chain	Develop a robust in-state low-carbon supply chain, spanning full product lifecycles, to increase focus on exporting low- and no-carbon products and to ensure that jobs in these emerging sectors become more accessible to the local workforce and to disadvantaged communities.
Climate Adaptation Planning and Investment for a Resilient Future	Integrate climate adaptation into transition planning, including through promotion of community resilience and investment in sustainable infrastructure.
Protection and Restoration of Natural and Working Lands Systems & Resources	Promote the restoration, conservation, and resiliency of the state's agricultural and natural systems, improving local food security and supply and fostering healthy ecosystems, particularly in disadvantaged communities through sustainable land and natural resource use.
Mutually-Affirming Targets for State Industrialization & Decarbonization	Implement decarbonization policies that simultaneously bolster industry retention and sustainable economic development and growth and ensure that economy-wide programs and policies address the social, environmental, and economic challenges of workers and communities in transition.

7.2 Workforce Impacts and Opportunities

Achieving a just and equitable transition will generate numerous opportunities for New York's existing and emerging workforce. Since the Council's JTWG and six multi-sector advisory panels were launched, representatives from public, private, academic, environmental, and community groups; labor unions; environmental justice communities; impacted industries; and renewable energy developers have met on several occasions to debate and analyze the impacts of transitioning to clean energy on the labor market.

Together, the JTWG and the Council's advisory panels have identified the following recommendations to help ensure that New York's workforce is prepared for and stands to benefit from the state's transition to a clean economy.

Direct Displaced Worker Support

New York's transition towards a cleaner, greener power grid will create new opportunities for economic success in communities that have historically relied on fossil fuel power plants. As New York leaves fossil fuels behind, some power plants will inevitably be forced to close. To mitigate any economic impact and ensure that current and formerly employed power plant workers benefit from the transition to clean energy, it is imperative to support displaced workers as much as possible and early on. This means establishing continuing education, Registered Apprenticeships, certifications, and licensing in trades and professions for current workers and supporting companies in transitioning their workforce to building operations and maintenance, design, construction, and other clean energy jobs. Consideration should be given to businesses and jobs not only in installation, but also in manufacturing and the entire supply chain. Engagement with clean energy providers will be important to evaluating current and future workforce needs, aligning training with business demand, including by geographical area and, ultimately, developing a successful talent pipeline.

In cases when continued operation of a power plant is needed, even as it winds down, efforts should focus on retaining workers while retraining them for new, clean energy jobs. In other cases, when facility closures are known ahead of time, training and supportive services should be implemented while individuals are still working to prepare workers for the transition to clean energy. Areas identified to support fossil fuel workers include securing wage support and setting aside a fund for on-the-job training, providing resume writing support and career coaching, and hosting job fairs with relevant clean energy employers, while also leveraging opportunities at dual-commodity utilities. Where business interests align, decarbonization-related roles should be leveraged. Surveys may also be a useful tool to identify power plant workers' career status, future interests, timing needs, and other considerations.

Distinct strategies and responses must be developed for key existing traditional energy sectors, namely electric power generation, transmission, distribution, storage fuels, and motor vehicles. In electric power generation, displaced power plant workers should be supported through retraining, retention, early retirement/pension support, and mutual aid/work agreements. One option might be to require a cost share by plant owners while distinguishing between workers and executives. In the transmission, distribution, and storage sector, natural gas utility workers are supported by PSC rules to retrain for roles on the

electric side of dual utilities (supported by cost recovery), with specific wage floors and protections. In the fuels industry, it will be important to address changes to businesses. Finally, greater attention must be paid to addressing the shift in work for other sectors that are central to the transition to a low carbon economy, for example automotive workers and service technicians as internal combustion engines are replaced with electric vehicles (EVs).

Evaluation of Labor Standards

As New York continues to work toward the Climate Act mandates and the overall energy landscape changes, labor standards should be further evaluated and enhanced to promote family sustaining wages and comprehensive benefits, as well as employer-led pre-apprenticeship and Registered Apprenticeship training, thereby supporting the development of pathways into good-paying jobs. Where appropriate, feasible, and permitted by law, project labor and community workforce agreements, as well as local and targeted hiring provisions, should be explored, particularly to incentivize the hiring of workers from disadvantaged communities, including environmental justice and New York opportunity zones. Enacting fair pay provisions will be particularly important in ensuring that new, clean energy jobs pay as well as former or existing jobs. Prevailing wage and project labor agreements, as well as the use of Registered Apprenticeship programs, can help ensure that jobs turn into long-term careers for New York residents that live in the local communities hosting renewable industries.

Targeted Financial Support for Businesses

To build a diverse, equitable, and inclusive clean energy economy, businesses must be supported with targeted financial support to ensure access to contracting and procurement opportunities in the transition away from fossil fuels. Funding must provide for supported on-the-job, recruitment, training, hiring, and job retention for disadvantaged communities, minority- and women-owned businesses (MWBEs), service-disabled veteran-owned businesses (SDVOBs), employee-owned businesses, cooperatives, design and installation firms, community-based organizations, and start-ups. Concurrently, manufacturing of clean energy components and equipment must be promoted locally to stimulate the economy and increase job growth. Government support must target efforts both specific to clean energy technologies and to affected regions. The focus must be on creating stable, well-paid jobs as opposed to takeover by out-of-state workers in the “gig” economy. Entrepreneurship training and small business startup support could further increase small business creation and ownership in climate adaptation and resilience products and services, particularly by MWBEs and SDVOBs.

Training Curriculum and Programs

New training curricula and programs will be critical to this economy-wide transition. These programs must be developed with a focus on Disadvantaged Communities. NYSERDA's Climate Justice Fellowship is one example of a program that will fund fellows from Disadvantaged Communities to advance climate justice and clean energy in their respective communities. Additional efforts should target education outreach and clean energy training at traditional education channels such as K-12 schools, Pathways in Technology Early College High Schools, Boards of Cooperative Education Services, local labor unions, community colleges, and 4-year colleges and universities. Some of the most successful education outreach programs feature ambassador programs, mentoring, job shadowing, science fairs, career days, guest speakers, and work site visits to generate excitement around clean energy and expose students to different career pathways early on. General science, technology, engineering, and mathematics programming should be expanded to include clean energy content leading to industry-recognized certificates, advanced training, internships, Registered Apprenticeship, and job placement. Within community and 4-year colleges and universities, decarbonization curricula must be developed for the fields of engineering, architecture, construction, and related programs. Collaborations with professional organizations and for-profit training groups can further be beneficial in developing training programs and scaling them statewide.

Comprehensive Career Pathway Programs

The state must develop comprehensive programs to develop career pathways into clean energy for both existing and future workers. Existing workers include workers from transitioning fossil fuel, clean energy industries, manufacturers, community-based organizations, MWBEs, SDVOBs, as well as state/public workers. Existing workers must be given access to technical skill development (upskilling) based on the most current, nationally recognized curricula and state-of-the-art labs and training equipment. This includes training on energy efficiency, building electrification, healthy homes/buildings in coordination with adjacent industries that work in homes. Working with unions will be crucial to incorporating renewable energy and decarbonization training into existing and new Registered Apprenticeship programs. Additionally, workers must be provided with opportunities for career advancement, including management and leadership training. Future workers are new entrants (primarily entry-level) to clean energy, often young adults (16-to-24-years of age) with high school degrees whose success depends on workforce development programs such as Youth Build and Job Corps, pre-apprenticeships, internships, and jobs with clean energy employers. Career awareness and supportive services are key to ensuring job placement and retention, particularly for members of disadvantaged communities and other segments of the population who may be underrepresented (such as women, single parents, and formerly incarcerated

individuals). Technical skills should further be complemented by professional skills, such as communication, leadership development, and workplace etiquette to ensure long-term success. Climate Justice Job Corps Fellowships for both entry-level and transitioning workers, as well as employer-sponsored on-the-job and Registered Apprenticeship programs, can serve as meaningful pipeline to good-paying clean energy careers.

Community Engagement, Stakeholder Input, Market Assessments

Finally, it is imperative to continue stakeholder engagement to identify and assess industry skills gaps, employee demand, as well as curriculum and training needs. Open dialogue among relevant stakeholders will be key to sharing needs and best practices, support industry opportunity awareness, and enhance recruitment efforts for new, transitioning, and existing workers. Particular attention must be placed on fossil fuel workers to understand and leverage transferrable skills with complementary training in both energy and non-energy roles. Additionally, the needs of people in frontline communities, indigenous community members, formerly incarcerated New Yorkers, women in non-traditional trades, immigrants, and people transitioning from unemployment must be prioritized. Strategies must be in place to reach underrepresented communities and to include them in the development of clean energy policies, strategies, and solutions; ensuring their voices are not only heard but also drive the successful achievement of New York's clean energy future. These strategies include campaigns to build public awareness of climate change effects and solutions, including co-benefits of actions to mitigate and adapt to climate change through public calls for ideas and projects to advance Climate Act requirements in disadvantaged communities.

General Considerations

As the state of New York and the world at large adapts to a new reality in the wake of COVID-19, workforce development and training initiatives will also be required to adjust. Flexibility and resilience are two important characteristics of successful workforce training models, enabling online and in-person training with courses offered in multiple languages and at different times to accommodate various health, safety, and learning needs. The most effective workforce development efforts further combine robust diversity, equity, and inclusion initiatives; generous wraparound services; and relevant safety training (such as the Occupational Safety and Health Administration and the U.S. Environmental Protection Agency [EPA]) as applicable. To the extent possible, training entities should leverage state, federal, or other funding to cover training and education costs and, thereby, eliminate barriers for both employers and individuals. Collaboration among relevant state entities, such as NYSERDA, City University of New York, State University of New York (SUNY), NYPA, ESD, and New York State Department of Labor

will be critical in ensuring an "all government approach" to designing, implementing, and resourcing the above-referenced workforce development and training efforts.

7.3 Measures to Minimize the Carbon Leakage Risk and Minimize Anti-Competitiveness Impacts

In its transition to a net zero emission economy, the State must also consider the issue of GHG emissions "leakage." Under the Climate Act, leakage is defined as, "a reduction in emissions of greenhouse gases within the state that is offset by an increase in emissions of greenhouse gases outside of the state."[55] The concept of leakage is important given the fact that climate change is a global problem, whereas the State's policy authority is confined to activities within its borders. New policies that increase the cost of energy, reduce the reliability of energy, or increase the cost of emitting GHGs could cause businesses to shift their production outside of New York State, or avoid the state altogether, and instead invest in out-of-state locations with lower energy cost and/or less stringent environmental and GHG emission reduction policies. Mitigating leakage risk is of interest to the state for both climate and economic reasons, which is further demonstrated by the Climate Act requirements related to mitigating anti-competitive impacts and for the emission reduction regulations ultimately adopted by DEC to incorporate measures to minimize emissions leakage.

As the State implements this Scoping Plan, it will need to carefully monitor the potential for unintended emission and economic leakage. The following are potential measures to mitigate the risk of leakage. A more detailed analysis related to the risk of leakage and the mitigation measures can be found in Appendix XYZ.

- **Recognize Early Action:** The State should credit emitters for early investments to reduce their GHG emissions. The absence of early action credit could discourage short-term emission reductions by firms as they await the onset of a new system and the establishment of their baseline.
- **Set Industry-Specific Benchmarks:** If assigning emission reduction targets to individual emitters, the State should apply benchmarks for the emissions intensity of their production, taking into account current technology and types of emissions and adjusting them over time to reduce the risk of leakage caused by the imposition of infeasible reduction requirements.

[55] ECL § 75-0101(12).

- **Utilize Market Forces:** The State should consider measures to financially incentivize emission reductions while also providing emitters with compliance methods intended to mitigate leakage, increasing the cost-effectiveness of reducing emissions, such as through a cap-and-trade program.

7.4 Power Plant Retirement and Site Reuse

On the road to achieving the power sector goals within the Climate Act – namely, to achieve 70% renewable electricity by 2030, and 100% zero-emission electricity by 2040 – the existing power sector will undergo significant evolutions and transformations, leading to uncertain outcomes for conventional power plants (primarily fossil fuel) and their workers and host communities. These impacts were contemplated by the Climate Act as something New York would have to proactively plan around: specifically, the Climate Act tasked the JTWG with two discrete deliverables, which the Group considered with the leadership of a Subgroup formed specifically to tackle these power plant topics. The two power plant tasks contained in the Climate Act include: 1) identifying generation facilities that "may be closed as a result of a transition to a clean energy sector" and 2) identifying issues and opportunities presented by the reuse of those sites.

The JTWG, with the help of a Power Plants Subgroup, set about to tackle these two tasks with a robust, data-driven approach rooted in real-world case-studies and the 'facts on the ground' as much as possible, while acknowledging that future scenarios would not be known and fixed. These full work-products are made available in the Appendix, with results making clear that power plant reuse is an area where there are both challenges as well as promises of opportunity moving forward.

7.5 Jobs Study

In accordance with the Climate Act, the JTWG is also providing oversight to a Jobs Study, serving to forecast clean energy job growth tied to the state's decarbonization goals, with the following specific objectives:[56]

- Objective 1: Develop the structural and analytical framework to estimate the number of jobs created and lost due to climate change mitigation strategies, investments, and related scenarios. This initial objective is focused on creating an accurate and consistent approach to estimating the employment and economic impacts that occur under different climate change mitigation scenarios.

[56] ECL section 75-0103(8)(g)

- Objective 2: Measure and describe the employment impacts by industry and occupation for each climate change scenario based on the outputs from the process developed in the first objective. This second objective is meant to account for the number of jobs that are growing and/or declining in each industry and occupational classification.
- Objective 3: Examine the workforce implications associated with each of the climate change mitigation strategies and related scenarios. This final objective is meant to assess how the change in employment could impact the need for new skills and workforce development activities as well as the potential impact that employment changes could have on labor standards, job quality measures, and the net impact of employment opportunities for specific disadvantaged communities and other cohorts of importance.

The Jobs Study team will leverage its modeling framework and analysis to better understand and characterize job requirements and how those requirements can be constructed into workforce training and development pathways, including for priority populations and Disadvantaged Communities. The Jobs Study modeling framework is currently under development and is expected to be released as a final report by December 30, 2021.

Chapter 8. Public Health

8.1 Principles

Climate change will have vast and varied impacts on public health and is already affecting the people of New York and its resources. New York continues to make progress on its goal to becoming the healthiest state through continued implementation of the New York State Prevention Agenda[57] and recent adoption of the Health Across All Policies approach.[58] The Prevention Agenda is the state health improvement plan, the blueprint for state and local action to improve the health and well-being of all New Yorkers and promote health equity, based on several cross-cutting principles.

[57] DOH. Prevention Agenda 2019-2024 New York State's Health Improvement Plan. 2019. https://www.health.ny.gov/prevention/prevention_agenda/2019-2024/

[58] New York State Health-Across-All-Policies: https://www.health.ny.gov/prevention/prevention_agenda/health_across_all_policies/

Cross-Cutting Principles of the Prevention Agenda

To improve health outcomes, enable well-being, and promote equity across the lifespan, the Prevention Agenda has several cross-cutting principles:

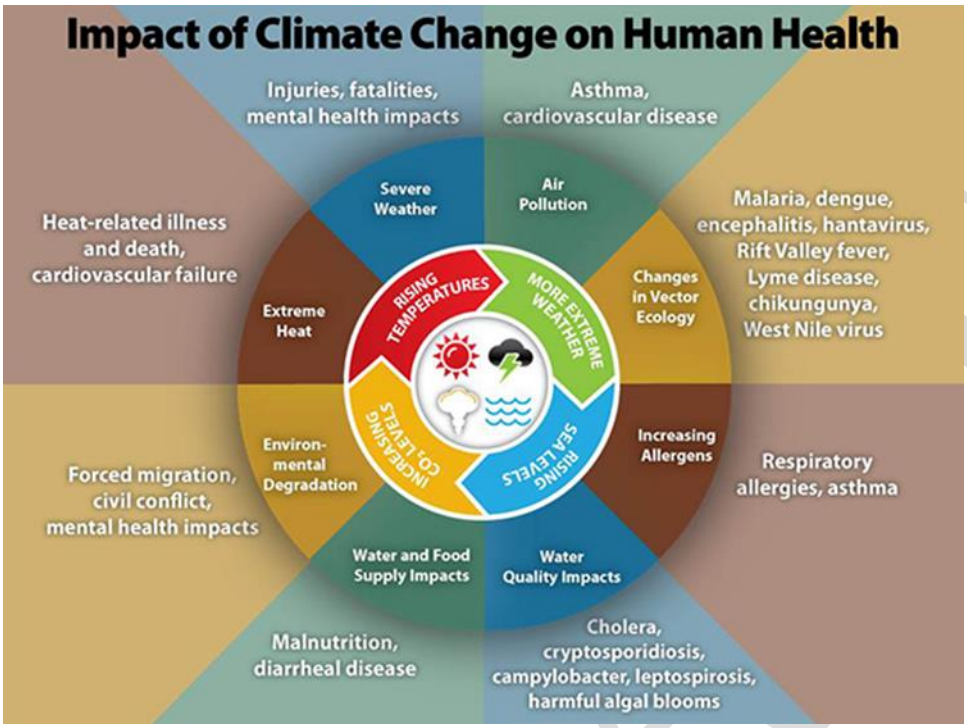
- Focuses on addressing social determinants of health and reducing health disparities
- Incorporates a Health Across All Policies approach
- Emphasizes healthy aging across the lifespan
- Promotes community engagement and collaboration across sectors in the development and implementation of local plans
- Maximizes impact with evidence-based interventions for state and local action
- Advocates for increased investments in prevention from all sources
- Concentrates on primary and secondary prevention, rather than on health care design or reimbursement

Embodiment of these principles is critical for developing a successful climate policy. The Climate Act provides a foundation that incorporates these principles in that it requires consideration of impacts to public health and Disadvantaged Communities, as well as mitigation actions that will address health impacts. This Scoping Plan goes further, identifying specific opportunities to reduce emissions, support communities, reduce existing health risks, and avoid introducing new risks. This chapter seeks to describe both the direct and indirect human health impacts of climate change and the health co-benefits of climate change mitigation and adaptation strategies and policies.

8.2 Climate Change Impacts on Public Health

Climate change directly and indirectly impacts physical, social, and mental health and will intensify some health stressors and cause other new health threats to emerge. Possible health impacts are far-reaching, even if not all are equally likely to occur among New Yorkers in the immediate future.

Figure 4. Impact of Climate Change on Human Health



Source: Centers for Disease Control and Prevention.

Recently, the editors of over 200 medical journals united to issue a call for urgent government action to address global warming and protect public health and nature.[59] NYSERDA's ClimAID report describes the impacts and adaptation strategies for New York's water resources, coastal zones, ecosystems, agriculture, energy, transportation, and telecommunications sectors, as well as vulnerabilities and adaptation strategies related to climate change and public health. According to the New York State Department of Health (DOH) Climate and Health Profile[60] (2015), there are several potential climate-related health impacts in the state:

- Increased heat stress (such as heat edema, heat stroke, heat cramps, heat stress, and dehydration) and other heat-related morbidity and mortality
- Exacerbation of respiratory conditions (including pneumonia, asthma, and chronic obstructive pulmonary disease) and cardiovascular disease
- Increased risk for food- and water-borne diseases due to increasing temperatures and flooding

[59] "Call for Emergency Action to Limit Global Temperature Increases, Restore Biodiversity, and Protect Health" see for example the *New England Journal of Medicine* September 5, 2021.

[60] DOH (2015) Building Resilience Against Climate Effects (BRACE) – Climate and Health Profile. climatehealthprofile6-2015.pdf (ny.gov)

- Increased duration and severity of allergy symptoms due to increased duration and intensity of pollen season
- Increased risk for vector-borne diseases (such as Lyme disease, West Nile virus, and other pathogens)
- Increased risk of injury and death following extreme precipitation events and flooding

Other significant impacts associated with public health that are not listed above include droughts, rising sea levels that threatening infrastructure, saltwater intrusion of our groundwater resources (which may impact drinking water supplies), poor indoor air quality (such as mold and moisture), and deteriorating outdoor air quality, particularly ground-level ozone that increases with rising temperature.[61] Extreme weather events that involve storm-related flooding and power outages have proven to be detrimental to public health.[62] Hurricane Ida resulted in drowning deaths in basement apartments and cars. Previous flooding events have resulted in extensive mold growth in homes, putting both residents and responders at risk.[63] These kinds of extreme weather events have been associated with anxiety and post-traumatic stress disorder. Some populations are more vulnerable to certain climate and health impacts than others, whether due to demographic factors, socioeconomic status, physiological condition, place, or occupation. Many impacts of climate change disproportionally affect Disadvantaged Communities.

Climate change mitigation and adaptation policies are crucial in reducing the public health impacts described above, particularly for vulnerable communities, such as those that can be identified by the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry Social Vulnerability Index. DOH has worked to support public health adaptation efforts. For example, DOH's scientific research on the health effects associated with heat contributed to the National Weather Service lowering its Heat Advisory Threshold and led to the development of County Heat and Health Profiles, where users can view county temperature trends and projections, along with heat-related health effects

[61] Stowell, Jennifer D., et al. "The impact of climate change and emissions control on future ozone levels: Implications for human health." Environment International 108 (2017): 41-50

[62] Alderman, Katarzyna, Lyle R. Turner, and Shilu Tong. 2012 "Floods and human health: a systematic review." Environment International. 47: 37-47.

[63] Centers for Disease Control and Prevention. Health concerns associated with mold in water-damaged homes after Hurricanes Katrina and Rita--New Orleans area, Louisiana, October 2005. MMWR Morb Mortal Wkly Rep. 2006 Jan 20;55(2):41-4. PMID: 16424858.
Chow NA, Toda M, Pennington AF, et al. Hurricane-Associated Mold Exposures Among Patients at Risk for Invasive Mold Infections After Hurricane Harvey - Houston, Texas, 2017. MMWR Morb Mortal Wkly Rep. 2019;68(21):469-473. Published 2019 May 31. doi:10.15585/mmwr.mm6821a1

and vulnerabilities.[64] DOH staff have worked with local partners to enhance awareness and accessibility to cooling centers during heat advisories.[65] DOH also identifies populations that are vulnerable to extreme heat by developing a Heat Vulnerability Index. Studies have sought to increase awareness about climate impacts on health in New York, and have explored associations between temperature and respiratory outcomes, cardiovascular outcomes, renal diseases, and birth defects. Additional studies have explored climate change trends in New York,[66] impacts of air pollutants on health (which could assist in understanding co-benefits to improved air quality through climate policy), and impacts of specific events that could stem from extreme weather. The state could conduct additional studies to continue to increase its understanding of the health impacts of climate change and the health benefits of climate policy.

8.3 Considering Health in Climate Policy

The development of sound policy to mitigate and adapt to the changing climate will provide direct and indirect public health benefits. Direct benefits will result from mitigating and adapting to global climate change by reducing the many public health impacts associated with climate change. Indirect health benefits will occur when initiatives to mitigate GHG emissions also result in other beneficial outcomes such as reducing air pollutant emissions (co-pollutants), encouraging active transport (such as walking and cycling), and reducing home health risks through building energy efficiency retrofit interventions. Improved air quality will reduce incidences of asthma and cardiovascular disease, and increased physical activity will reduce negative cardiovascular outcomes. Cardiovascular disease is the leading cause of death nationally and in New York, with almost 44,000 New Yorkers dying of cardiovascular disease every year. Asthma is a major health problem nationally, and in New York 1.4 million adults and 315,000 children suffer from this disease.[67]

State and federal government programs to control air pollutant emissions through regulations and permitting have contributed to greatly improved air quality in New York over the last 40 years (see the Appendix). Although the state currently complies with the requirements of, or is "designated attainment

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[64] Chow NA, Toda M, Pennington AF, et al. Hurricane-Associated Mold Exposures Among Patients at Risk for Invasive Mold Infections After Hurricane Harvey - Houston, Texas, 2017. MMWR Morb Mortal Wkly Rep. 2019;68(21):469-473. Published 2019 May 31. doi:10.15585/mmwr.mm6821a1
Nayak SG, Shrestha S, Kinney PL, Ross Z, Sheridan SC, Pantea CI, Hsu WH, Muscatiello N, Hwang SA. Development of a heat vulnerability index for New York State. Public Health. 161:127-137. 2018.

[65] Nayak, Seema G., Srishti Shrestha, Scott C. Sheridan, Wan-Hsiang Hsu, Neil A. Muscatiello, Cristian I. Pantea, Zev Ross et al. "Accessibility of cooling centers to heat-vulnerable populations in New York State." Journal of Transport & Health 14 (2019): 100563.

[66] Insaf, T.Z., Lin, S., S.C. Sheridan. Climate trends in indices for temperature and precipitation across New York State, 1948-2008. Air Quality, Atmosphere & Health. 2013. 6(1): 247-257.

[67] Most Recent Asthma State or Territory Data https://www.cdc.gov/asthma/most_recent_data_states.htm

for," the National Ambient Air Quality Standards for the criteria pollutants carbon monoxide, lead, nitrogen dioxide, and particulate matter, substantial additional health benefits will be achieved through continued emission reductions. For sulfur dioxide (SO_2), a small portion of St. Lawrence County has been designated as nonattainment. Nine counties, in which 65% of the state's population reside, are currently not in attainment for the 2015 ozone standard. Concentrations of non-criteria pollutants attributed to fuel combustion have also decreased significantly over the last decade, due in part to programs and regulations directed at reducing transportation source pollution, including the adoption of reformulated gasoline programs and improvements in vehicle emissions technology, the statewide adoption of the California Low Emission Vehicle program, and emission reductions from oil refineries and other stationary sources under federal and state air pollution control programs.

Disadvantaged Communities, as defined in the Climate Act, are likely to have greater health disparities (or inequities) and shoulder more significant environmental burdens than other communities. The recommendations laid out in the Sector Strategies chapters of this Plan highlight the opportunity to protect and improve health, and address underlying economic and social inequities using asset-based approaches.

8.4 Sector-Specific Health Co-Benefits of Climate Policies

In addition to the health impacts associated with climate change, the production, distribution, and use of carbon-based fuels can have many other health impacts. These impacts can arise from routine operations, accidents, and catastrophic events. Health impacts resulting from routine carbon-based fuel use and production can range from local to global in scale and examples include degradation of air quality due to the combustion of fossil fuels and accidents such as fires, fuel oil spills, natural gas pipeline explosions, and other occupational and nonoccupational accidents. Reduction of these impacts through GHG emissions reductions strategies results in health co-benefits. Some of these impacts are discussed in the sections below. Table 3 summarizes the human health effects that are associated with GHG emissions (climate change) and exposure to some air pollutants commonly associated with carbon-based fuel combustion.

Table 3. Health Effects Associated with Carbon-Based Fuel Combustion Pollutants

Air Pollutant	Human Health Effects
GHGs	Climate-related effects on morbidity and mortality (such as increased mold and pollen allergy incidence and severity, heat stress, heat-related mortality, vector-borne disease, injury, and death due to flooding)
Carbon monoxide[68]	Likely effects on existing cardiovascular disease
Nitrogen oxides (NO_X)[69]	Respiratory effects
Ozone[70]	Respiratory effects
Fine particulate matter[71]	Cardiovascular effects and mortality
SO_2[72]	Respiratory effects
Metals[73]	Effects vary depending on specific metal
Polycyclic aromatic hydrocarbons[74]	Cancer (not all polycyclic aromatic hydrocarbons)
VOCs[75]	Effects vary depending on the specific chemical (some examples are central nervous system effects; liver or kidney toxicity; eye, skin, and respiratory tract irritation; and cancer)

Many VOCs, such as toluene, can cause central nervous system effects and some, like benzene, are carcinogens. In addition to VOCs and GHGs (discussed earlier), non-criteria pollutants that can be emitted from fuel combustion include chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans, polycyclic aromatic hydrocarbons, and various metals, particularly mercury from coal combustion. Exposure to high levels of chlorinated dioxins and furans is associated with cancer and effects on the liver and skin. Health effects associated with exposure to metals vary by the metal. For example, mercury, after being transformed to methylmercury in the environment and entering the food chain, can cause effects on the nervous system, especially for children and fetuses. Exposure to high levels of some polycyclic aromatic hydrocarbons is associated with lung cancer. Modeling changes in health outcomes associated

[68] EPA. EPA/600/R-019F/January 2010: Integrated Science Assessment for Carbon Monoxide, 2010.

[69] EPA. EPA/600/R-15-068/January 2016: Integrated Science Assessment for Oxides of Nitrogen – Health criteria, 2016.

[70] EPA/600/R-20/012, April 2020 U.S. EPA. Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants, 2020

[71] EPA. EPA/600/R-19/188, December 2019: Integrated Science Assessment (ISA) for Particulate Matter, 2019.

[72] EPA. EPA/600/R-17/451/December 2017.: Integrated Science Assessment for Sulfur Oxides- Health Criteria.

[73] Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. Toxicological Profiles for Specific Metals. http://www.atsdr.cdc.gov/toxprofiles/index.asp.

[74] ATSDR. Toxicological Profiles for specific PAHs: http://www.atsdr.cdc.gov/toxprofiles/index.asp.

[75] ATSDR. Toxicological Profiles for specific VOCs: http://www.atsdr.cdc.gov/toxprofiles/index.asp.

with exposure to air pollutants can be helpful to inform policy, but modeling those for non-criteria pollutants is more challenging and uncertain.

Power Generation

The transition in the power generation sector away from carbon-based fuel combustion to meet the requirements of the Climate Act will result in the same kinds of health co-benefits achieved through this transition across all sectors. However, there are health concerns specific to this sector, and they have been considered in the development of this Plan. The health risks associated with combustion emissions and combustion waste products are not associated with renewable power generation and will substantially decrease with large-scale reduction in combustion for power generation. Coal—a fuel with significant emissions and associated health impacts—has already been phased out in New York power generation following DEC's adoption of CO_2 emission limits for power plants, as part of 6 NYCRR Part 251.

Health concerns associated with onshore generation of wind energy are limited. Physical safety concerns can be mitigated through the choice of appropriate minimum setbacks (the minimum allowable distances between turbines and roads, property lines, or structures). Annoyance,[76] associated with wind turbines producing characteristic sounds or noise as wind passes over the rotating blades, is a health effect according to the *Environmental Noise Guidelines for the European Region*, published by the World Health Organization in 2018.[77] Data indicates that noise from wind turbines may be more noticeable, annoying, and disturbing than other community or industrial sounds of the same level. Reviewing acceptable noise thresholds for wind turbine siting as scientific understanding evolves will be important as onshore wind energy is increasingly adopted.

Finally, there are emerging energy technologies that may pose new opportunities as well as new risks that have yet to be fully understood. Hydrogen combustion does not generate most combustion byproducts such as particulate matter, thus conveying a potentially large health benefit, but may emit NO_X at levels that may be higher than those from natural gas combustion because of its high combustion temperature. Opportunities to further reduce NO_X emissions from hydrogen combustion exist and need to be further

[76] Noise annoyance is defined by the World Health Organization as a (long term) feeling of displeasure, nuisance, disturbance or irritation caused by a specific sound.

[77] WHO 2018

studied. The combustion of renewable natural gas (RNG) is likely to result in pollutant emissions similar to fossil gas combustion.

Transportation

Opportunities for health co-benefits associated with transportation sector climate policies include reductions in traffic noise and accidents and reductions in morbidity and mortality associated with improved air quality and increased availability and use of active transportation options. Transportation sector emissions are usually concentrated at the ground level, often in densely populated areas, resulting in a tendency toward higher levels of exposure for more people than emissions associated with other energy use sectors. Some of the co-pollutants emitted are associated with an increased risk of respiratory and cardiovascular effects, among others. Numerous studies have investigated the increased risk of these effects by looking at the relationship between traffic patterns and the distance from roadways and the associated pollutant concentrations and health endpoints. Studies have found associations between asthma exacerbation or emergency room visits for respiratory illness and transportation-related factors such as traffic proximity or traffic density[78] and diesel traffic density in particular.[79]

The recommendations for reducing single-occupancy vehicle travel and reducing gasoline and diesel use, discussed further in this Plan, could improve health outcomes. Transportation emissions have been concentrated in disadvantaged communities for generations and decarbonizing the transportation sector provides an opportunity to focus emission reductions in the communities that have historically been overburdened by pollution.[80] Additionally, transportation planning that uses Complete Streets policies ensures that considerations are made for the safety of all roadway users (pedestrians, bicyclists, public transportation users, and motorists). Not getting enough physical activity is a risk factor for diabetes and obesity (which are also risk factors for those with high blood pressure and a family history of these health risks). Almost 1.7 million New Yorkers (10.5%) had diabetes in 2016, and obesity has reached epidemic proportions with more than half (60.8%) of New York adults reported to be overweight or obese in 2016. Being obese or overweight is currently the second leading preventable cause of death in the United States

[78] Lin, S., Munsie, J.P., Hwang, S.A., Fitzgerald, E., Cayo, M.R.. Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic. Environmental Research. 2002. Section A (88): 73-81.
Lwebuga-Mukasa, James S. Traffic Volumes and Respiratory Health Care Utilization among Residents in Close Proximity to the Peace Bridge Before and After September 11, 2001. Journal of Asthma. 2003. 40(8): 855-864.
Kim, Janice. Residential Traffic and Children's Respiratory Health. Environmental Health Perspectives. 2008. 16(9):1274-9.

[79] McCreanor, James. Respiratory Effects of Exposure to Diesel Traffic in Persons with Asthma. New England Journal of Medicine. 2007. 357(23):2348-58.

[80] https://www.dot.ny.gov/programs/completestreets

and may soon overtake cardiovascular disease as the leading cause of death. Additionally, one-third of New York's children are obese or overweight. A reduction in the reliance on personal automobiles by incorporating Smart Growth and Complete Streets policies into transportation planning has the benefit of increasing opportunities for physical activity. In recent years, studies have begun to examine the relationship between neighborhood walkability and physical activity levels, body mass index, waist circumference, obesity, and hypertension. These studies have generally shown that neighborhood walkability is associated with increased physical activity and decreased body mass index, waist circumference, obesity, and hypertension.

Health risks associated with transportation emissions can be reduced with a shift toward technologies that do not rely on carbon-based fuels and the enhancement of public transportation systems and other low-carbon mobility options. Currently, most mobile source emissions result from the combustion of gasoline and traditional petroleum-based diesel fuel. When compared with petroleum-based fuels, biodiesel and alcohol-based fuels have higher levels of combustion emissions of respiratory irritants and some ozone-precursors such as acrolein, carcinogens, formaldehyde, and acetaldehyde.[81] Work conducted as part of the New York "Renewable Fuels Roadmap" discusses research suggesting that replacing gasoline with ethanol reduces emissions of carcinogenic benzene and butadiene but increases emissions of formaldehyde and acetaldehyde, which have other health impacts.[82]

Widely used public transportation results in considerably less fuel use and air contaminant emissions per person-mile traveled than other modes of transportation such as personal cars. Therefore, targeted geographic and temporal expansion of public transportation availability could reduce health risks associated with transportation emissions. Electrifying transit buses can ensure that emissions are reduced even further. Investments in transit bus electrification will benefit overburdened communities, both because many bus depots are located in these areas and because buses provide essential transportation services in these areas. Emissions associated with transportation can also be reduced through carpools and

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[81] Corrêa, Sergio M. and Arbilla, G. Formaldehyde and Acetaldehyde Associated with the Use of Natural Gas as a Fuel for Light Vehicles. Atmospheric Environment 39. 2005. 4513-4518.
Tang, Shida. Unregulated Emissions from a Heavy-Duty Diesel Engine with Various Fuels and Emission Control Systems. Environmental Science and Technology. 2007. 41:5037-5043.

[82] NYSERDA. Renewable Fuels Roadmap and Sustainable Biomass Feedstock Supply for New York. https://www.nyserda.ny.gov/About/Publications/Research-and-Development-Technical-Reports/Biomass-Reports/Renewable-Fuels-Roadmap
Vieira da Silva, M.A., B.L.G. Ferreira, L.G. da Costa Marques, A.L.S. Murta, and M.A.V. de Freitas. 2017. Comparative study of NO_X emissions of biodiesel-diesel blends from soybean, palm and waste frying oils using methyl and ethyl transesterification routes. Fuel, 194: 144-156.

investments in infrastructure that supports safe walking and bicycling. These mechanisms can be supported through integrated local and regional transportation planning using Complete Streets principles.

Reductions in fuel use and emissions can also be achieved through congestion mitigation and smart growth planning that facilitates the establishment of more walkable communities, with sidewalks, bike lanes, and bike paths. Policies and technologies to reduce congestion, such as congestion pricing and traffic signal synchronization, can alleviate major bottlenecks and improve local air pollution, especially in communities located near busy roads. Bike sharing programs have become a popular feature in cities across the nation, providing additional opportunities for physical activity. Active transport for shorter journeys has both the benefits of reduced emissions and of exercise, leading to reduced risk for obesity, cardiovascular disease, and other health impacts. Nevertheless, in spite of the emission reductions associated with bicycling and walking for transportation and the health benefits, exercising in polluted air can also have health impacts, especially for vulnerable populations.[83] However, among healthy adults, moderate to high-intensity exercise may neutralize any short-term negative effects of air pollution. While the benefits of increased physical activity have been found to outweigh the risks of exercise in polluted air,[84] air quality in areas of heavy traffic should still be considered in the choices made for siting of bicycle lanes and paths.[85] Further, traffic accidents have been found to increase in number and severity with increased active transport. Therefore, as active transport options continue to be made available, efforts to minimize accident potential become increasingly important.

Vehicle electrification can also contribute to reduced traffic noise, especially at slower and medium speeds where tire and wind noises are low. Particularly in cities, with high volumes of traffic, noise reduction is important health co-benefit for the deployment of EVs.

Buildings

The building industry presents a unique and largely untapped resource for integrating climate action and public health. Workforce education, training, job placement, and job development equips the state's current and future workforce to design, install, inspect, maintain, and operate healthy, comfortable, low-

[83] Mittleman, Murray A. Air Pollution, Exercise and Cardiovascular Risk. New England Journal of Medicine. Sept 13. 2007. 357(11):1147- 9.

[84] Tainio, M., de Nazelle, A., Götschi, T., Kahlmeier, S., Rojas-Rueda, D., Nieuwenhuijsen, M., Hérick de Sá, T., Kelly, P., Woodcock, J. 2016. Can air pollution negate the health benefits of cycling and walking? Preventive Medicine; 87:233-236.

[85] Hertel, Ole. A Proper Choice of Route Significantly Reduces Air Pollution Exposure – A Study on Bicycle and Bus Trips in Urban Streets. Science of the Total Environment. 2008. 389(1):58-70.

carbon buildings while increasing clean energy job placement for disadvantaged communities and advancing industry diversity. This could be accomplished by promoting broad public awareness and education to create strategic partnerships with trusted community leaders, and by scaling-up targeted outreach and decision-making to increase market demand and accelerate the transition to low-carbon, energy-efficient, all-electric buildings.

Building energy efficiency measures provide significant energy savings and health benefits. These include the basic benefits of affordably maintaining a comfortable living and working environment, preventing hypo- and hyperthermia, and combatting fuel poverty (facing the choice between heating the home or feeding the family).

Tight insulation in residential and commercial buildings without ensuring appropriate ventilation can negatively impact indoor air quality. The New York Building Code and Property Maintenance Code designates minimum air ventilation rates for new and existing buildings. Inadequate ventilation increases exposure to air contaminants such as VOCs (including those from consumer care products and off-gassing from building materials), radon gas, dust, allergens, mold, carbon monoxide, and CO_2. Moreover, leaking home heating systems were the primary cause listed among the 15,000 carbon monoxide poisonings resulting in emergency department visits in the United States annually.[86] In New York alone, there are approximately 1,500 emergency department visits and 160 hospitalizations for carbon monoxide poisoning annually.[87]

NYSERDA has programs to use industry-accrediting organizations to set standards and best practices for conducting energy efficiency upgrades. Program requirements concerning source removal, ventilation systems, minimum ventilation rates, and proper sizing and installing of HVAC systems help avoid and alleviate indoor air quality problems in existing buildings and the associated health effects. NYSERDA also strives to support advanced sustainability standards and tools by partnering with organizations like the Collaborative for High Performance Schools, the U.S. Department of Energy, the EPA, and the U.S. Green Building Council.

[86] Centers for Disease Control and Prevention. Nonfatal, Unintentional, Non-Fire Related, Carbon-Monoxide Exposures-U.S. 2008.

[87] Bureau of Environmental and Occupational Epidemiology, Center for Environmental Health, DOH. Based on Analysis of Statewide Planning and Research Cooperative System Hospital Outpatient Emergency Department data. Statewide Planning and Research Cooperative System (ny.gov)

When effectively combined with other home intervention programs (such as the New York State Healthy Neighborhoods Program), energy efficiency upgrades can have direct and indirect health benefits for residents. For example, these combined measures can reduce hot and cold thermal stress, arthritis symptoms, asthma hospitalization or emergency department visits, missed days of work, carbon monoxide poisonings, home fires, and trip and fall injuries for residents.[88] Electrification of the building sector will also reduce the health risks associated with combustion-based heating appliances.

Emissions of some co-pollutants from wood burning, such as particulate matter, exceed those for some fossil heating fuels by 1,000-fold. Adverse health effects associated with exposure to wood smoke are consistent with those identified for fine particulate matter from fossil fuel combustion, including exacerbation of cardiovascular symptoms (including chest pain, heart rhythm changes, heart attack, and stroke) and respiratory symptoms (such as asthma). The elderly, people with heart and lung diseases, people of low economic status, and children are particularly vulnerable to the effects of fine particle exposures in wood smoke.

In the industrial sector, in addition to the potential use of green hydrogen as described above for the power generation sector, carbon capture and sequestration could reduce GHG emissions. Depending on the specific technology, carbon capture and sequestration may also reduce emissions of some other pollutants, but in many cases does not. While carbon capture technology requires energy, which can lead to additional power sector emissions,[89] potential increases in emissions for powering carbon capture and sequestration would depend on the energy generation source.

[88] Bureau of Environmental and Occupational Epidemiology, Center for Environmental Health, DOH. Based on Analysis of Statewide Planning and Research Cooperative System Hospital Outpatient Emergency Department data. Statewide Planning and Research Cooperative System (ny.gov)

[89] Jacobson, M.Z. Energy Environ. Sci., 2019,12, 3567-3574

Evaluation of the Plan

Chapter 9. Analysis of the Plan

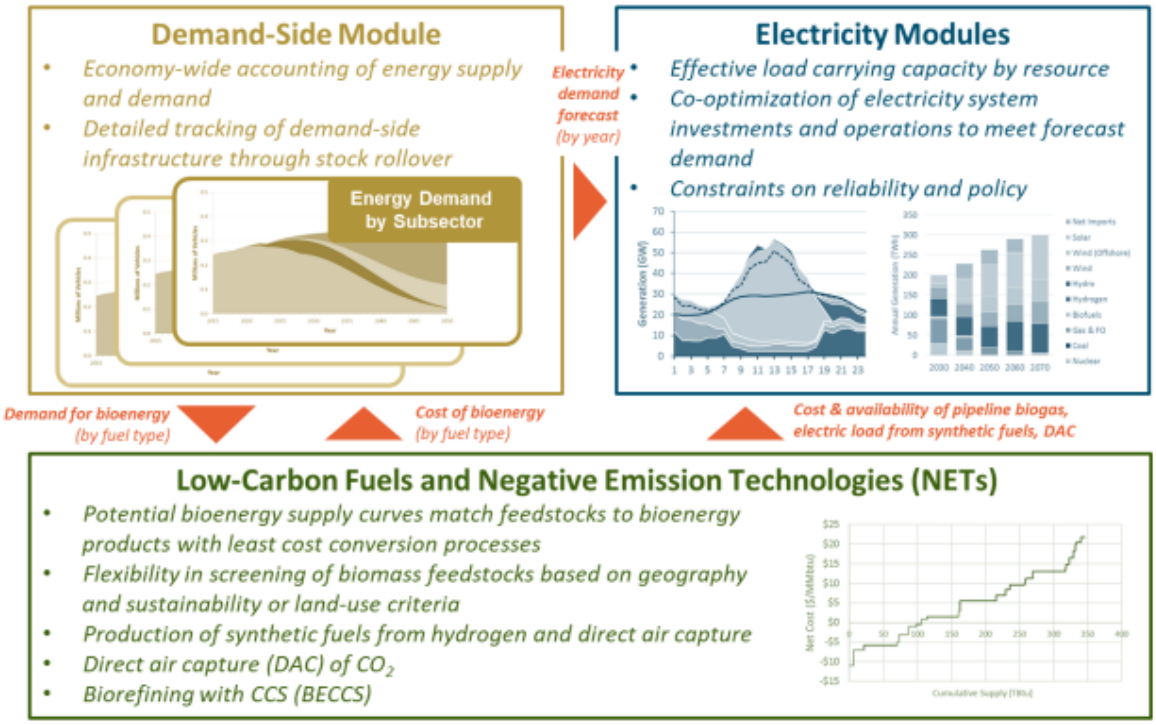
9.1 Integration Analysis Approach

The objective of the integration analysis is to develop GHG mitigation scenarios for the Council's Scoping Plan that incorporate Advisory Panel and Working Group recommendations, capture interactions across sectors, and evaluate benefits and costs. The integration analysis is built within the New York Pathways model,[90] which is a multi-model framework that includes a representation of all categories of GHG emissions in New York and takes as inputs relevant complementary analyses, including the Power Grid Study, building and transportation roadmaps, oil and gas system analysis, and refrigerant management analysis.

The New York Pathways model uses bottom-up, user-defined scenarios to test "what if" questions and to compare long-term decarbonization actions. The New York Pathways model includes stock-rollover resolution in critical subsectors in buildings and transportation to reflect the lifetimes of existing devices and realistic opportunities for new technology replacements. The New York Pathways incorporate interactions between demand- and supply-side variables, including a detailed representation of the electric sector that contains hourly electric loads and least-cost optimization of zero-emissions electric resource mix (Figure 5).

[90] The New York Pathways model was developed by Energy and Environmental Economics, Inc. www.ethree.com. More detail on the NY Pathways model will be found in [APPENDIX TO COME], including methodology and input assumptions. Currently, detailed information about the modeling framework, inputs, and drivers can be found at: https://climate.ny.gov/Climate-Resources

Figure 5. New York Pathways Modeling Framework



9.2 Scenario Design

The integration analysis evaluated a business-as-usual future (Reference Case), a representation of recommendations from CAC Advisory Panels (Scenario 1), and three scenarios designed to meet or exceed GHG limits and carbon neutrality (Scenarios 2 through 4). Scenarios 2, 3, and 4 all carry forward foundational themes based on findings from Advisory Panels and supporting analysis but represent distinct worldviews.

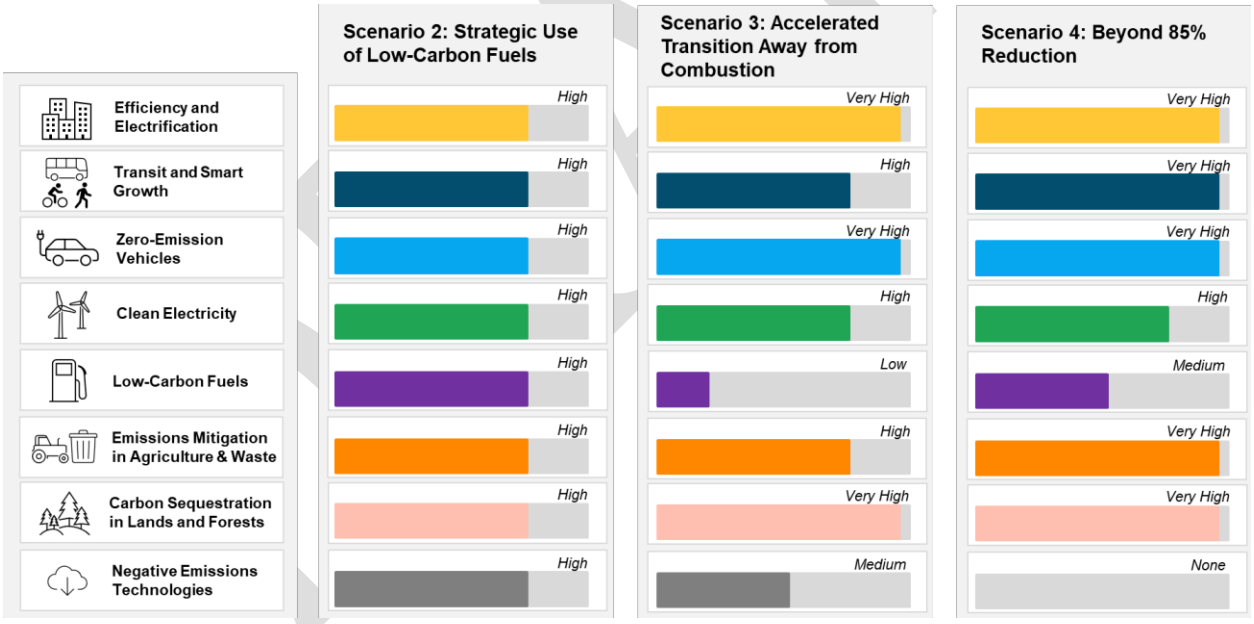
- **Reference Case**: Business as usual plus implemented policies[91]
- **Scenario 1: Advisory Panel Recommendations**: Representation of CAC Advisory Panel recommendations, which provide a foundation for all scenarios; however, scenario modeling shows that incremental effort is needed to meet CLCPA emissions limits.
- **Scenario 2: Strategic Use of Low-Carbon Fuels**: Includes the use of bioenergy derived from biogenic waste, agriculture and forest residues, and limited purpose grown biomass, as well as a critical role for green hydrogen for difficult-to-electrify applications. This scenario includes a role for negative emissions technologies to reach carbon neutrality.

[91] The Reference Case is used for evaluating incremental societal costs and benefits of GHG emissions mitigation.

- **Scenario 3: Accelerated Transition Away from Combustion**: Very limited role for bioenergy and hydrogen combustion and accelerated electrification of buildings and transportation. This scenario includes a role for negative emissions technologies to reach carbon neutrality.
- **Scenario 4: Beyond 85% Reduction**: Accelerated electrification and targeted use of low-carbon fuels. This scenario includes additional reductions in VMT and innovation in methane abatement. This scenario overachieves 85% direct reductions and avoids the need for negative emission technologies.

Figure 6 highlights the key differences in assumptions across the three scenarios that meet or achieve New York's GHG emissions limits and achieve carbon neutrality by midcentury. All scenarios share common foundational themes of decarbonization, including a zero-emission power sector by 2040, enhancement and expansion of transit, rapid and widespread efficiency and electrification, electric end-use load flexibility, and methane mitigation in agriculture and waste.

Figure 6. Level of Transformation by Mitigation Scenario

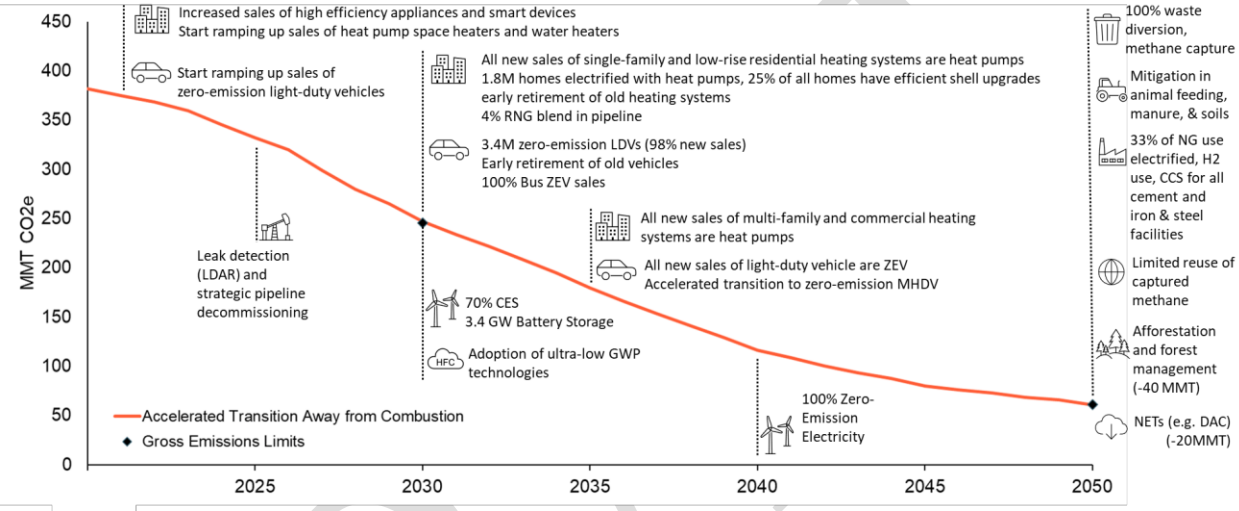


More detailed scenario assumptions are available in [APPENDIX TO COME] and on https://climate.ny.gov/Climate-Resources.

Transformative levels of effort are required across all sectors, and all compliant scenarios include high levels of electrification including Scenario 2, which also includes strategic use of low-carbon fuels. Scenario 3 pushes harder on accelerated electrification to meet the limits in a very low-bioenergy and low-combustion worldview. Scenario 4 pushes beyond 85% direct reductions in 2050 by layering some low-carbon fuels back in, examining very high VMT reduction, and assuming high (but also highly

uncertain) levels of innovation in the waste and agriculture sectors. Scenario 4 is the only evaluated scenario that achieves carbon neutrality without the use of negative emissions technologies like direct air capture of CO_2, which is also subject to high uncertainty, but is required in scenarios 2 and 3 to address the gap between remaining gross emissions in 2050 and the ambitious assumed projections of natural sequestration. Additional documentation of scenario assumptions can be found in [APPENDIX TO COME], but an example of key assumptions in Scenario 3 is shown in Figure 7.

Figure 7. Key Assumptions in Scenario 3: Accelerated Transition Away from Combustion



9.3 Economy-Wide Scenario Results

Greenhouse Gas Emissions

GHG emissions decline gradually in the Reference Case and decline dramatically in all scenarios. Scenarios 2 through 4 meet or exceed CLCPA GHG emission limits and achieve carbon neutrality by 2050 (Figure 8, Table 4).

Figure 8. Greenhouse Gas Emissions by Mitigation Scenario

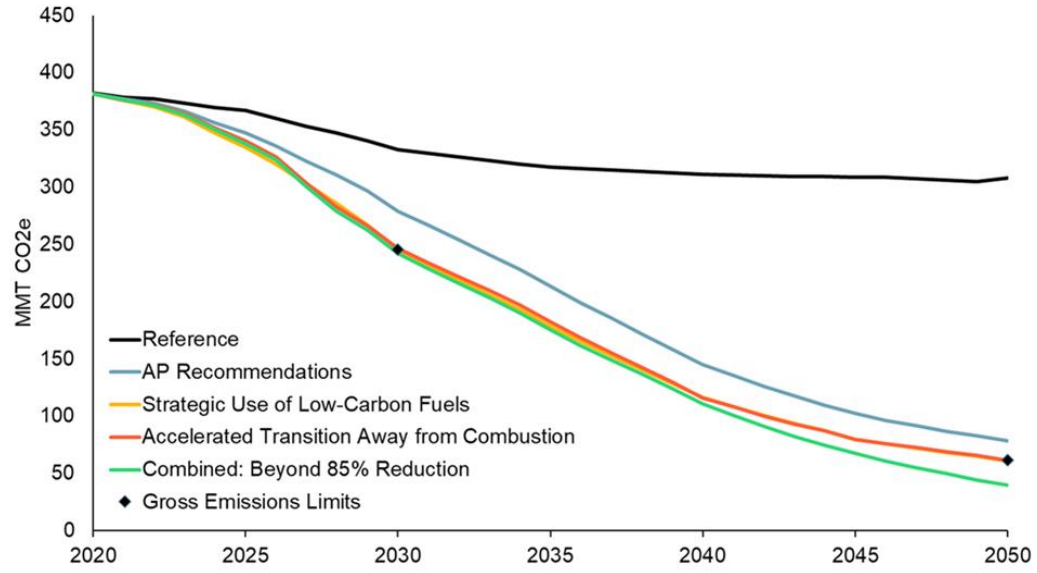


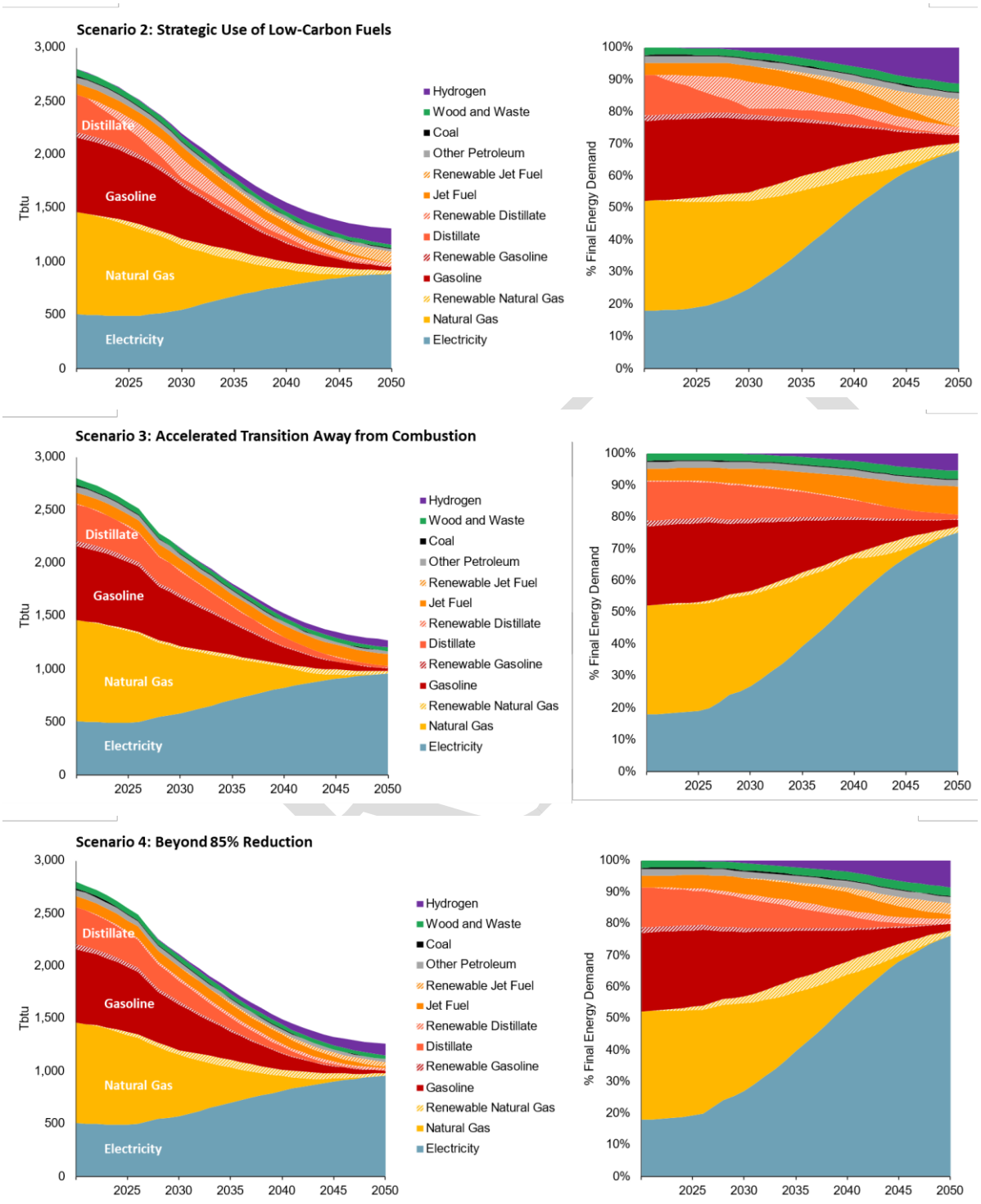
Table 4. Greenhouse Gas Emissions and Percentage Reductions by Scenario

	2030		2050	
	MMT CO_2e	**% Reduction vs. 1990**	**MMT CO_2e**	**% Reduction vs. 1990**
Reference	332	19%	311	25%
Advisory Panel Recommendations	276	32%	72	81%
Strategic Use of Low-Carbon Fuels	246	40%	61	85%
Accelerated Transition Away from Combustion	246	40%	61	85%
Beyond 85% Reduction	242	41%	40	90%
CLCPA Gross Emissions Limits	*246*	*40%*	*61*	*85%*

Final Energy Demands

Across scenarios there is nearly a 50% decline in total final energy demand in 2050 relative to today due to efficiency and electrification. Electricity grows from under 20% today to between 68% and 75% of final energy demand in 2050. Low-carbon fuels have a targeted role, ranging between 2% and 14% of final energy demand in 2050 for bioenergy and between 5% and 11% of final energy demand for green hydrogen, even as each scenario takes a different perspective on the role of those fuels. After accounting for electricity and green hydrogen, jet fuel is largest share of remaining liquid or gaseous fuel demand across scenarios in 2050 (Figure 9).

Figure 9. Total Energy by Fuel, Scenarios 2 through 4

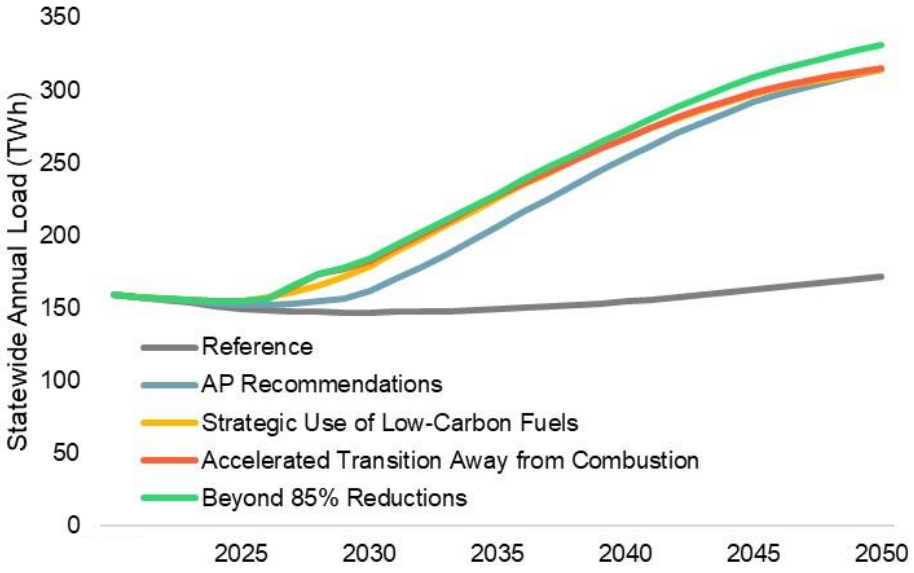


Includes final energy use from transportation, industrial, commercial, and residential sectors.

Electricity Demands

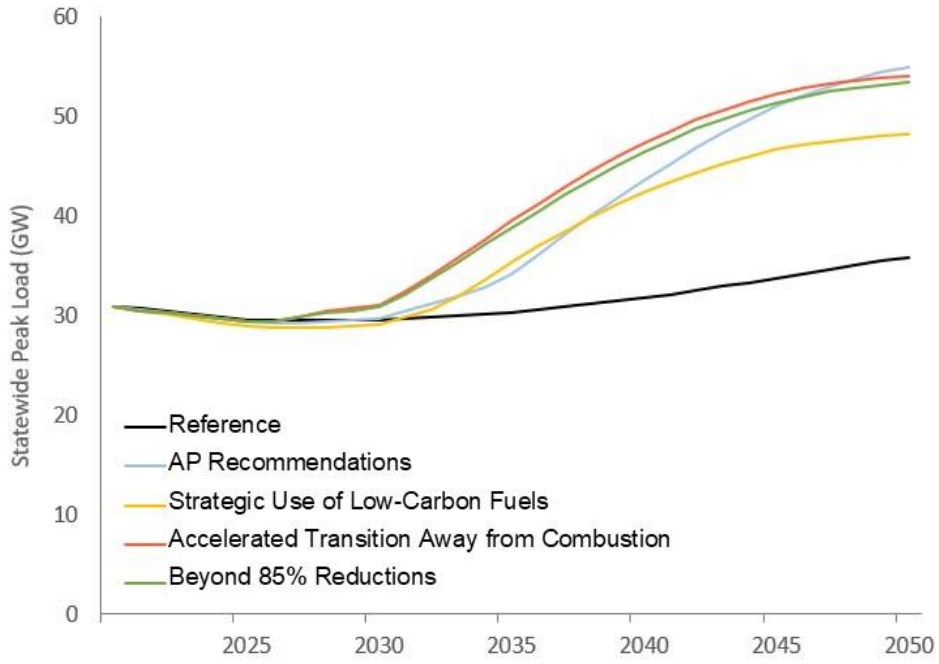
Across all pathways, clean electricity is a central pillar of New York's strategies to meet the Climate Act requirements and targets, with electricity powering the large majority (68% to 76%) of the New York State economy by 2050. Driven by the electrification of other sectors of the economy, electricity demand is projected to double—with peak loads also nearly doubling—by 2050, even with aggressively managed loads. As building heating needs are electrified, both the magnitude and timing of electricity loads will change rapidly, and New York will transition to a winter-peaking system by 2035. Additional electricity demand will also result from the build-out of electrolyzers necessary to supply the state with green hydrogen (Figure 10, Figure 11).

Figure 10. Statewide Annual Electric Load



This chart represents total electricity demand at the generator level and include estimated line losses. Values in this chart include electrolysis loads to produce green hydrogen, assuming that 50% of New York's hydrogen demand is produced in the state. Values in this chart do not account for behind-the-meter generation resources, which are included as a source of electricity supply in this analysis.

Figure 11. Statewide Peak Load Growth

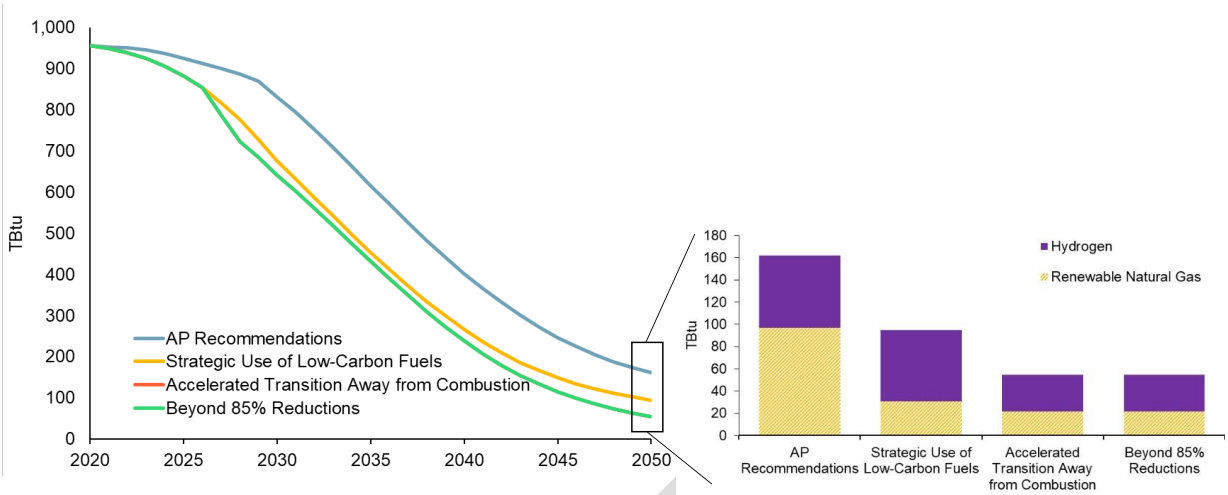


This figure represents the median (one-in-two) coincident peak for the New York Control Area. The sum of non-coincident local peaks (occurring during different hours) may be higher. The median peak was determined by assessing hourly loads over 40 years (1979-2018) of weather data, as detailed in [APPENDIX TO COME]

Gas Demand

As New York's economy becomes more electrified, end-use gas demand will decline significantly, by approximately 83% to 95% by 2050. The small remaining gas demand can be met with RNG and hydrogen across all scenarios by 2050 (Figure 12).

Figure 12. Annual End-Use Gas Demand by Scenario (left) and 2050 End-Use Gas Demand by Fuel (right)

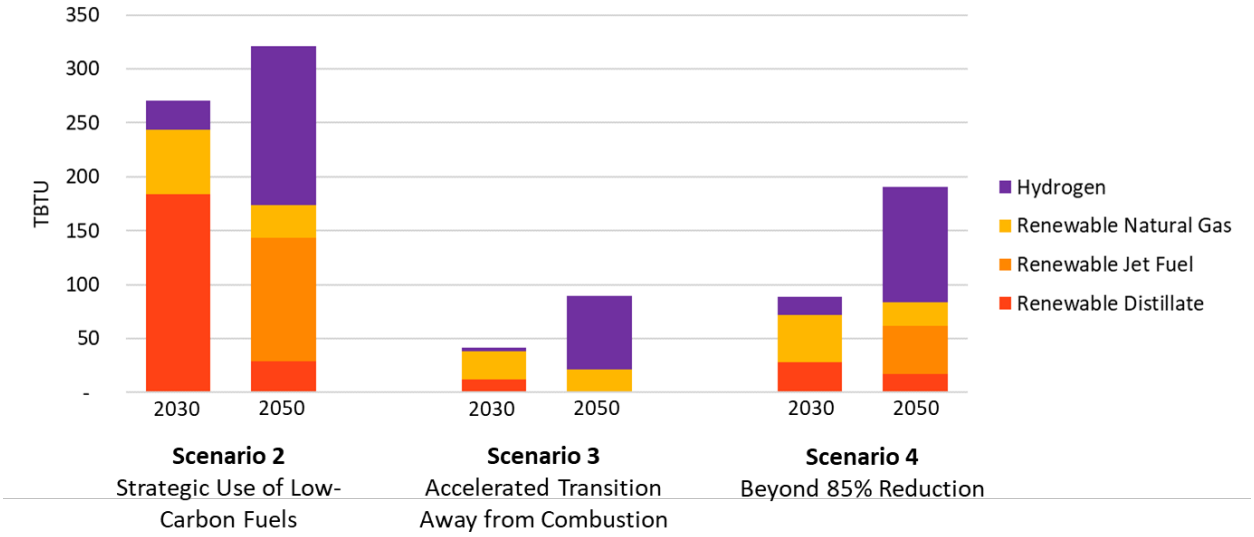


Includes gas demand in buildings, industry, and transportation. Excludes gas burned in electric generating units and hydrogen for fuel cell vehicles.

Low-Carbon Fuels

The scenarios use a range of low-carbon fuels: RNG, renewable distillate, renewable jet fuel, and green hydrogen. The range of total demand for low-carbon fuels is approximately 50 to 250 TBtu in 2030 and approximately 100 to 300 TBtu in 2050 (Figure 13).

Figure 13. Bioenergy and Green Hydrogen Utilization

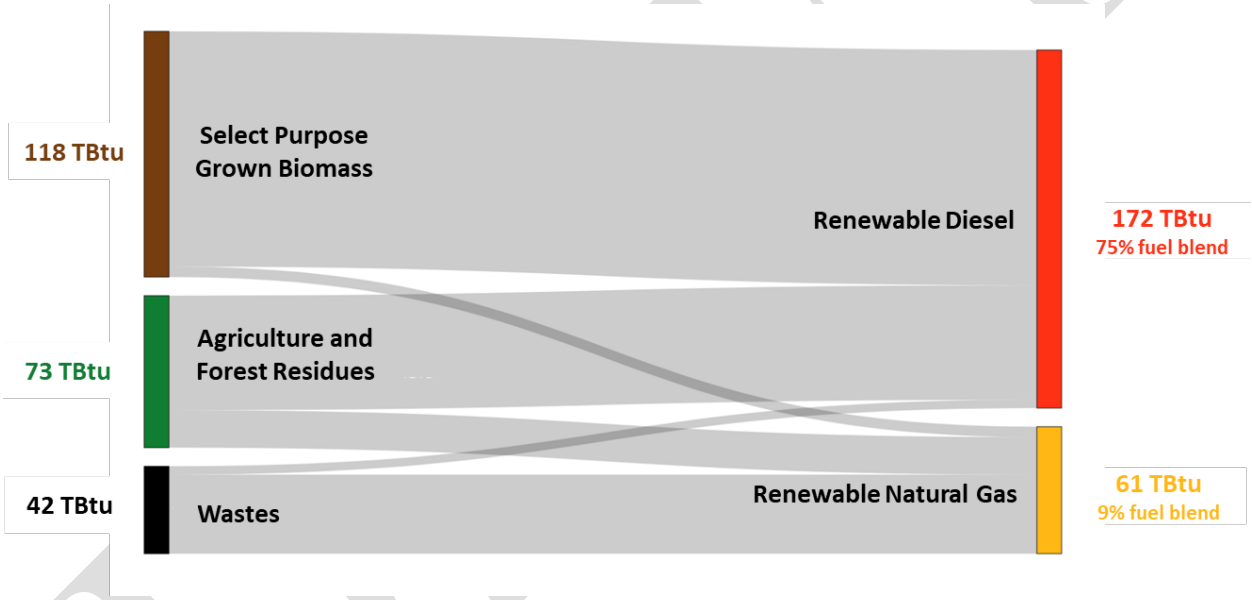


Feedstocks supply was sourced from the DOE Billion Ton Study, NYSERDA Potential Studies, and adjusted based on Advisory Panel deliberations with academic researchers. Feedstocks are allocated to final fuels based on production costs, fossil fuel prices, and emissions abatement potential.

Biofuels are a substitute for an existing fossil fuel, and allocation is therefore limited by the long-term demand for that fuel type in hard-to-electrify applications. Scenarios assume that the allocation of limited biofuels maximize emissions reductions and minimize fuel production costs, which prioritizes the role of RNG and renewable diesel.

Scenarios included a careful evaluation of biomass feedstock availability for New York. Scenario 2 included a regional supply of wastes, residues, and purpose grown biomass (Figure 14). Scenario 3 included only targeted in-state methane abatement (such as landfills). Scenario 4 assumed an in-state supply of wastes and residues.

Figure 14. Bioenergy by Feedstock and Final Fuel in 2030, Scenario 2: Strategic Use of Low-Carbon Fuels



9.4 Key Sectoral Results

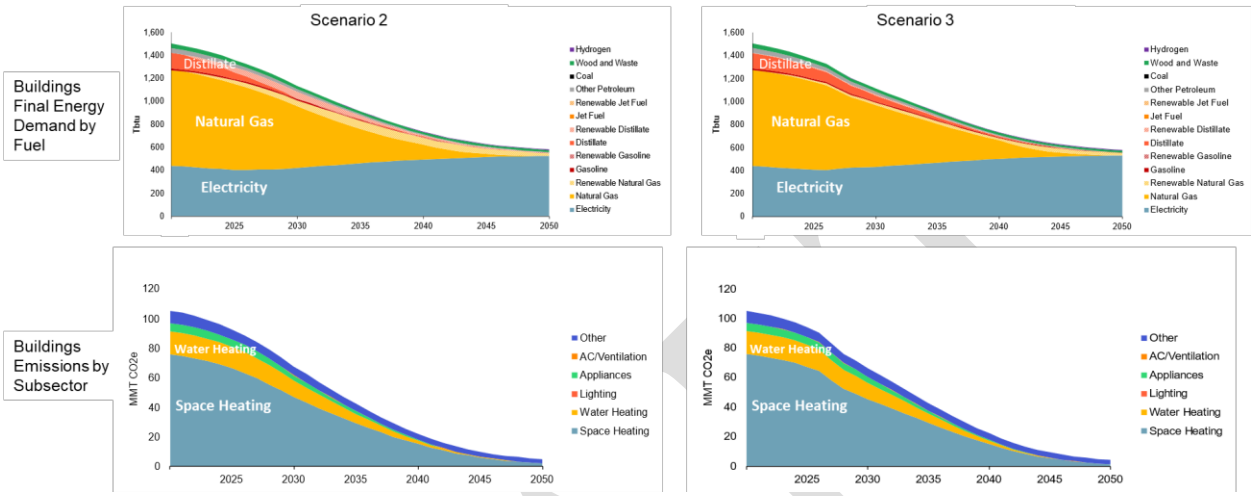
This section is focused on key results from the largest emitting sectors in the state: buildings, transportation, and electricity generation. More detail on all other sectors can be found in [APPENDIX TO COME] .

Buildings

Building emissions are dominated by emissions from space and water heaters (note that emissions associated with electricity generated to power electric appliances is captured under electricity generation). The population and household size are expected to grow in New York, but all scenarios see a significant

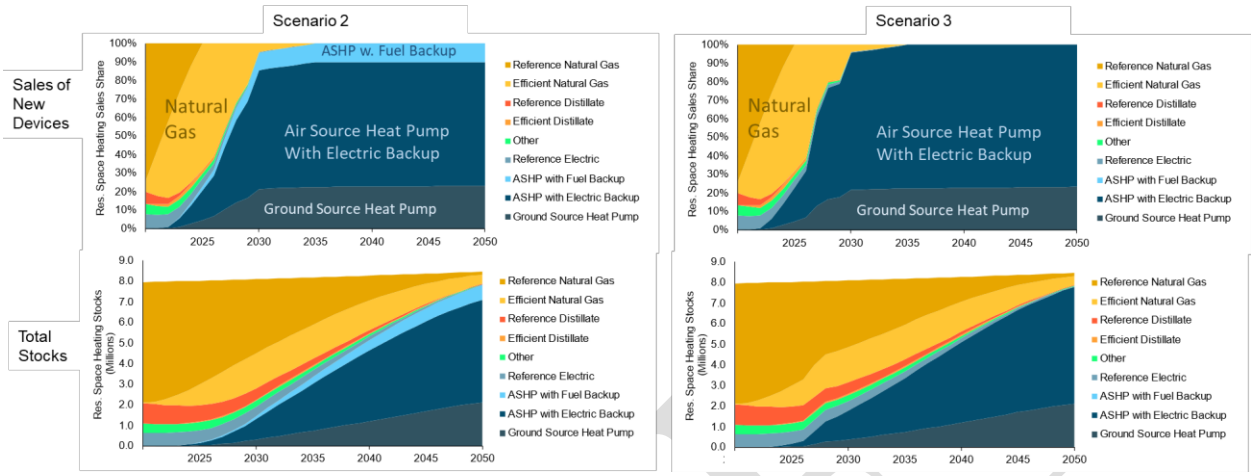
decline in GHG emissions due to the critical role for energy efficiency, rapid electrification, and improved building shells (Figure 15).

Figure 15. Buildings Final Energy Demand by Fuel (top) and Emissions by Subsector (bottom), Scenarios 2 and 3



To achieve the reductions in energy use and emissions shown in Figure 15, rapid adoption of new technologies will be required. In all scenarios, electric heat pump space heating technology systems become the majority of new purchases by the late 2020s and no fossil-emitting appliances are sold after 2035. In all scenarios electric heat pump space heating technologies are predominantly cold-climate air-source heat pumps (ASHPs), with electric backup and a significant role for ground-source heat pumps (GSHPs); ASHPs are significantly more efficient than electric resistance heaters during most heating load conditions but lose efficiency during the coldest hours of the year and require some backup heat source. ASHPs with electric backup use electric resistance as the backup heat source, resulting in increased electric system peak impacts (but generally lower than purely resistance heaters alone), whereas ASHPs with fuel backup use combustion or thermal heat sources to provide backup heat while GSHPs operate with little to no performance degradation in cold conditions. Scenario 2 includes a small share of ASHPs with fuel backup. Scenarios 3 and 4 also include a role for early retirements of least efficient and most polluting space heaters (Figure 16).

Figure 16. New Sales (top) and Total Stocks (bottom) of Residential Space Heating Systems



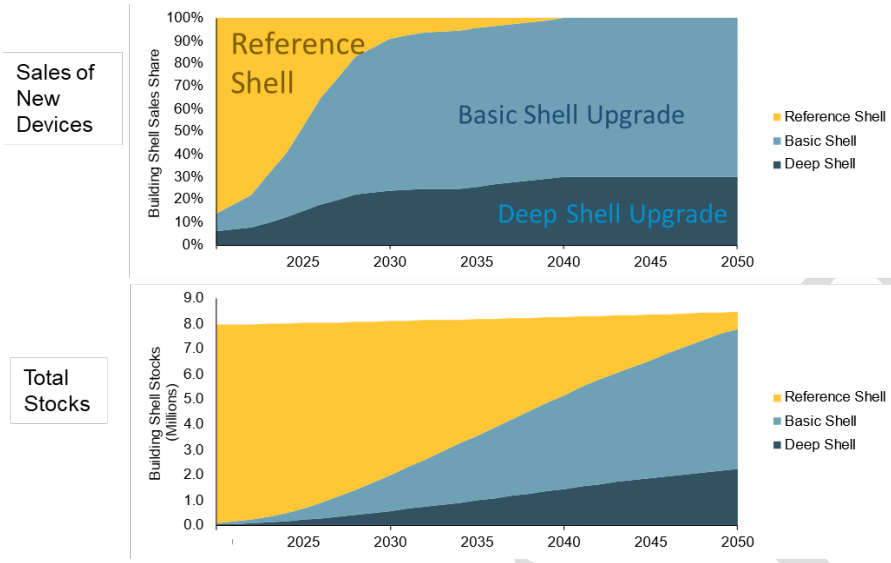
Scenario 4 adoption is the same as Scenario 3 adoption.

Building shell improvements (such as improved insulation, window treatments, or deep home retrofits) are simulated as decreasing the service demand in HVAC end-use device types. Improvements to building incur costs but improve home and office comfort, as well as reduce energy bills. Two bundles of building shell packages have been included: a basic shell upgrade and a deep shell upgrade.[92] The resulting building shell effect on service demand is a function of the market penetration of each building shell type (Figure 17).[93]

[92] Space heating demands are reduced by 27% to 44% by the basic shell package, and by 57% to 90% by the deep shell package, depending on building type. Air conditioning demands are reduced by 14% to 27% by the basic shell package and by 9% to 57% by the deep shell package.

[93] E3 calculated the stock rollover of building shells with a 20-year lifetime to reflect improvements in new construction and opportunities for home retrofits.

Figure 17. New Sales (top) and Total Stocks (bottom) of Residential Building Shell in Scenarios 2, 3, and 4



HFCs use has grown from near zero in 1990 to over 20 MMT CO_2e in 2020, driven by the replacement of other refrigerants (Chlorofluorocarbons [CFCs] and hydrochlorofluorocarbons [HCFCs]) over that time period. HFCs are a potent GHG but a critical part of the building electrification transition in New York. All scenarios include maximum adoption of ultra-low GWP technologies for all building, transportation, industrial HVAC, and refrigeration systems and maximum possible service reclaim at product end of life (90% recover rates).[94]

Transportation

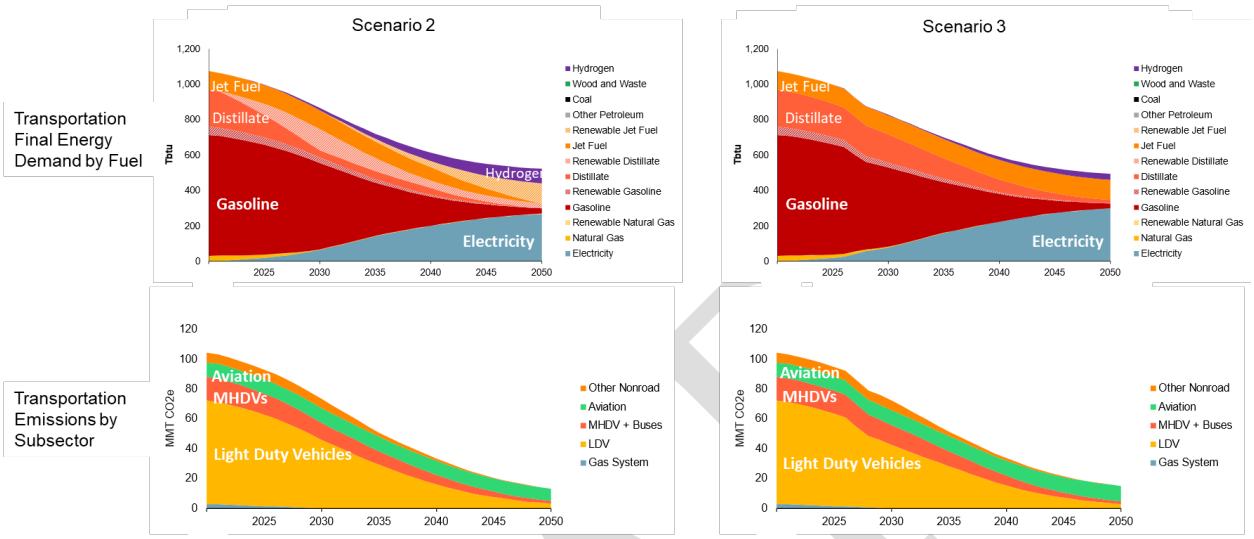
Vehicle ownership and VMT are expected to grow in the Reference Case. All scenarios include a key role for VMT reduction, zero-emission vehicle adoption, electrification of non-road sectors, and targeted low-carbon fuel use. These actions collectively reduce total final energy consumption and GHG emissions within the transportation sector (Figure 18).

All scenarios include a core focus on VMT reduction due to transit, transportation demand management, telework, mixed-use development, and complete streets policies. Scenario 4 includes greater ambition in these categories as well as strategic investments in regional rail. Scenario 2 includes significant vehicle electrification and a greater focus on low-carbon fuels, particularly advanced renewable diesel and

[94] Note that the GHG emissions associated with refrigerants are captured in the Industrial Product and Product Use sector, but the analysis captures interaction effects with the adoption of heat pump space heating systems and refrigerant products.

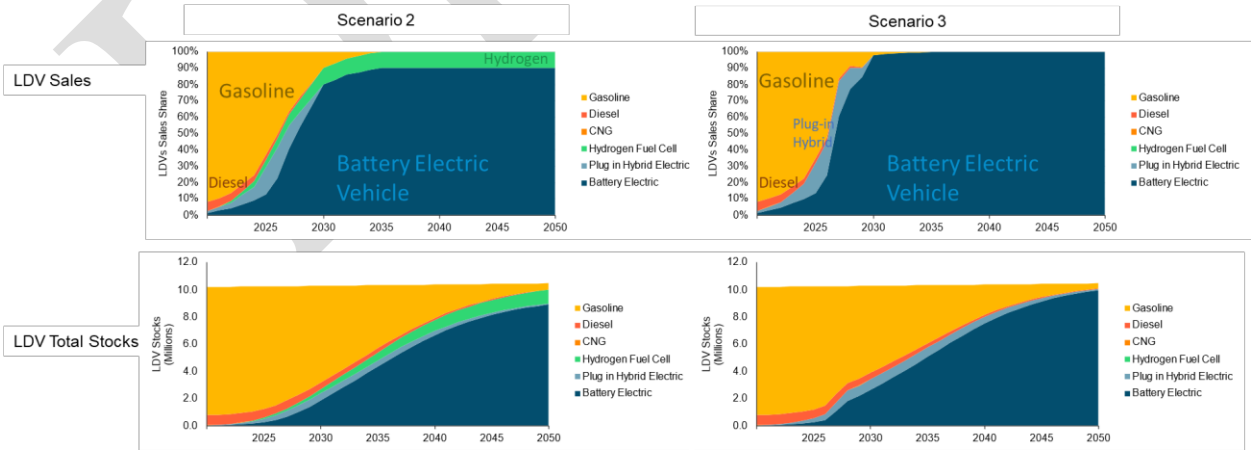
renewable jet kerosene that are used to decarbonize trucking and aviation. Scenario 3 includes more accelerated vehicle electrification and early retirements of the oldest vehicles on the road.

Figure 18. Transportation Final Energy Demand by Fuel (top) and Emissions by Subsector (bottom), Scenarios 2 and 3



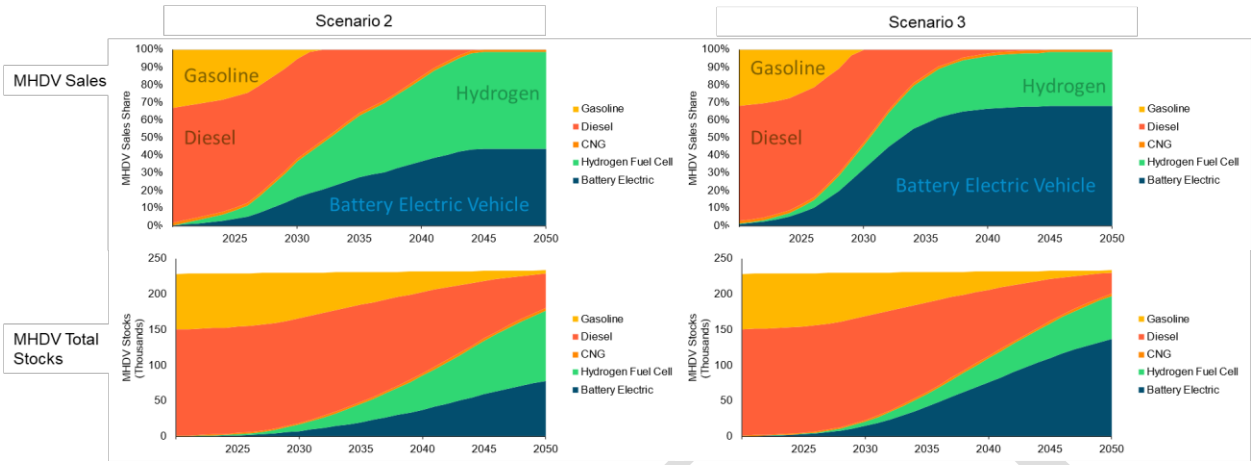
All scenarios include a critical role for zero-emission vehicles, with a rapid increase in the adoption of battery electric and hydrogen fuel cell vehicles being sold, depending on the vehicle class and scenario. Internal combustion engine light-duty vehicles (LDVs) are not sold after 2035 across all scenarios (Figure 19, Figure 20).

Figure 19. New Sales (top) and Total Stocks (bottom) of Light-Duty Vehicles



Scenario 4 adoption is the same as Scenario 3 adoption.

Figure 20. New Sales (top) and Total Stocks (bottom) of Medium- and Heavy-Duty Vehicles



Electricity

In order for the electric sector to become the primary fuel of New York's carbon-neutral economy, the state must tackle a two-pronged challenge over the next three decades: (1) the electric sector must rapidly expand to reliably serve increased demand that results from the electrification of buildings, transportation, and industry; and (2) the generation mix must transform into a carbon-free system, primarily powered by wind, water, and sunlight.

Energy Efficiency and Managed Electrification

Energy efficiency and managed electrification strategies will be critical to achieving New York's goals. In each modeled pathway, New York makes significant investments in energy efficiency and pursues aggressive strategies to offset the impacts of electrification and mitigate the peak heat challenge.[95]

Strategies to manage the impacts of electrification can be broken into three broad categories: Managed Infrastructure, Managed Usage, and Dynamic Usage. Each strategy can be critical to successfully limit growth in system peak loads. In this analysis, all pathways include achievement of Managed Infrastructure and Managed Usage; sensitivity analysis was performed to explore the impacts of varying levels of Dynamic Usage.

The managed infrastructure category includes installation and adoption of technologies that mitigate the peak impacts of electrified heating. Building shell improvements are critical to reducing building heating

[95] Peak heat refers to increases in winter peak electricity demand as a result of the electrification of building heating needs.

needs and thus reducing the amount of electricity required to power heat pumps. The adoption of efficient heat pump technologies, such as GSHPs, as well as installation of heat pumps with fuel backup, further reduce the amount of electricity needed on the coldest days of the year (relative to solely relying on electric resistance backup). In the transportation sector, the development of workplace charging infrastructure is also critical to reducing the peak impacts of EV charging, because if drivers are able to plug in their vehicles while at work, then they may not need to charge for as long (or at all) when they get home each evening, even before accounting for time-of-use incentives to shift charging away from peak times.

The Managed Usage category represents relatively easy to implement strategies to shift customer demand away from times of system peak. This analysis focused on opportunities in the transportation sector and assumed that customers would be incentivized to shift LDV charging away from peak times by implementing time-of-use electricity rates, some of which are already being piloted for EV owners in New York.

Without investments in infrastructure and implementation of rate designs to manage the impacts of electrification, load growth and peak impacts would be substantially higher, which would, in turn, increase the amount of new electricity infrastructure and associated costs that would be required to reliably meet demand with zero-carbon generation.

Dynamic Usage represents more aggressive and innovative load management, in which customer demand interacts with signals from grid operators and dynamically responds to changing prices and system conditions. This type of highly flexible customer load can be particularly valuable on a highly renewable system, in which static time-of-use rates may no longer accurately reflect real-time grid conditions (for example, grid operators may want customers to shift loads to mid-day during sunny days but to evenings or mornings during windy, cloudy days). Given the uncertainty around widespread adoption of Dynamic Usage practices, the modeled pathways conservatively assume that a portion of EV loads become capable of real-time grid interactivity, but that other end uses in buildings do not.

Zero-Emissions Electric Supply

In order to meet rapidly growing demand while decarbonizing its supply mix, New York must significantly expand its generation and transmission infrastructure. Coupled with New York's existing clean firm resources, all pathways require major investments in wind, solar, and battery storage, which serve as the foundational resources to achieve New York's 70x30 and 100x40 requirements.

To achieve 70% renewable electricity by 2030, New York must continue to increase its Clean Energy Standard procurements for large-scale renewables, including by scaling up its offshore wind procurements on the path to the 9 GW by 2035. Although partially offset by investments in the New Efficiency: New York program, New York must also prepare for increases in electric demand by 2030 and rapid increases afterwards, which will place additional pressure on the new resources needed to meet and maintain the 70% requirement over time. Behind-the-meter solar resources are critical to meeting the 70x30 requirement, and the modeled pathways include achievement of the recently announced 10 GW behind-the-meter photovoltaics (PV) goal by 2030.

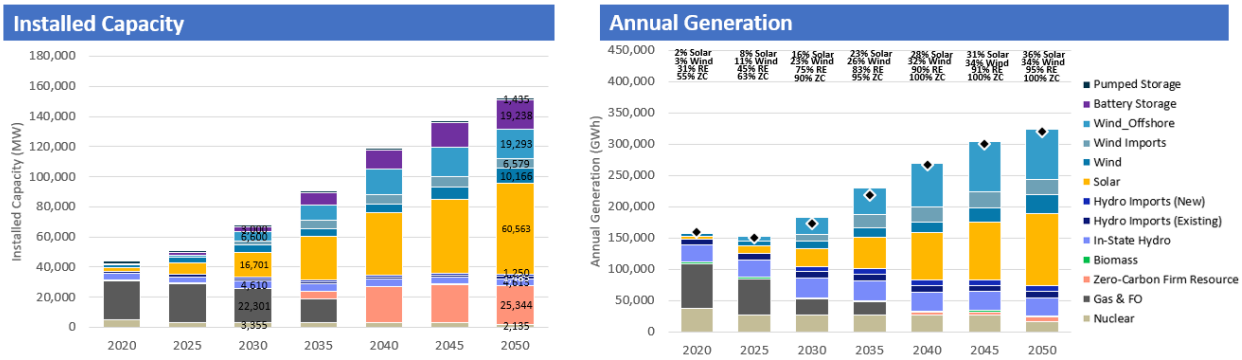
New transmission infrastructure is also expected to be an important part of the state's 70x30 and 100x40 goals. The pathways include proxy assumptions for Tier 4 bulk transmission: a 1,250 MW line from Hydro-Quebec to New York City, as well as a 1,300 MW line from Upstate New York to New York City, both of which support the state's decarbonization efforts and in particular help reduce the need for fossil generation in Zone J. In addition to new bulk transmission infrastructure, multiple studies have found that investments in local system upgrades will be critical to reducing congestion and ensuring that new renewable generation can be delivered to load centers.[9697] This analysis assumes that all new large-scale renewable projects are accompanied by investments in local transmission upgrades to remove bottlenecks to using renewables and ensure that new resources are fully deliverable.

Between 2030 and 2050, New York must accelerate the build-out of new renewable resources to meet the 100% zero-emissions target as electrification loads are added to the system. Figure 21 demonstrates the transformation of the New York capacity and generation mix over the 2020 through 2050 period.

[96] NYISO. June 2020. *2019 CARIS Report*. https://www.nyiso.com/documents/20142/13246341/2019_CARIS_Report_v20200617.pdf/fa44a341-786d-2b83-0c00-22951bb112a0.

[97] New York Utilities, November 2020. *Utility Transmission and Distribution Investment Working Group Report*. Appendix C. https://www.nyserda.ny.gov/About/Publications/New-York-Power-Grid-Study

Figure 21. Installed Capacity and Annual Generation for Scenario 3: Accelerated Transition away from Combustion



By 2050, across all modeled pathways, New York installs over 60 GW of solar capacity (both utility-scale and distributed resources), between 16 and 17 GW of new land-based wind capacity (including imported wind from neighboring system operators), and between 16 and 19 GW of offshore wind resources, illustrated in Figure 22 and Figure 23.

Figure 22. Installed Capacity in 2050, All Scenarios

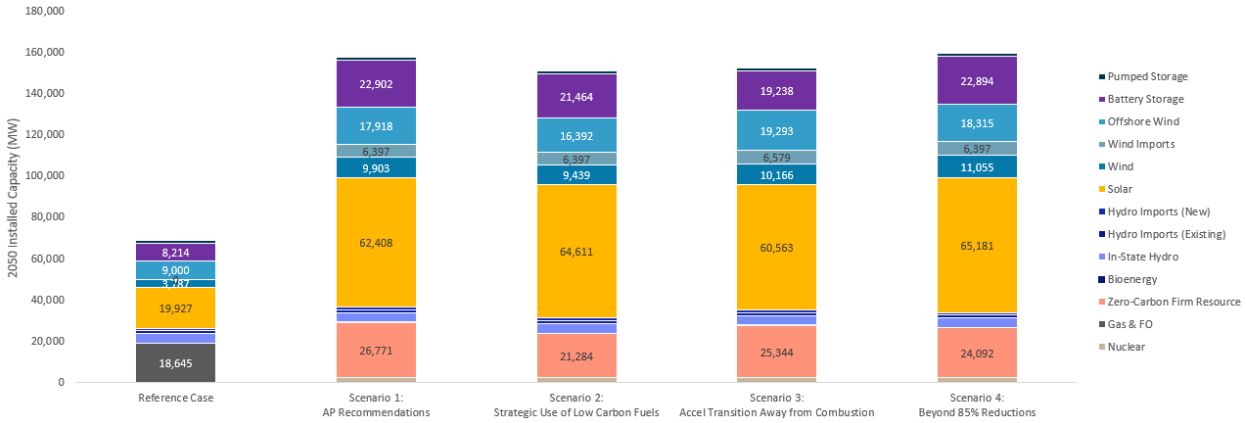
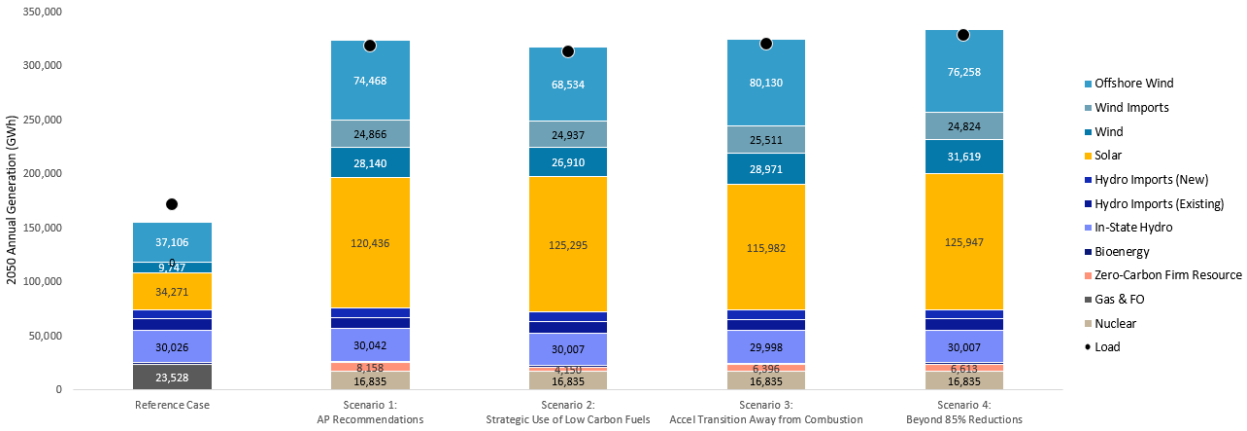


Figure 23. Annual Generation in 2050, All Scenarios



To integrate large quantities of intermittent resources into the New York electricity system, wind and solar output must be balanced with customer demand on multiple timescales, with different resources providing integration value over each timescale.

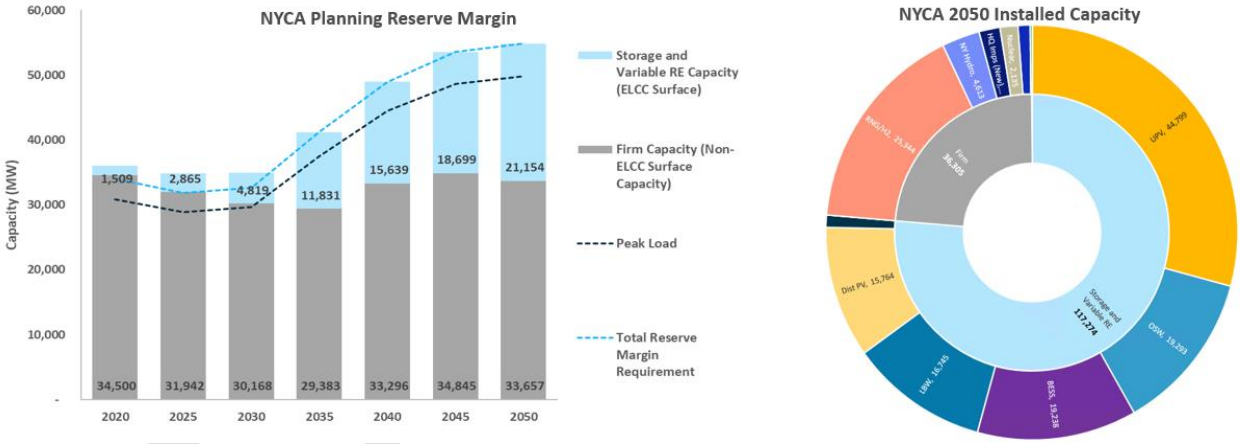
On the intraday timescale, battery storage is critical to providing flexibility and balancing renewables with customer loads on both an hourly and subhourly basis. At the hourly level, batteries can charge during times of high renewable output and discharge during times of lower renewable output or high customer demand, and batteries can also help meet subhourly reserve requirements. New York installs between 19 and 23 GW of battery storage across our modeled pathways. Dynamic end-use flexibility also has similar potential to help meet hourly balancing needs, as long as customers are incentivized to shift their demand to times of highest renewable output.

On the interday timescale, firm resources are needed to serve load and maintain system reliability during multi-day periods of low renewable output (periods in which the contributions of short-duration battery storage are limited). Our analysis identified a need for firm, zero-carbon capacity—in addition to the state's existing hydro and nuclear facilities—of between 21 and 27 GW to maintain system reliability while achieving a 100% zero-emissions grid.[98]

[98] In Scenarios 1, 2, and 4, this firm capacity need is met by a combination of existing and new combustion-based resources (combustion turbines and combined cycle gas turbines) converting to hydrogen as a zero-carbon fuel. In Scenario 3, all existing fossil fuel resources are retired by 2040 and no new combustion-based (combined cycle gas turbine or combustion turbine) capacity is permitted. New firm capacity is provided by a combustion-free resource (such as hydrogen fuel cells).

Ultimately, each resource category—renewables, battery storage, and firm zero-carbon capacity—will make important contributions to the state's achievement of a reliable carbon-free electric system. The reliability contributions of different resource types to statewide capacity requirements are detailed in Figure 24, which provides an alternative view of the 2050 resource mix in Scenario 3.[99] New renewable and storage resources provide significant reliability contributions of over 20 GW toward statewide capacity requirements. However, at high penetrations of renewables and storage, the incremental reliability value of new resources is limited because the most challenging periods for system reliability become times in which renewable output is low and storage is quickly exhausted. Firm zero-carbon capacity, including the existing nuclear and hydro facilities as well as new resources, contribute the remaining 34 GW of capacity requirements to ensure that the system is fully reliable, including during extended periods of low renewable output.

Figure 24. Contributions to Statewide Capacity Requirements



The following section details the contributions of each resource type at more granular timescales.

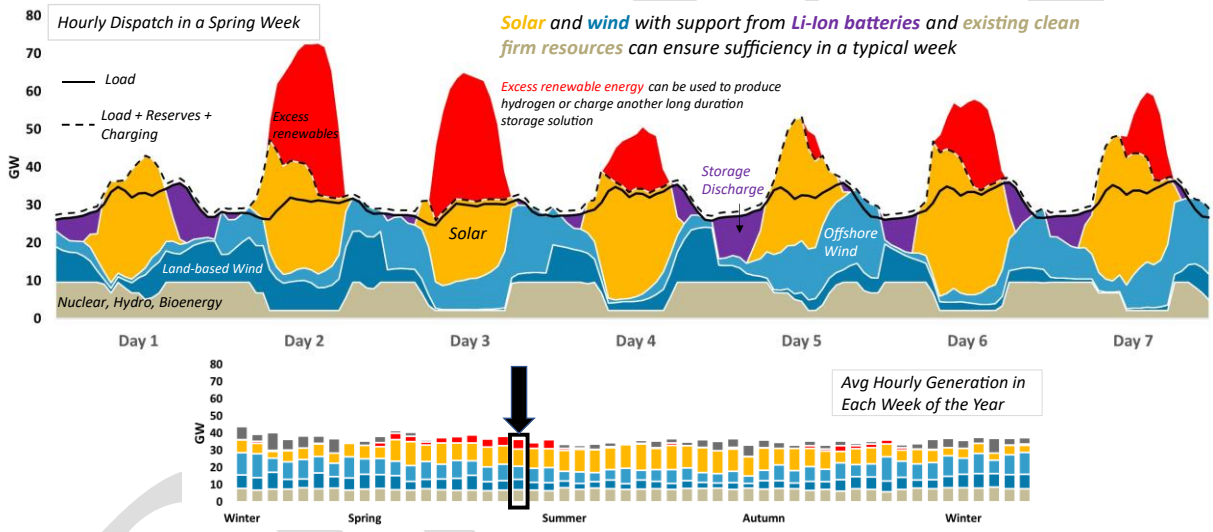
System Operations and Reliability

Wind and solar resources are foundational to New York's decarbonization goals and provide over 75% of annual generation. Their contributions vary over the course of the year, as indicated in the bottom of

[99] In all of the modeled pathways, the analysis ensures that the resulting electric system portfolios are reliable by enforcing the current statewide and local capacity requirements on an Unforced Capacity basis. The reliability contributions of intermittent and limited-duration resources (renewables and battery storage) toward New York's Unforced Capacity requirements are measured using an effective load carrying capability methodology, which is the quantity of "perfect capacity" or Unforced Capacity that could be replaced with renewables or storage while providing equivalent system reliability. The analysis included loss of load probability modeling using E3's reliability model, RECAP, as detailed in [APPENDIX TO COME]

Figure 25.[100] There are many weeks in which wind and solar, coupled with existing clean firm resources like the Upstate nuclear and hydro facilities, meet the entirety of system needs over the course of the week. Figure 25 illustrates system dispatch during a typical spring week, in which short-duration batteries provide intraday balancing by charging during times when renewable output exceeds demand and filling gaps of lower renewable output. Demand over the entire week is met with wind, solar, existing nuclear and hydro, and balancing from battery storage. There are also times during this week of excess renewable output, beyond what batteries are able to absorb, which could be used to produce green hydrogen or to charge a long-duration (100+ hours) battery storage resource.

Figure 25. Hourly Dispatch over a Typical Spring Week In 2050



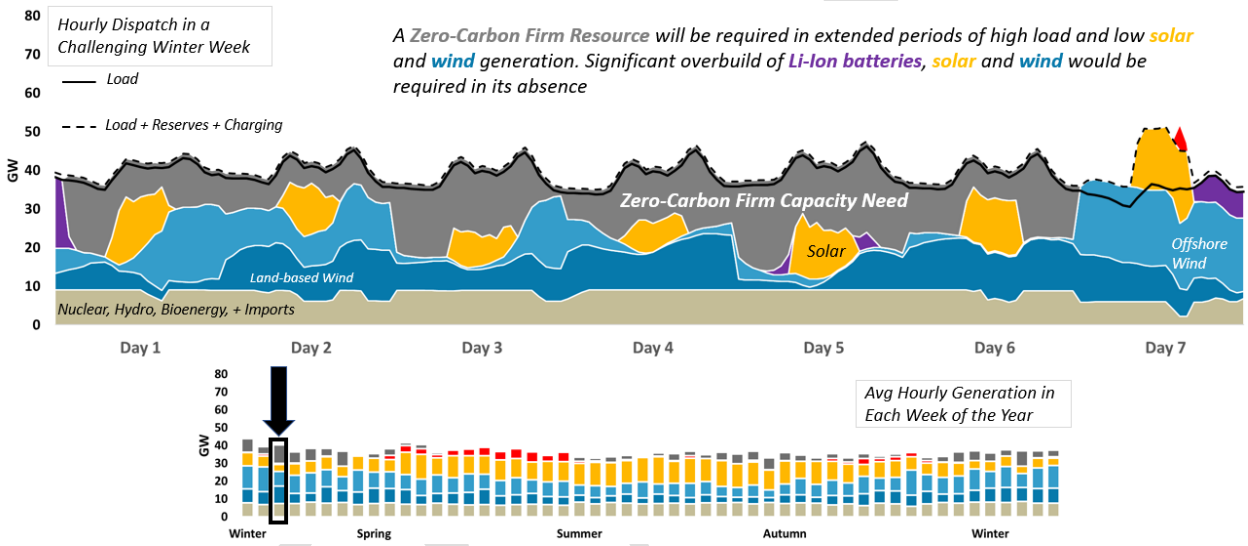
There are many weeks similar to the one illustrated above during the spring, summer, and fall. However, as indicated by the gray contributions in the weekly generation chart, there are also many weeks in the year—especially during the winter—in which the contributions from renewables and existing clean firm resources are not sufficient to meet demand. During cold weeks, as a result of the electrification of building heating needs, electric demand will be much higher in the winter than it is today. Winter months also often coincide with extended periods of low renewable output.

During a week with persistently low solar and wind generation, additional firm zero-carbon resources, beyond the contributions of existing nuclear and hydro, are needed to avoid a significant shortfall;

[100] Figure 26 and Figure 27 depict electric loads, renewable contributions, and system dispatch over a single weather year. However, to ensure robust system reliability, the modeling examined 40 years of historical weather conditions and performed hundreds of simulations of load-renewable correlation, as detailed in [APPENDIX TO COME]

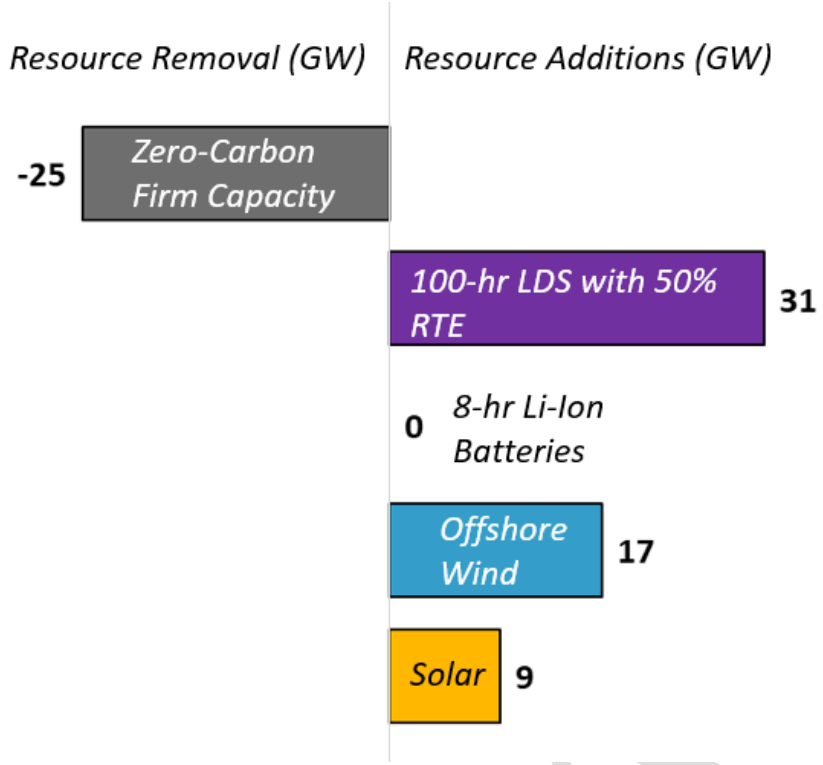
Figure 26 demonstrates the system needs during this type of week. During the first day of this week, most of the short-duration battery storage is quickly depleted, and there are still several days in which wind and solar are not sufficient to meet demand. A zero-carbon firm resource becomes essential to maintaining system reliability during such instances. In the modeled pathways, the need for a firm zero-carbon resource is met with hydrogen-based resources; ultimately, this system need could be met by a number of different emerging technologies.

Figure 26. Zero Carbon Firm Capacity Need over a Challenging Winter Week in 2050



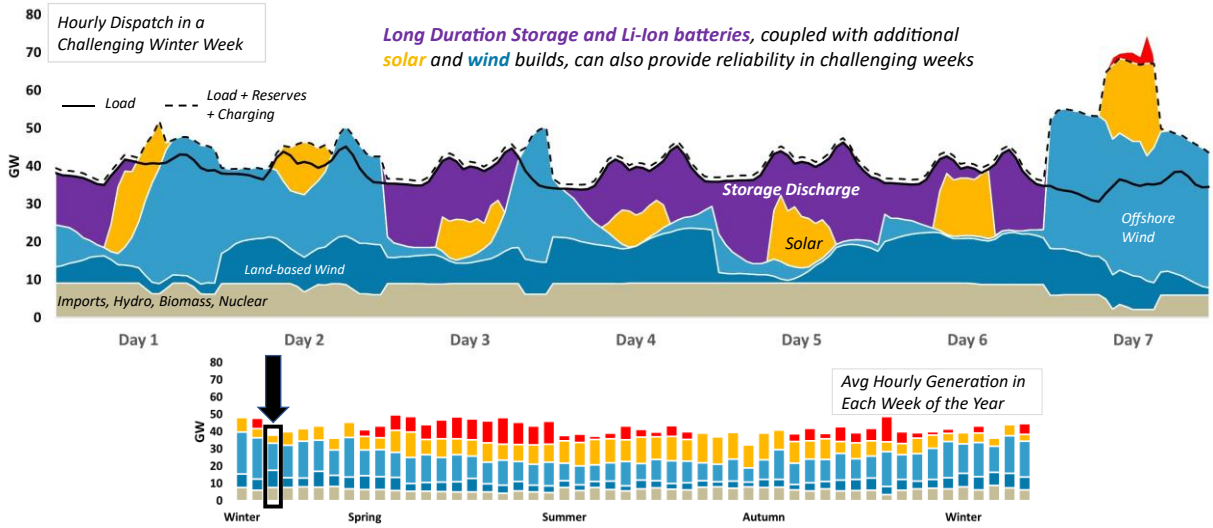
In addition to hydrogen-based resources, the analysis also examined the potential to meet reliability needs with a long-duration battery storage solution. In this assessment, the firm zero-carbon capacity, as well as renewable resources needed to produce hydrogen, was removed from the system, and the analysis identified a need for 31 GW of 100-hour battery storage to replace the contributions of 25 GW of a fully dispatchable hydrogen-based resource, along with additional wind and solar to provide storage charging. Hydrogen effectively provides a form of storage to the system on the order of hundreds of hours, because large quantities of fuel can be produced during the spring and summer and then used over the course of the winter as long as there is sufficient fuel storage. In contrast, a long-duration battery resource still has limited storage duration, which leads to a higher overall capacity need (Figure 27 and Figure 28).

Figure 27. Replacement of Hydrogen-Based Resources with 100-Hour Battery Storage



The starting portfolio already contains 7 GW of 8-hour Li-ion batteries; as a result, the reliability value of incremental 8-hour storage was limited due to extended loss of load periods.

Figure 28. Utilization of Long-Duration Storage to Maintain Reliability over Challenging Winter Week

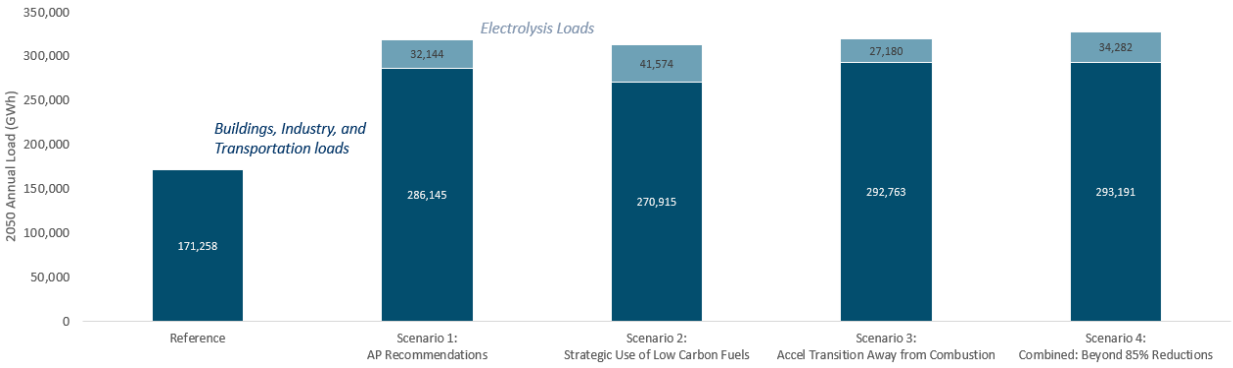


Role of Hydrogen

Hydrogen or bioenergy will be critical to decarbonizing sectors or applications that are difficult to electrify. By 2030, New York will likely need to spur initial market adoption of green hydrogen in order to help decarbonize MHD vehicles, as well as high-temperature industrial applications. In the longer term, low-carbon fuels may be critical to decarbonizing district heating and non-road transportation, including rail and aviation. Additionally, hydrogen-based resources can be key to the electric sector by providing firm capacity during extended periods of low renewable output, as discussed above.

Across all modeled pathways, New York's hydrogen demand is met with green hydrogen, defined as hydrogen produced using electrolysis powered by renewable electricity, with consumption ranging from 100 to 225 TBtu across modeled pathways in 2050. The production of large quantities of hydrogen will place significant additional pressure on the electric system; in this analysis, it is assumed that New York produces 50% of its hydrogen needs in the state and imports the remainder.[101] Producing half of its hydrogen demand with electrolysis adds up to 42 TWh of additional electricity demand, as shown in Figure 29.

Figure 29. Impacts of Electrolysis Loads on Total Electric Loads in 2050



Although curtailed renewable electricity can contribute to producing hydrogen, new renewable resources are also required to power hydrogen production. However, although electrolysis loads require additional build-out of renewables, they also can contribute to renewable integration and balancing. Electrolysis

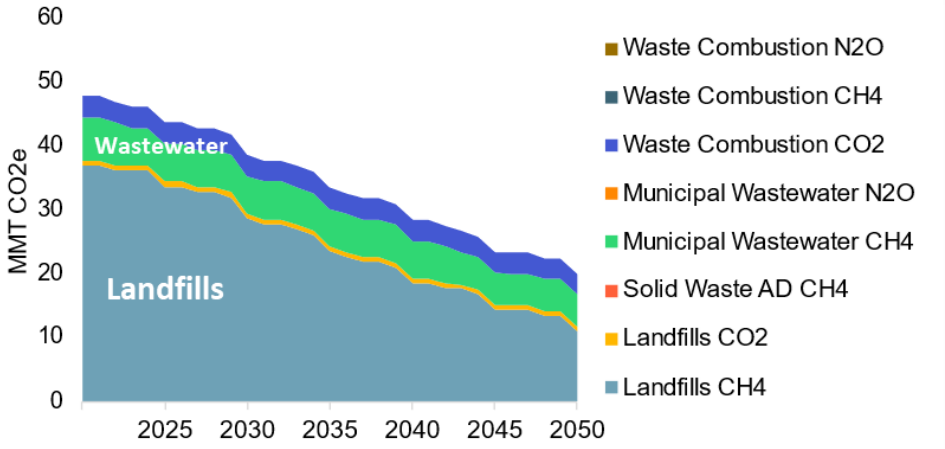
[101] Sensitivity analysis may be performed to examine the impacts of lower or higher in-state production on renewable resource requirements.

loads are highly flexible and can take advantage of excess renewables on a seasonal timescale, serving as a form of long-duration storage that cannot be met with battery storage resources.

Waste

Emissions in the waste sector are dominated by methane emissions from landfills and wastewater treatment facilities. Scenarios 2 and 3 include actions to divert 100% of waste from landfills and reduce methane leakage by 10% every five years from existing landfills (Figure 30).

Figure 30. Greenhouse Gas Emissions in Waste Sector, Scenarios 2 and 3

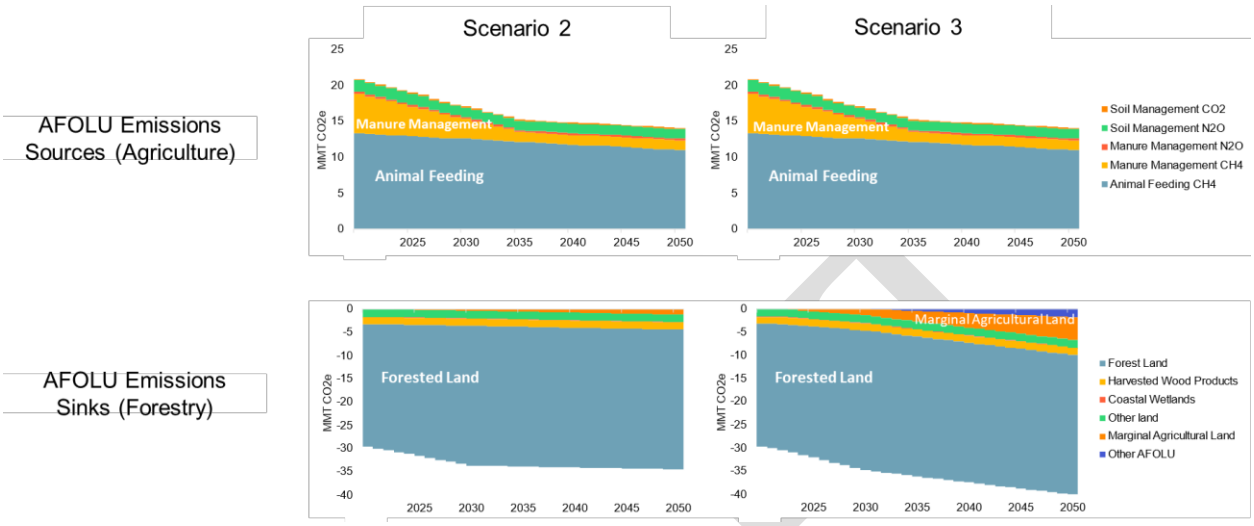


Agriculture, Forestry, and Other Land Use

Emissions within the agriculture, forestry, and other land use sector include emissions sources from agriculture and emissions sinks from forestry and other land use. Key measures in Scenarios 2 and 3 include achievable agricultural emissions in line with Cornell University estimates[102] and expansion of forest land sequestration to restore the sink to 1990 levels. Scenario 3 includes additional afforestation on marginal agricultural lands (Figure 31).

[102] Wightman and Woodbury. 2020.

Figure 31. Greenhouse Gas Emissions Sources in Agriculture (top) and Emissions Sinks in Forestry (bottom), Scenarios 2 and 3

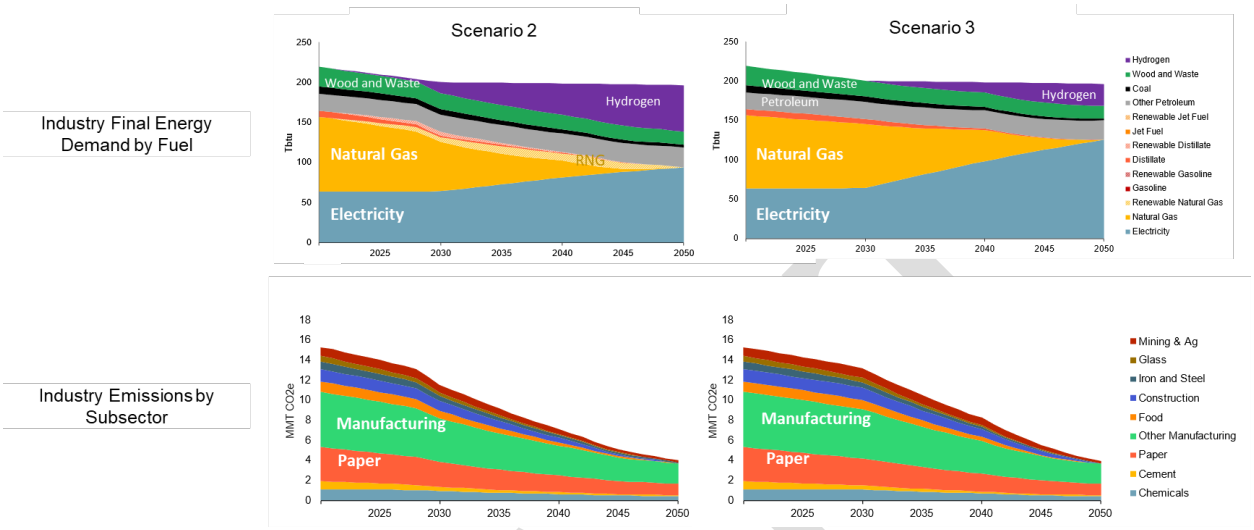


Industry: Energy

New York's industrial sector is diverse, but GHG emissions are dominated by manufacturing and paper industries.[103] Key measures in Scenarios 2 and 3 include manufacturing energy efficiency, electrification and hydrogen fuel switching, and carbon capture and storage for cement and iron and steel facilities. Scenario 2 includes a larger role for hydrogen and more accelerated electrification (Figure 32).

[103] The Industry: Energy sector covers all GHG emissions associated with combustion of fuels within New York industries; industrial process and product use emissions are captured separately.

Figure 32. Industrial Final Energy Demand (top) and Greenhouse Gas Emissions (bottom), Scenario 2 and 3

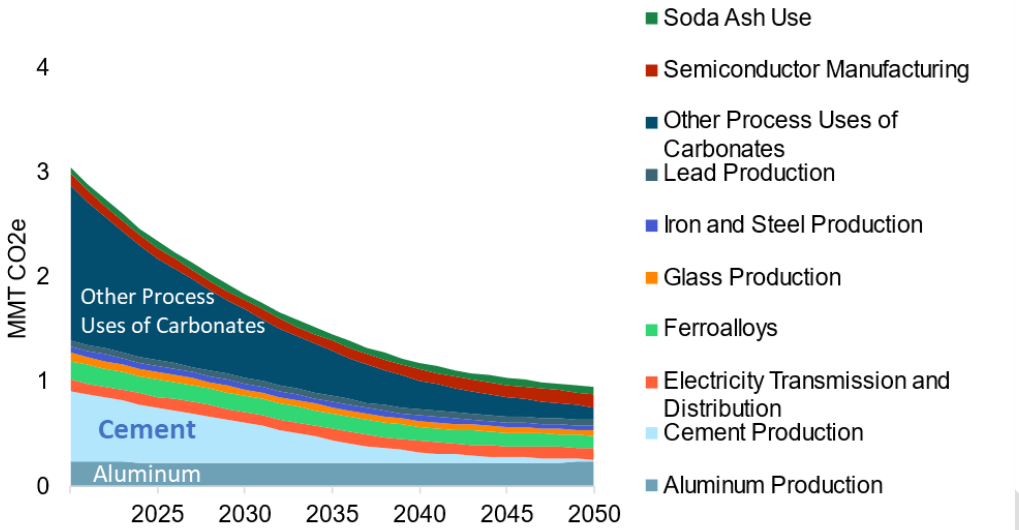


Industrial Processes and Product Use

The industrial process and product use sector includes emissions from industrial processes (such as cement and aluminum) and product use, which is primarily from refrigerants. Key measures in industrial process emissions are historical declines in uses of carbonates and carbon capture and storage for cement process emissions (Figure 33).[104]

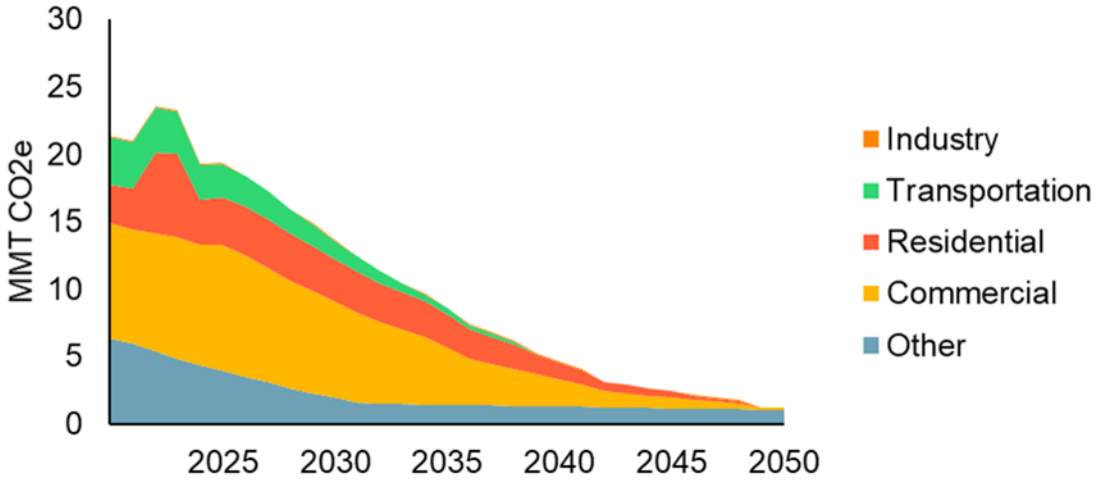
[104] Other process uses of carbonates includes flux stone use, flue gas desulfurization, magnesium production, acid neutralization, and sugar refining. Other non-CO_2 industrial process emissions are reduced based on incorporating mitigation potential from the EPA non-CO_2 report: https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections

Figure 33. Greenhouse Gas Emissions from Industrial Processes, Scenarios 2 and 3



HFC use has grown from near zero in 1990 to over 20 MMT CO_2e in 2020, driven by the replacement of other refrigerants (CFCs/HCFCs) over that time period. HFCs are a potent GHG but a critical part of the building electrification transition in New York. All scenarios include maximum adoption of ultra-low-GWP technologies for all building, transportation, industrial HVAC, and refrigeration systems and maximum possible service reclaim at product end of life (90% recover rates; Figure 34).

Figure 34. Greenhouse Gas Emissions from Industrial Product Use, Scenarios 2 and 3

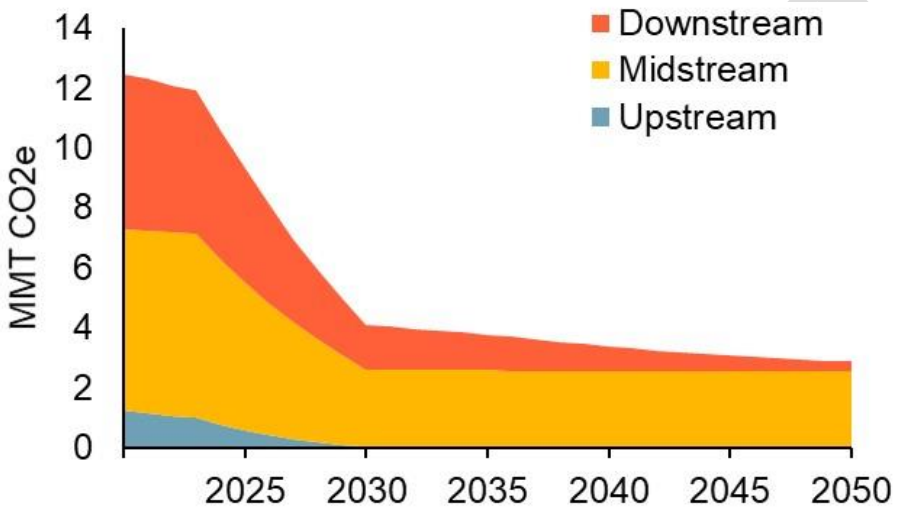


"Other" includes emissions from foams, aerosol propellants, solvents, and fire suppressants.

In-State Oil and Gas Fugitive Emissions

Emissions from New York's oil and gas industry are dominated by fugitive methane emissions in low-producing natural gas wells, transmission and storage compressor stations, steel and cast-iron pipes in the distribution system, and buildings. Key measures in Scenarios 2 and 3 include equipment replacement and leak detection and repair at compressor stations, abatement at upstream sources, distribution pipeline decommissioning, and residential building disconnection and decommissioning (Figure 35).

Figure 35. Greenhouse Gas Emissions from In-State Oil and Gas, Scenarios 2 and 3



Downstream includes distribution pipelines and building meters; midstream includes gas transmission, compression, and storage; and upstream includes gas production and abandoned oil and gas wells.

9.5 Key Findings

The integration analysis determined multiple pathways to achieving New York's Climate Act GHG emissions limits. There were several key findings based on the integration analysis:

- **Achieving deep decarbonization is feasible by mid-century.** Achievement of emissions reductions to meet state law **requires action in all sectors**, especially considering New York State's novel emissions accounting. Every sector will see high levels of transformation over the next decade and beyond, requiring critical investments in New York's economy.
- **Energy efficiency and end-use electrification will be essential parts of any pathway that achieves New York State emissions limits**. Approximately 1 to 2 million efficient homes are electrified with heat pumps by 2030 across compliant scenarios. Approximately 3 million zero-emission vehicles (predominantly battery electric) are sold by 2030.
- **A transition to low-GWP refrigerants and enhanced refrigerant management will be required** to electrify while reducing and ultimately eliminating GHG emissions from refrigerants.

- **Consumer and community decision-making is key, and especially important for the purchase of new passenger vehicles and heating systems for homes and businesses through the next decade.** In all modeled scenarios, zero-emission vehicles and heat pumps become the majority of new purchases by the late 2020s, and fossil-emitting cars and appliances are no longer sold after 2035.
- **New York will need to substantially reduce VMT while increasing transportation access**. This should include expansion of transit service structured around community needs, smart growth inclusive of equitable TOD, and transportation demand management.
- **Wind, water, and sunlight power most of New York's economy in 2050 in all pathways**. Even with aggressively managed load, electric consumption doubles and peak nearly doubles by 2050, and New York State becomes a winter peaking system by 2035, with offshore wind on the order of 20 GW, solar on the order of 60 GW, and 4- and 8-hour battery storage on the order of 20 GW by 2050. Firm, zero-emission resources, such as green hydrogen or long-duration storage, will be important to ensuring a reliable electricity system beyond 2040.
- **Low-carbon fuels such as bioenergy or hydrogen may be critical in helping to decarbonize sectors that are challenging to electrify.** By 2030, scenarios include initial market adoption of green hydrogen in the several applications (including MHD vehicles and high-temperature industrial). Additional promising end-use applications include district heating and non-road transportation such as aviation and rail.
- **Large-scale carbon sequestration opportunities include lands and forests and negative emissions technologies.** Protecting and growing New York's forests is required for carbon neutrality. Negative emissions technologies (such as the direct air capture of CO_2) may be required if the state cannot exceed 85% direct emissions reductions. Strategic land-use planning will be essential to balance natural carbon sequestration, agriculture activities, new renewables development, and smart urban planning.
- **Necessary methane emissions mitigation in waste and agriculture will require transformative solutions.** Diversion of organic waste and the capture of fugitive methane emissions are key in the waste sector. Alternative manure management and animal feeding practices will be critical in reducing methane emissions in agriculture.
- **Continued research, development, and demonstration (RD&D) is key to advancing a full portfolio of options and mitigating risk.** Additional innovation will be required in areas such as carbon sequestration solutions, long-duration storage, flexible electric loads, low-GWP refrigerants, and animal feeding, in concert with federal action (such as Earthshots).

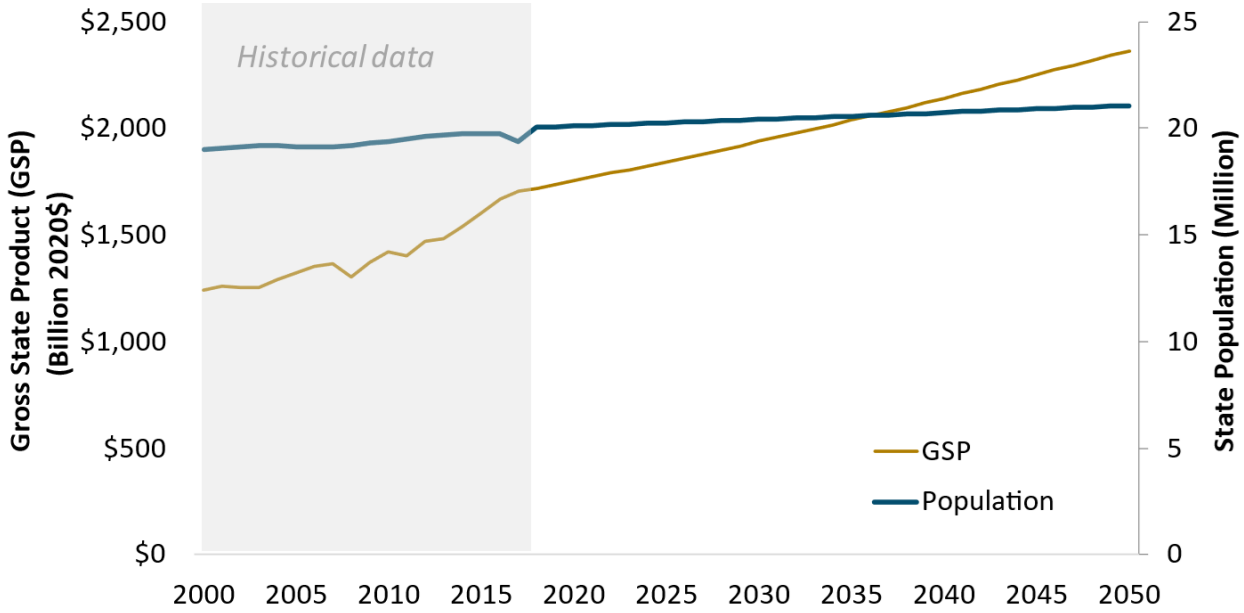
- **The largest three remaining sources** of emissions in 2050 across scenarios are landfills, aviation, and animal feeding.

Chapter 10. Benefits of the Plan

10.1 Background

New York's economy has been steadily growing for the last two decades and state economic output per capita has been growing even more quickly. These trends are projected to continue over time (Figure 36).

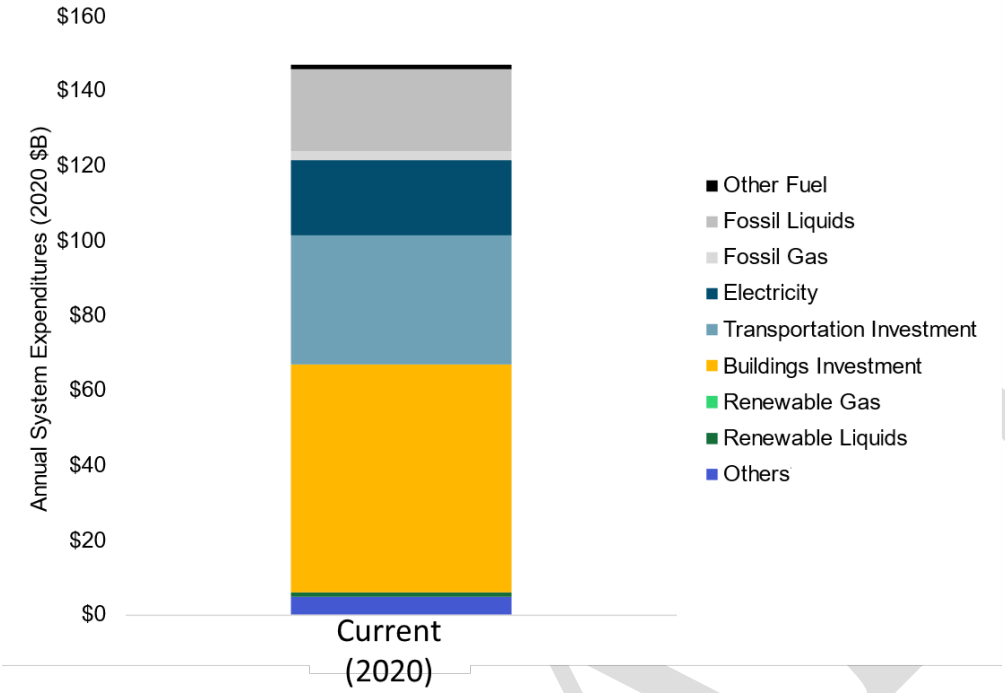
Figure 36. Historical and Projected Population and Gross State Product



Source: NYSERDA Patterns and Trends, Federal Reserve Economic Data, Cornell Program on Applied Demographics.

System expenditure is an estimate of the costs related to energy consumption in the state, which includes capital investments for energy consuming devices, liquid and gas fuel costs, and costs for in-state and imported electricity generation. While system expenditures are significant, these make up a small share of gross state product (GSP; 8.9% in 2020, see Figure 37).

Figure 37. Estimated Current System Expenditure by Category



Estimated system expenditures do not reflect direct costs in some sectors that are represented with incremental costs only. These include investments in industry, agriculture, waste, forestry, and non-road transportation.

Of these total system expenditures, annual energy expenditures are approximately $50 billion, with over half of that amount (almost $30 billion) estimated to leave New York State.[105] Petroleum fuel expenditures are the largest single category at approximately $24 billion. Current energy expenditures outline the opportunity for import substitution through electrification, where a greater share of energy services is provided by in-state resources, driving economic activity and job creation.

10.2 Integration Analysis Benefit-Cost Approach

The integration analysis included benefits and costs of the decarbonization scenarios evaluated. The quantified benefits include the value of avoided GHG emissions and avoided health impacts.

[105] NYSERDA Patterns and Trends,

Value of Avoided GHG Emissions

All scenarios model significant GHG emissions reductions, which avoid the economic impacts of damages caused by climate change.[106] The value of these avoided GHG emissions is measured in each scenario relative to the Reference Case.

Health Co-Benefits

The integration analysis also evaluated health benefits of mitigation scenarios relative to the Reference Case. For more information on these analyses, see the *Health Effects* section below. Three categories of potential health benefits were analyzed:

- Improvements in health outcomes due to improved air quality, including reduced incidence of premature mortality, heart attacks, hospitalizations, asthma exacerbation and emergency room visits, and lost workdays
- Public health benefits from increased physical activity due to increased use of active transportation modes (such as walking and cycling) while accounting for changes in traffic collisions
- Estimated benefits of energy efficiency interventions in LMI homes.

For a detailed description of the health analysis methods, see [APPENDIX TO COME].

Integration Analysis Costs

The pathways framework produces economy-wide resource costs for the various mitigation scenarios relative to a reference case. The framework is focused on annual societal costs and benefits and does not track internal transfers (such as incentives). Outputs are produced on an annual time scale for the state of New York, with granularity by sector. Cost categories include annualized capital, operations, and maintenance cost for infrastructure (such as devices, equipment, generation assets, and transmission and distribution) and annual fuel expenses by sector and fuel (conventional or low-carbon fuels, depending on scenario definitions).[107]

[106] The value of avoided GHG emissions calculations are based on DEC guidance: https://www.dec.ny.gov/energy/99223.html

[107] This analysis does not natively produce detailed locational or customer class analysis, but those may be developed through subsequent implementation processes.

Jobs Study

The integration analysis serves as key input to the JTWG Jobs Study (forthcoming).

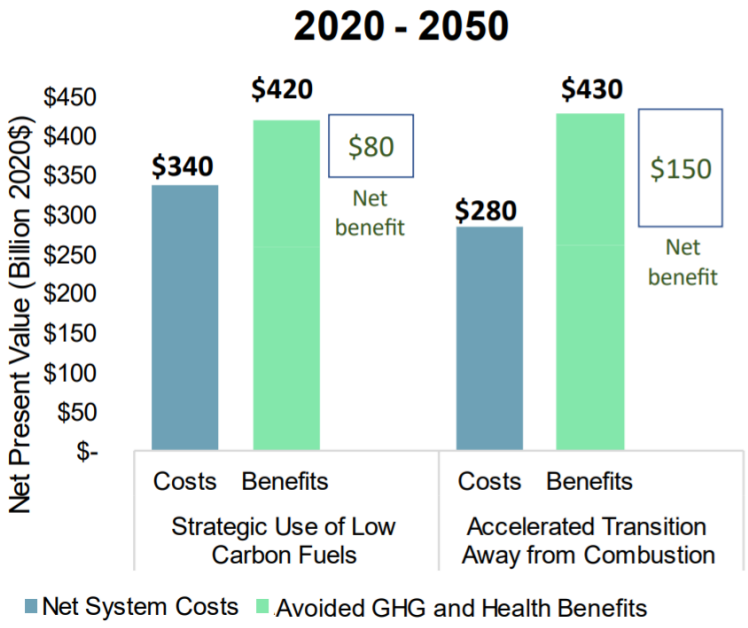
10.3 Key Benefit-Cost Findings

The integration analysis assessed the benefits of avoided GHG emissions, health co-benefits, and resource costs for Scenario 2: Strategic Use of Low-Carbon Fuels and Scenario 3: Accelerated Transition Away from Combustion (Figure 38).[108] There are three key findings from this assessment:

- **The cost of inaction exceeds the cost of action by more than $80 billion.** There are significant required investments to achieve Climate Act GHG emissions limits, accompanied by even greater external benefits and the opportunity to create hundreds of thousands of jobs.
- **Net benefits range from $80 billion to $150 billion.** Improvements in air quality, increased active transportation, and energy efficiency interventions in LMI homes generates health benefits ranging from $160 billion to $170 billion. Reduced GHG emissions avoids economic impacts of damages caused by climate change equaling approximately $260 billion. The combined benefits range from $420 billion to $430 billion.
- **Net direct costs are small relative to the size of New York's economy.** Net direct costs are estimated to be 0.6% to 0.7% of GSP in 2030, and 1.9% to 2.1% in 2050.

[108] A benefit-cost analysis for Scenario 4: Beyond 85% Reduction is not available at this time.

Figure 38. Summary of Benefits and Costs (Net Present Value Relative to Reference Case)

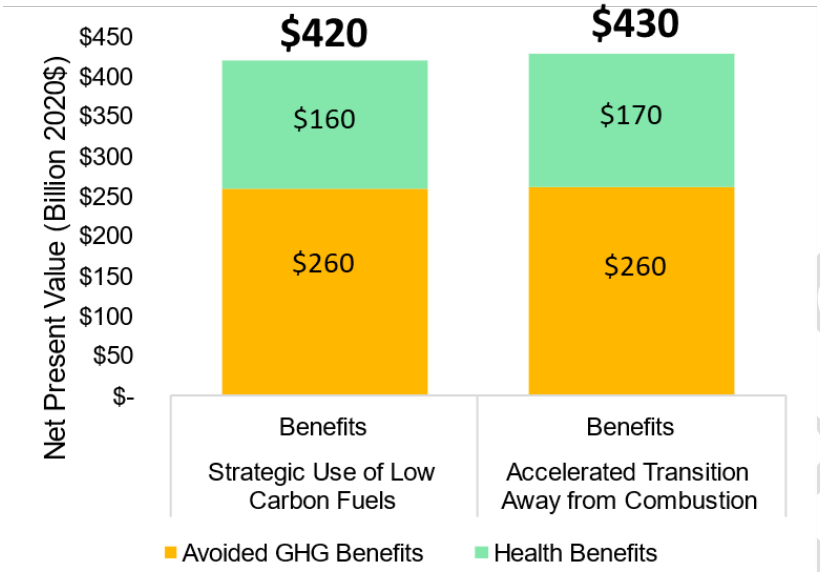


10.4 Benefit-Cost Results

Value of Avoided GHG Emissions and Health Co-Benefits

Reducing GHG emissions in line with the Climate Act limits avoids economic impacts of damages caused by climate change equaling approximately $260 billion. In addition, improved health outcomes, including improvements in air quality, increased active transportation, and energy efficiency interventions in LMI homes generate benefits ranging from $160 billion to $170 billion. Collective benefits range from $420 billion to $430 billion over the next 30 years (Figure 39).

Figure 39. Net Present Value of Benefits Relative to Reference Case (2020–2050)



Integration Analysis Costs

The integration analysis included calculations for three cost metrics: net present value (NPV) of net direct costs, annual net direct costs, and system expenditure.

- **NPV of Net Direct Costs**: NPV of levelized costs in a given scenario incremental to the Reference Case from 2020 through 2050.[109] This metric includes incremental direct capital investment, operating expenses, and fuel expenditures.
- **Annual Net Direct Costs**: Net direct costs are levelized costs in a given scenario incremental to the Reference Case for a single year snapshot. This metric includes incremental direct capital investment, operating expenses, and fuel expenditures.
- **System Expenditure**: System expenditure is an estimate of absolute direct costs (not relative to the Reference Case). Estimates of system expenditure do not reflect direct costs in some sectors that are represented with incremental costs only. These include investments in industry, agriculture, waste, forestry, and non-road transportation.

[109] All NPV calculations assume a discount rate of 3.6%. This discount rate was applied to all annual cost and benefit streams, including the value of avoided GHG emissions, which has an embedded, separate and distinct perspective on discounting described in the DEC guidance: https://www.dec.ny.gov/energy/99223.html.

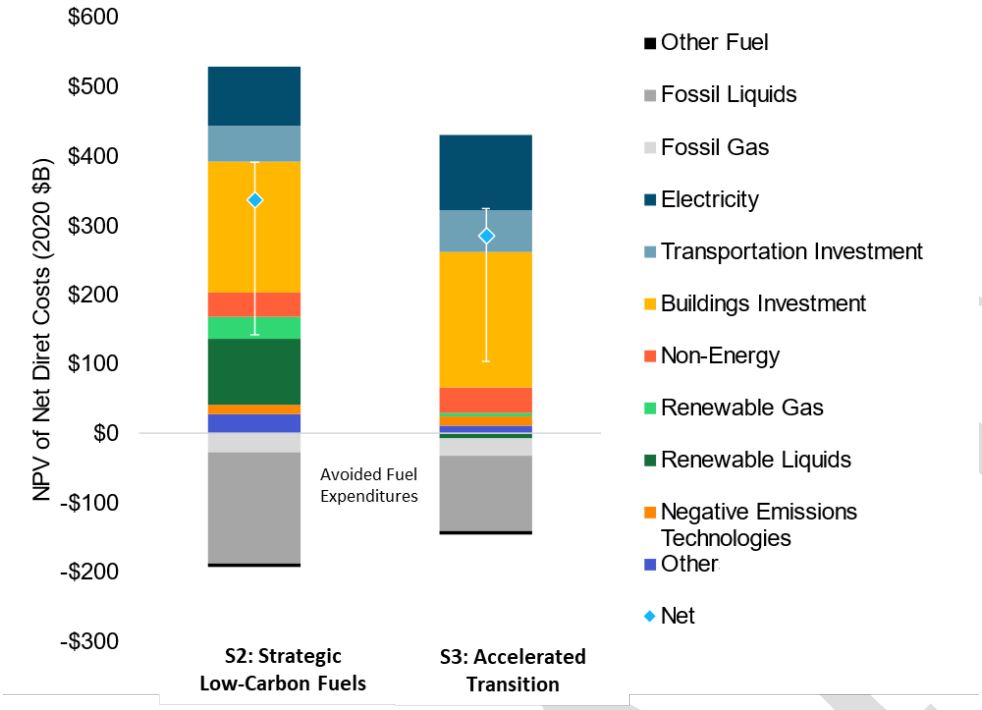
Cost categories included in the metrics listed above are shown in Table 5.

Table 5. Integration Analysis Cost Categories

Cost Category	Description
Electricity System	Includes incremental capital and operating costs for electricity generation, transmission (including embedded system costs), distribution systems, and in-state hydrogen production costs.
Transportation Investment	Includes incremental capital and operating expenses in transportation (e.g. BEVs and EV chargers)
Building Investment	Includes incremental capital and operating expenses in buildings (e.g. HPs and building upgrades)
Non-Energy	Includes incremental mitigation costs for all non-energy categories, including agriculture, waste, and forestry
Renewable Gas	Includes incremental fuel costs for renewable natural gas and imported green hydrogen
Renewable Liquids	Includes incremental fuel costs for renewable diesel and renewable jet kerosene
Negative Emission Technologies (NETs)	Includes incremental costs for direct air capture of CO2 as a proxy for NETs
Other	Includes other incremental direct costs including industry sector costs, oil & gas system costs, HFC alternatives, and hydrogen storage
Fossil Gas	Includes incremental costs spent on fossil natural gas (shown as a negative for cases when Gas expenditures are avoided compared with the Reference Case)
Fossil Liquids	Includes incremental costs spent on liquid petroleum products (shown as a negative for cases when liquids expenditures are avoided compared with the Reference Case)
Other Fuel	Includes incremental costs spent on all other fossil fuels

The NPV of **net direct costs in Scenario 2 and Scenario 3 are in the same range given uncertainty**, and are primarily driven by investments in buildings and the electricity system (Figure 40). All scenarios show avoided fossil fuel expenditures due to efficiency and fuel-switching relative to the Reference Case (shown in the chart as negative costs). Scenario 2: Strategic Use of Low-Carbon Fuels includes significant investment in renewable diesel, renewable jet kerosene, and RNG. Scenario 3: Accelerated Transition Away from Combustion meets emissions limits with greater levels of electrification, which results in greater investments in building retrofits, zero-emission vehicles, and the electricity system. Scenario costs are sensitive to the price of fossil fuels and technology cost projections, as reflected in error bars.

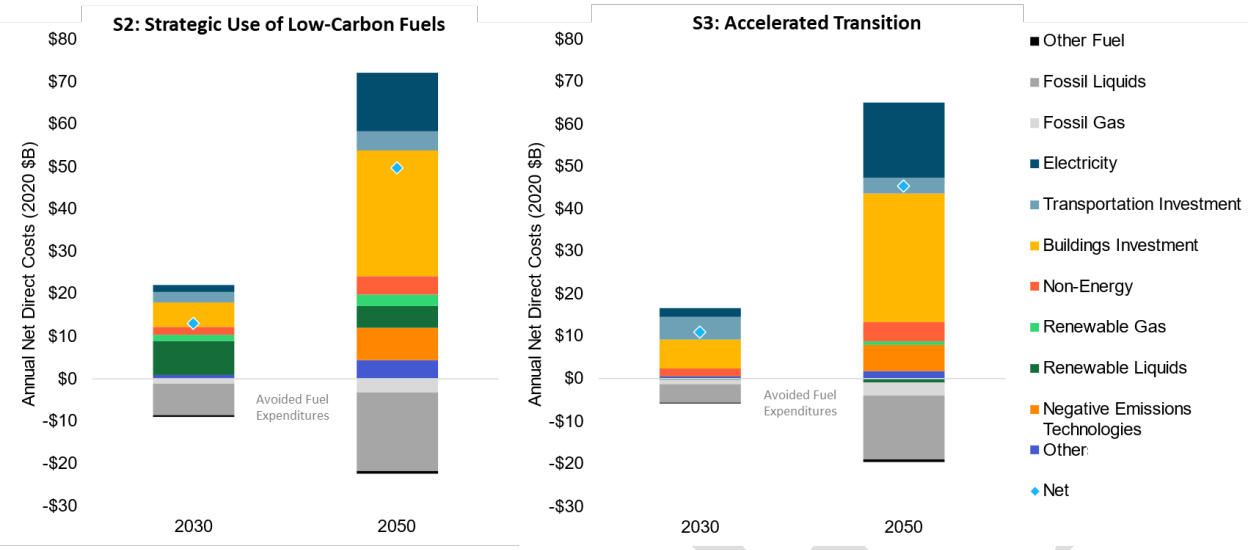
Figure 40. Net Present Value of Net Direct Costs Relative to Reference Case (2020–2050)



Uncertainty error bars include low and high fuel price sensitivities from AEO 2021, and low technology costs for heat pumps, EVs, wind, solar, storage, and direct air capture of CO_2.

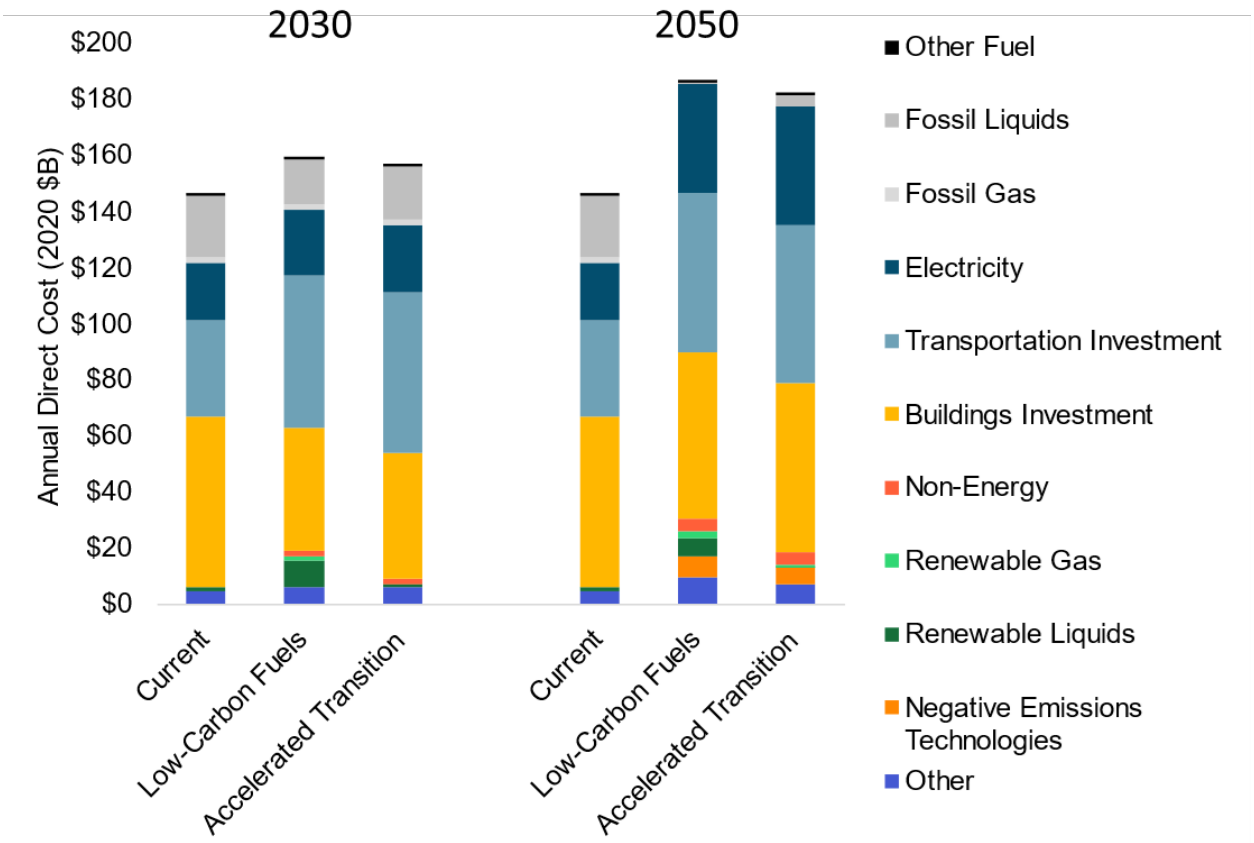
Annual net direct costs show the timing of key investments required to meet the Climate Act GHG emissions limits. Scenario 2 includes significant investment in renewable diesel, renewable jet kerosene, and RNG starting in the mid-2020s. Scenario 3 includes greater levels of electrification compared to Scenario 2, which results in greater investments in building retrofits, zero-emission vehicles, and the electricity system. Both scenarios 2 and 3 include investment in negative emissions technologies to achieve net zero emissions by 2050. In 2030, annual net direct costs are around $10 billion per year, approximately 0.6% of GSP; in 2050, costs increase to $50 billion per year, or 2% of GSP (Figure 41).

Figure 41. Annual Net Direct Costs Relative to Reference Case in Scenario 2 (left) and Scenario 3 (right)



Net direct costs were measured relative to the Reference Case, but system expenditures were evaluated on an absolute basis. System expenditures increase over time as New York invests in infrastructure and clean fuels to meet the Climate Act's emissions limits. As a share of overall system expenditures, costs are moderate: 7.1% to 8.6% in 2030 and 24% to 27% in 2050 relative to current estimated expenditure levels (Figure 42).

Figure 42. Annual System Expenditures in Scenario 2 and Scenario 3



Electric Sector Sensitivities

Across a wide range of technology cost and fuel price sensitivities, New York is projected to power more than 90% of its electricity demand with renewable power from wind, solar, and hydro resources. As discussed in Chapter 9, firm zero-carbon resources will be critical to providing the remaining 5% to 10% of demand during times of low wind and solar output, high demand, or both.

This analysis examined a number of sensitivities regarding the availability of both existing and new technologies to meet remaining electricity needs. The analysis detailed below, and illustrated in Figure 43, was focused on sensitivities performed on Scenario 3. The cost assessment compared the costs of each sensitivity relative to the Reference Case and controlling for electrification loads (to isolate the impacts of changes in the resource mix from changes in overall demand).

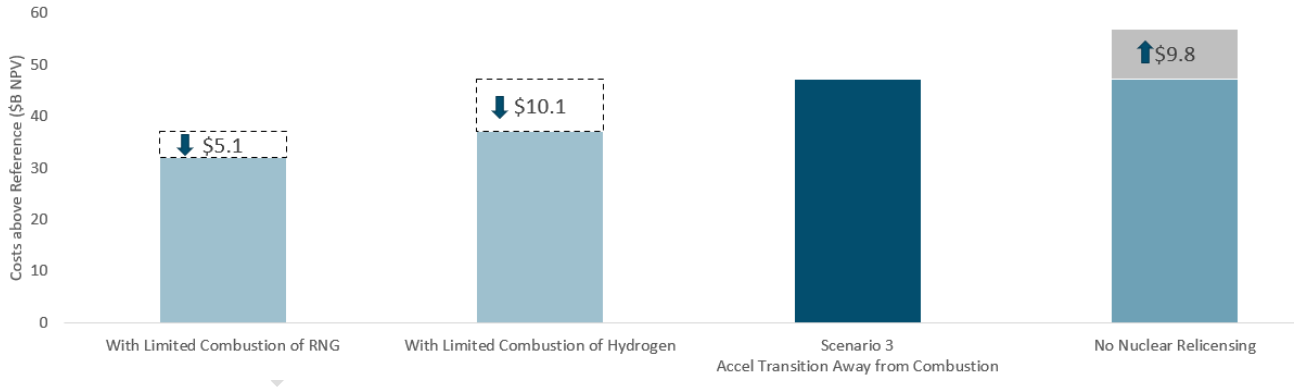
Under the primary assessment of Scenario 3, in order to facilitate a transition away from combustion in the electric sector, all existing fossil fuel resources are retired by 2040, with no new combustion-based

resources (for example, combustion turbines or combined cycle new firm capacity needs are met with a resource that avoids combustion and local air pollution).[110]

The overall electric system costs of Scenario 3 relative to the Reference Case, controlling for electrification loads, is $47 billion on an NPV basis over the 2020 through 2050 forecast period. The sensitivity analysis also examined a scenario in which upstate nuclear units do not receive license extensions and are retired at the end of their 60-year lifetimes; this places additional pressure on the New York system by (1) increasing the amount of zero-carbon energy needed from new renewable resources and (2) increasing the amount of new firm capacity needed to replace the energy and reliability contributions of nuclear generation during times of low renewable output. Retiring the upstate nuclear units at the end of their 60-year licenses would increase costs by $10 billion relative to Scenario 3.

The modeling also included sensitivities in which limited combustion of zero-carbon fuels such as hydrogen or RNG is used to meet firm capacity needs, similar to the assumptions in Scenarios 1, 2, and 4. Shifting from fuel cells to hydrogen combustion resources would reduce costs by about $10 billion relative to Scenario 3. The use of RNG, which is expected to be cheaper than hydrogen, would further reduce costs by about $5 billion, or $15 billion below Scenario 3.

Figure 43. Cost Impacts of Electric Sector Sensitivities



The costs presented in the figure represent the costs relative to the Reference Case with equivalent levels of electrification loads, and as a result are not directly comparable to the electric sector costs presented in the economy-wide analysis, in which costs were measured relative to the Reference Case with reference loads.

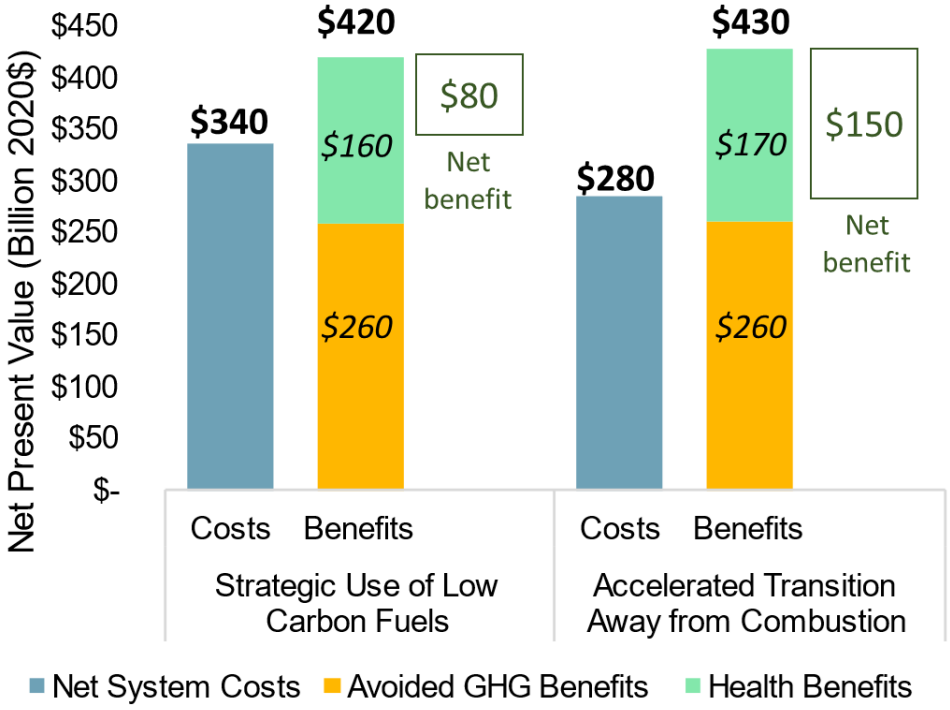
[110] For the purpose of the cost analysis, this resource was assumed to be a hydrogen fuel cell; however, the need could be met by a number of emerging technologies. Analysis of long-duration (100-hour) battery storage is detailed in Chapter 9.

This sensitivity analysis was focused on the contributions of different firm capacity resources and their impacts on electric system costs, while other analyses may consider the impacts on health benefits from the combustion of fuels relative to a no-combustion alternative such as hydrogen fuel cells.

Combined Benefit-Cost Results

Aggregating the impacts of benefits and cost analyses, mitigation cases show positive net benefits (of between $80 billion and $150 billion) when considering the value of avoided GHG emissions and health co-benefits, in addition to cost savings from reduced fuel use (Figure 44).

Figure 44. Net Present Value of Benefits and Costs Relative to Reference Case, Including Avoided GHG Benefits, Health Benefits, and Net Direct Costs (2020–2050)



10.5 Health Effects

Health Analyses Approach

The analysis of potential public health benefits associated with the decarbonization policy scenarios evaluated the potential for the scenarios to effect public health outcomes relative to the Reference Case. Three analyses were undertaken, evaluating three types of potential:

- To improve air quality and ensuing health outcomes through reduced combustion and associated pollutant emissions
- To improve public health through increased activity associated with active transportation modes such as walking and cycling
- To improve health outcomes in homes, especially LMI homes, through energy efficiency interventions

The air quality analysis applied EPA's CO Benefits Risk Assessment Health Impacts Screening and Mapping Tool, customized with detailed inputs specific to New York State and the scenarios analyzed, to evaluate air quality and ensuing public health outcomes at the county level. The model evaluated ambient air quality based on sulfur dioxide (SO_2), VOC, nitrogen oxides (NO_X), and direct emissions of fine particulate matter ($PM_{2.5}$) and the ensuing changes in annual $PM_{2.5}$ concentrations from 2020 through 2050. The results include 12 different health outcomes, such as premature mortality, heart attacks, hospitalizations, asthma exacerbation and emergency room visits, and lost workdays.

Results were calculated for high and low estimates, reflecting two alternative methods adopted by EPA for evaluating premature mortality and non-fatal heart attacks based on two epidemiological studies of the impacts of air quality on public health. The economy-wide benefit results described in the sections above applied the high estimate. Note that the model does not include additional potential benefits from reduce ozone concentrations: the value of those benefits was estimated to be a few percentage of the benefits associated with $PM_{2.5}$. Additional benefits not included are reduced nitrogen dioxide (NO_2) concentrations and reduced toxics, which were not evaluated given the high uncertainty and lack of sufficient data to provide reasonable estimates.

Potential public health benefits from increased physical activity due to increased use of active transportation modes, while accounting for potential increases in traffic collisions, were estimated using the Integrated Transport Health Impacts Model, customized to represent New York State.

Values from published literature on the health and safety benefits of energy system changes and weatherization programs in homes were used to estimate the potential benefits of energy efficiency interventions. These applied only to LMI homes expected to have upgraded systems and weatherization. While additional benefits may result from building changes in higher income homes, they would likely be lower, and no data is available to estimate those details.

For a detailed description of the health analyses methods, see [**APPENDIX TO COME**].

Key Health Findings

Decarbonization of New York can result in a substantial health benefits from improved air quality, on the order of $50 billion to $120 billion from 2020 through 2050 (based on reduced mortality and other health outcomes) relative to the Reference Case.

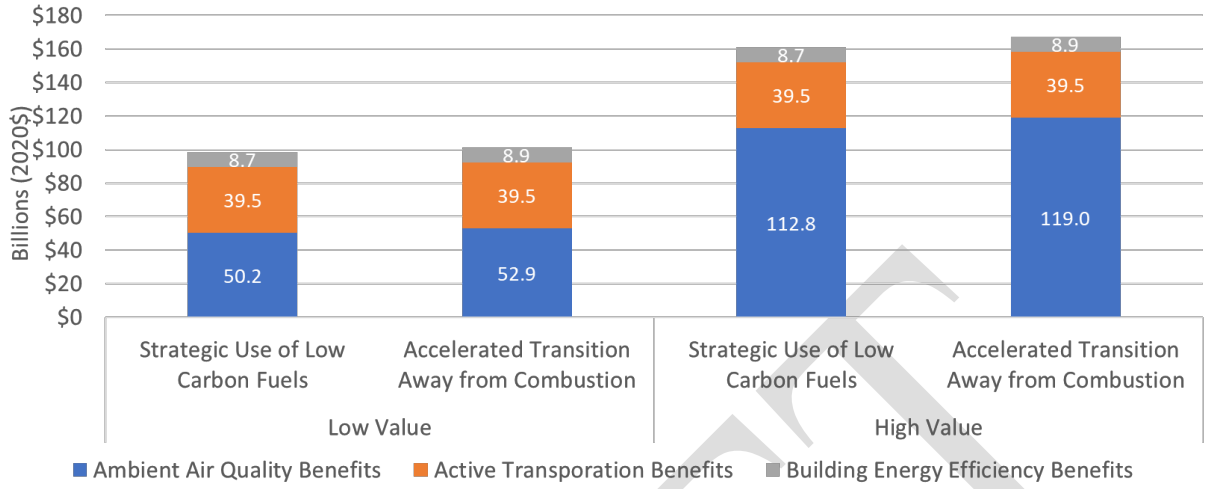
- Benefits would be experienced throughout the state and downwind in neighboring states.
- Benefits of reduced fossil fuel combustion are higher in urban areas due to both higher emissions and a larger impacted population.
- Benefits of reduced wood combustion are higher in Upstate areas.
- Annual benefits would grow over time as pollution rates decrease.

In addition, we estimated additional related potential health benefits:

- $40 billion associated with the health benefits of increased active transportation (such as walking and cycling)
- $9 billion associated with energy efficiency interventions in LMI homes (additional benefits, not quantified, may occur in other buildings as well)

The total projected potential health benefits associated with the scenarios analyzed are presented in Figure 45. Results are presented for the high and low estimates.

Figure 45. Total Projected Health Benefits (Net Present Value, 2020–2050)

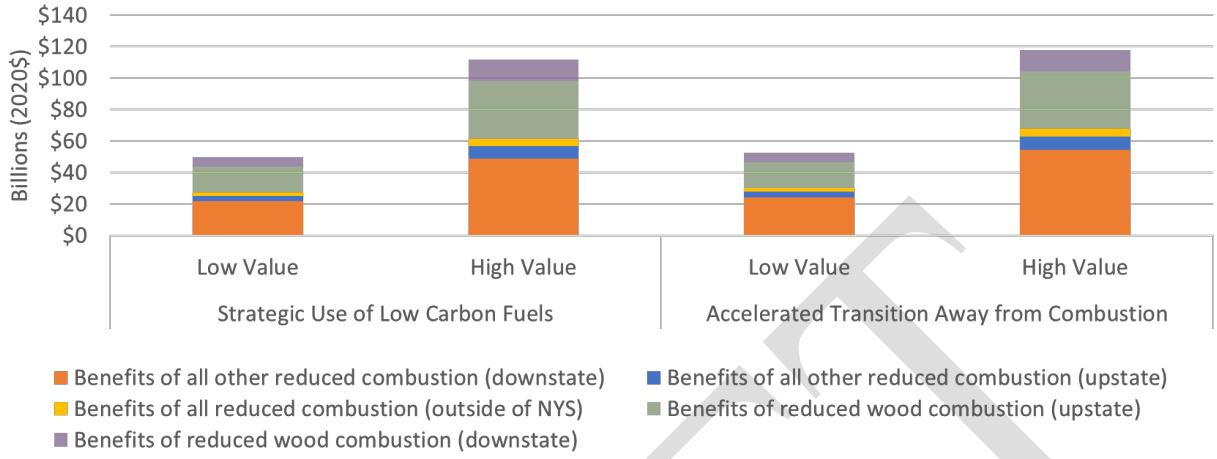


Ambient Air Quality Benefits

In all scenarios, air quality improvements can avoid tens of thousands of premature deaths, thousands of non-fatal heart attacks, thousands of other hospitalizations, thousands of asthma-related emergency room visits, and hundreds of thousands of lost workdays.

The value of the benefits by scenario are presented in Figure 46. While a small amount of benefits would occur downwind of New York in neighboring states, the vast majority of benefits would occur within New York. A large portion of the projected benefits would result from reduced wood combustion. Benefits from reduced fuel combustion (excluding wood) would be larger Downstate, and benefits from reduced wood combustion would be larger Upstate. While the reduced wood combustion represents a small amount of the total reduced fuel combustion, it has an outsized impact on particulate matter emissions, resulting in substantially high benefits.

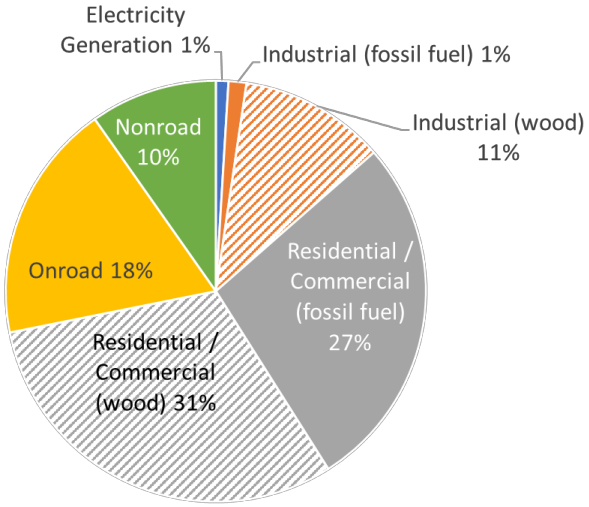
Figure 46. Total Projected Ambient Air Quality Health Benefits (Net Present Value, 2020–2050)



Benefits would increase over time as policies affecting emission reductions take effect, gradually increasing up to approximately $6 billion in the low case and under $15 billion in the high case by 2050.

As presented in Figure 47, approximately 40% of the projected benefits are associated with wood combustion in industrial, commercial, and residential uses. The remaining benefits are associated with relatively equal amounts from transportation (on-road and non-road) and building fuel combustion, and additional small fractions of the benefits are associated with reduced combustion in the electricity generation sector. While buildings and electricity generation can have substantial emissions and ensuing health impacts locally, much of the building energy and power in New York is based on natural gas, which burns much cleaner and therefore has a substantially lower impact on particulate matter emissions and public health. Oil combustion can have a much larger health impact locally, but the quantities of oil used statewide are much smaller. However, despite having lower particulate matter emissions than wood combustion overall, those oil and natural gas emissions from buildings do have a large impact on public health because they are located in more populated urban areas, while wood combustion is more heavily weighted to rural areas with less dense population.

Figure 47. Health Benefits by Sector, 2020–2050



The fractions of benefits by sector are similar in both the Low Carbon Fuels and Accelerated Transition scenarios.

The maximum annual average $PM_{2.5}$ concentration reductions by county projected to be achieved by 2050 are presented in Figure 48. Note that the concentration reductions in both scenarios are very similar. The distribution of benefits per capita are presented in Figure 49, both with and without the benefits of wood combustion. While much higher benefits overall would accrue in urban areas due to higher population, per-capita benefits are also higher in urban areas due to higher baseline health incidence and larger reductions in emissions (due to larger sources available to be reduced). The distribution of benefits would be very similar in both scenarios.

Figure 48. Reduction in $PM_{2.5}$ Annual Average Concentrations, Strategic Use of Low Carbon Fuels, 2050

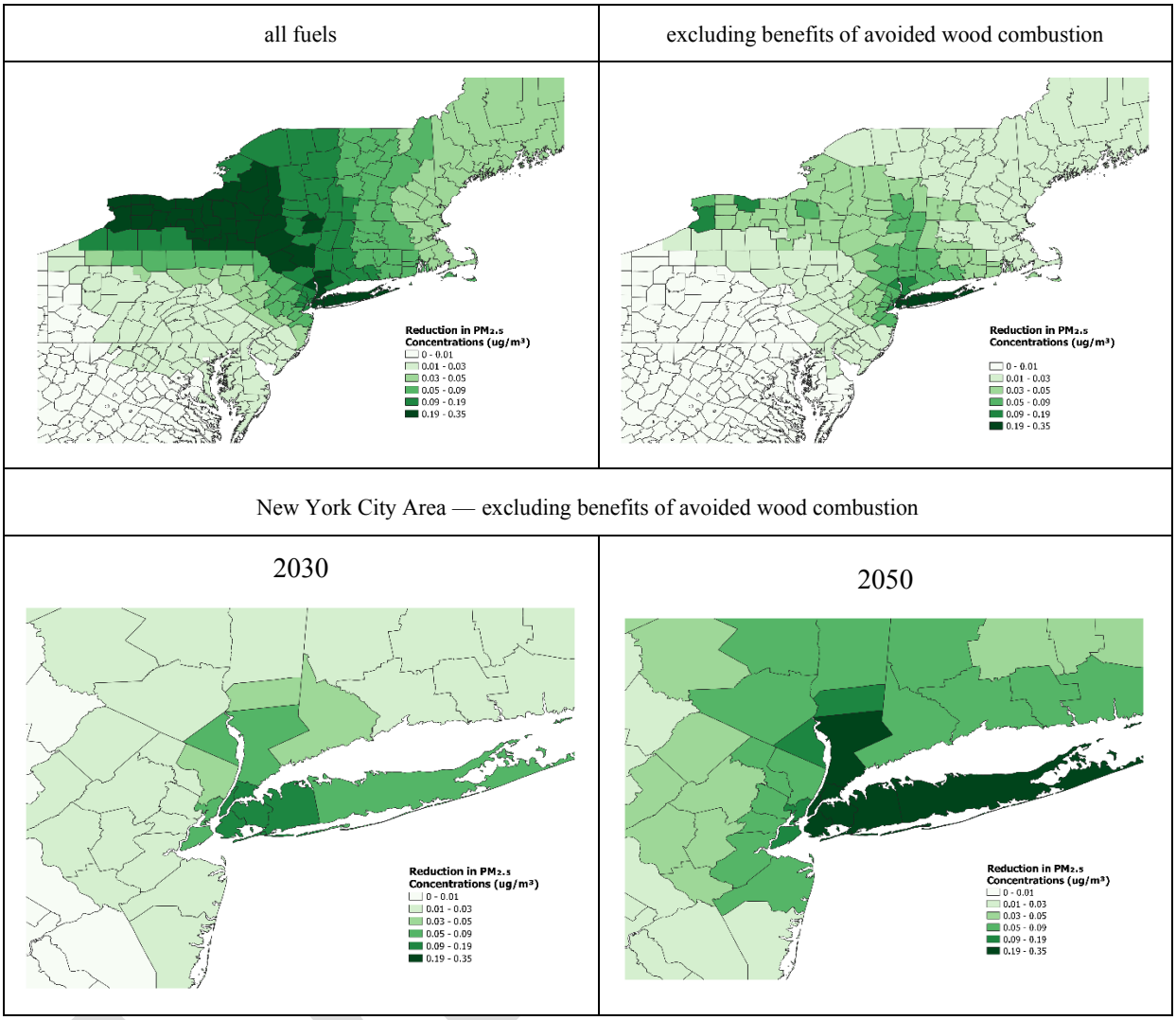
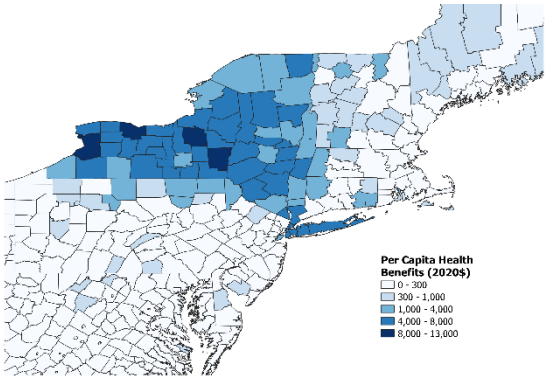
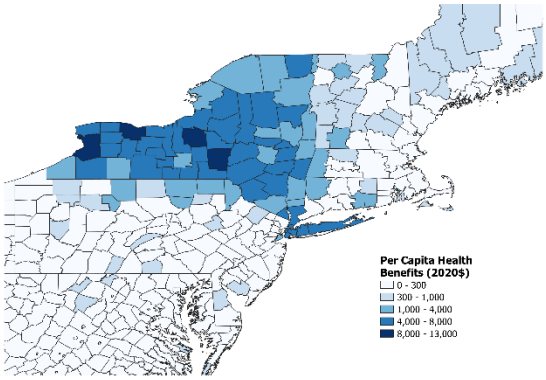
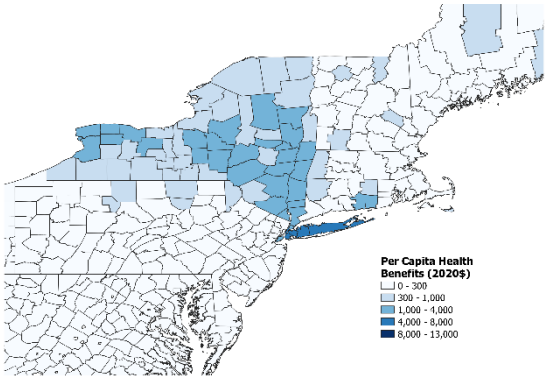
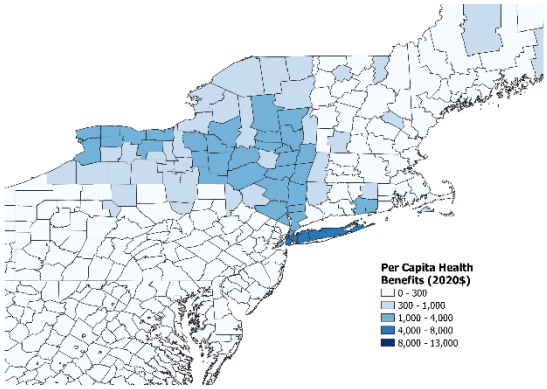
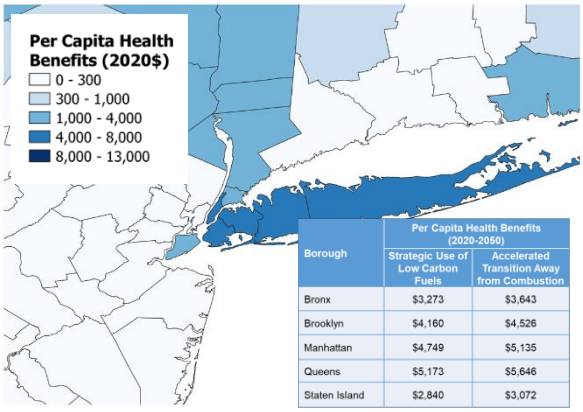


Figure 49. Per Capita Health Benefits, 2020–2050

	Strategic Use of Low Carbon Fuels	Accelerated Transition Away from Combustion
all fuels		
excluding benefits of avoided wood combustion		



Borough	Per Capita Health Benefits (2020-2050)	
	Strategic Use of Low Carbon Fuels	Accelerated Transition Away from Combustion
Bronx	$3,273	$3,643
Brooklyn	$4,160	$4,526
Manhattan	$4,749	$5,135
Queens	$5,173	$5,646
Staten Island	$2,840	$3,072

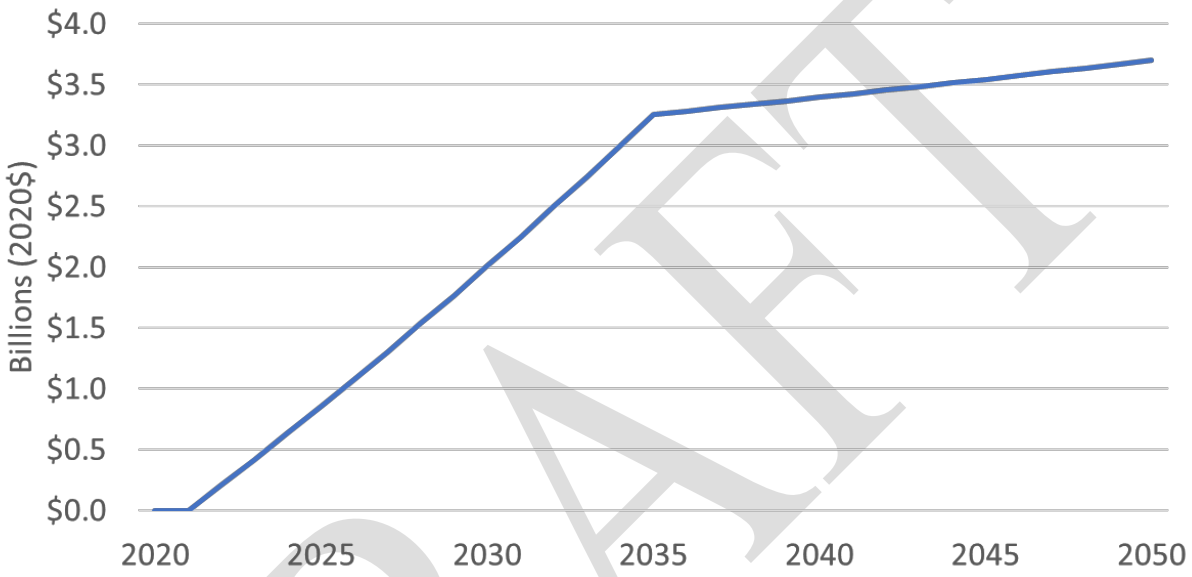
Health Benefits of Increased Active Transportation

The potential value of the net reduction in the number of deaths, including the decrease in deaths from increased physical activity and the increase in deaths from traffic collisions, is estimated to be a NPV of $39.5 billion (2020 to 2050). As presented in Figure 50, the values increase over the years as walking and cycling mode use increases with the introduction of infrastructure and other measures to encourage the

use of these modes. Note that the projected decrease in premature deaths from physical activity far outweighs the potential increase in deaths from traffic collisions.

Active transportation benefits are the same for the Low Carbon Fuels and Accelerated Transition scenarios.

Figure 50. Potential Annual Value of Public Health Benefits from Increased Active Transportation



Health Benefits of Residential Energy Efficiency Interventions

Health benefits in residential energy efficiency interventions are expected to result from several factors listed in Table 6. These do not include all the potential benefits, but rather only those for which sufficient study of benefits per intervention was available to apply to the New York scenarios. Not included, for example, are benefits of indoor air quality associated with reduced indoor combustion of gas for cooking. Indoor air quality improvements can be achieved by ensuring appropriate ventilation (often in cases where ventilation and existing conditions were not appropriate prior to the intervention) combined with heat recovery where needed. Crucial to this benefit is ensuring appropriate ventilation when tightening building envelopes.

Table 6. Health Benefits Included in the Analysis of Residential Energy Efficiency Interventions

Health-Related Measure	Causes for each Benefit	Low-Income Single Family	Low-Income Multifamily
Reduced thermal stress – heat and cold	Building envelope tightening, appliance replacements	☑	☑
Reduced asthma-related incidents or reduced asthma symptoms	Improved ventilation	☑	*
Reduced trip or fall injuries	Removal of trip hazards, roofing improvements, lighting improvements	☑	☑
Reduced carbon monoxide poisonings	Appliance replacements, carbon monoxide monitors	☑	Not available

* This was studied but no significant difference was detected.

In many cases, benefits occur due to programs ensuring that associated measures are taken at the same time, such as ensuring that carbon monoxide monitors are available where needed and that weatherization does not happen prior to fixing existing conditions such as mold.

The analysis was undertaken at high-level, applying the number of homes to average benefits from the existing studies. Benefits were estimated only for LMI homes. There are likely also benefits for higher income homes, but data to estimate those benefits is not available.

Benefits would be highly dependent on the structure of the interventions. Energy efficiency programs differ based on whether they include appliance change outs, building shell retrofits, or other non-energy interventions (such as installing carbon monoxide detectors).

Following the current practice in NYSERDA's energy efficiency programs, the analysis assumes that a range of non-energy measures would be included as appropriate in each case.

The projected benefits by health measure and building type are detailed in Table 7 and Table 8 for the Strategic Use of Low Carbon Fuels and the Accelerated Transition Away from Combustion, respectively.

Table 7. Potential Public Health Benefits of Energy Efficiency Intervention (2020–2050) — Strategic Use of Low Carbon Fuels

Health-Related Measure	LMI Single Family (billion $)	LMI Multifamily (billion $)	Total (billion $)
Reduced asthma-related incidents or reduced asthma symptoms	$3.0	Not available	$3.0
Reduced trip or fall injuries	$1.4	$0.5	$1.9
Reduced thermal stress - cold	$0.4	$0.9	$1.2
Reduced thermal stress - heat	$0.6	$1.5	$2.2
Reduced carbon monoxide poisonings	$0.5	Not available	$0.5
Total	**$5.8**	**$2.9**	**$8.7**

Table 8. Potential Public Health Benefits of Energy Efficiency Intervention (2020–2050) — Accelerated Transition Away from Combustion

Health-Related Measure	LMI Single Family (billion $)	LMI Multifamily (billion $)	Total (billion $)
Reduced asthma-related incidents or reduced asthma symptoms	$3.0	Not available	$3.1
Reduced trip or fall injuries	$1.4	$0.5	$1.9
Reduced thermal stress - cold	$0.4	$0.9	$1.3
Reduced thermal stress - heat	$0.6	$1.6	$2.2
Reduced carbon monoxide poisonings	$0.5	Not available	$0.5
Total	**$5.9**	**$3.0**	**$8.9**

Sector Strategies

Chapter 11. Transportation

11.1 State of the Sector

Overview

Historically, the evolution of transportation systems has served as a catalyst for economic growth, productivity, and land use and development patterns. Transportation investments significantly influence where economic growth ensues, at what rate that growth occurs, and the design and density of the built environment. The challenge is how to balance growth, facilitated by transportation, while mitigating harmful GHG emissions. Compounding this challenge are historically low motor fuel prices and individual consumers' preference for larger, less fuel-efficient vehicles. Short trips are often accomplished by single occupancy vehicles. Innovations in commerce—such as just-in-time delivery and dispersion of production facilities—have made delivery of goods more inefficient. Local residential land use and commercial development policies have driven unconstrained sprawl and thereby increasing VMT and congestion. These challenges present an opportunity for adopting mobility-oriented development (MOD) strategies through targeted transportation investments.

The challenge of achieving the Climate Act requirements should be approached strategically and with an eye toward recognizing the opportunity and delicate balance of facilitating transportation's role in economic growth with the need to address adverse community, environmental, and human health impacts. To fully implement the requirements of the Climate Act while maintaining economic competitiveness, the State needs the full support of complementary national, regional, and local strategies.

When considering how to reduce transportation emissions, it is important to note that measures for reducing GHG emissions from transportation are interconnected. Actions to achieve the Climate Act goals and requirements transcend the transition to ZEVs and include diversified mobility alternatives, promotion of denser land use and development policies, and implementation of market-based policies to influence travel decisions.

As of October 2021, there were over 9 million registered LDV (source DMV registrations) in NY state, one half of one percent of which are ZEV (BEV). To facilitate the level of transformation required by the Climate Act and accounting for growth in vehicle registrations, there will need to be approximately 3 million ZEV LDVs in use by 2030 and approximately 10 million ZEV LDVs in use by 2050. In addition,

enhancing the availability, accessibility, reliability and affordability of public transportation services, with an emphasis on unserved and underserved communities, as well as reimagining residential and commercial development utilizing MOD principles, will be integral to mitigating single-occupant discretionary vehicle trips, and associated vehicle congestion and harmful GHG emissions.

Vision for 2030

Emissions Overview

The transportation sector was responsible for approximately 28% of the state's emissions in 2019, which includes road transportation (59%), non-road such as aviation (12%), emissions from imported fuels (26%), and HFCs used in vehicle air-conditioning and refrigeration (3%). Transportation sector emissions are about 16% higher today than they were in 1990. The transportation sector today is largely dependent on petroleum-based fuels such as gasoline, diesel, and jet fuel, but the state has made strong progress in transitioning from petroleum-based fuels to zero-emission technologies.

An aggressive and implementable mix of policies will be required to accelerate GHG emission reductions to the level needed by 2030. By 2030 nearly 100% of LDV sales and 40% or more of MHD vehicle sales must be ZEVs and a substantial portion of personal transportation in urbanized areas would be required to shift to public transportation and other low-carbon modes.[111] New York can achieve these goals through ZEV sales requirements and accompanying incentives and investments to help achieve these mandates, historic investments in expanded public transportation and micro-mobility, enhanced bicycle and pedestrian infrastructure, smart growth development, a clean fuel standard that reduces the average carbon intensity of fuels, and market-based policies that support lower-carbon transportation choices.

The recommended policies is expected result in as many as three million ZEVs (about 30% of LDVs and 10% of MHD vehicles) on the road by 2030.[112] Hydrogen fuel cell vehicles are expected to begin to emerge into the market by 2030 and the State should begin investing in the required supporting infrastructure to enable these vehicles to play a larger role in transportation emission reductions beyond

[111] E3 Integration Analysis, as presented by Carl Mas to CAC on October 14, 2021, slides 18-22, https://climate.ny.gov/-/media/CLCPA/Files/2021-10-14-CAC-Meeting-presentation.pdf

[112] E3 Integration Analysis, as presented by Carl Mas to CAC on October 14, 2021, slides 18-22, https://climate.ny.gov/-/media/CLCPA/Files/2021-10-14-CAC-Meeting-presentation.pdf

2030. Regional collaboration among states and coordination with the federal government will be needed to ensure that ZEV technologies can achieve the hoped-for growth trajectory.

Because a large portion of vehicles on the road are expected to still use internal combustion engines in 2030, particularly in the MHD subsector, one path to achieving 2030 emissions reduction targets focuses on shifting diesel vehicle fuel use to renewable diesel in 2030. Policies like a clean fuel standard would increase use of low-carbon fuels, including electricity, green hydrogen, and advanced biofuels. Another path to achieving 2030 emissions reduction targets requires accelerated ZEV adoption and early retirement of internal combustion vehicles. Additional incentives would be required to achieve these outcomes.

Significant increases in the availability of public transportation services and other zero-emission mobility alternatives in the state's urbanized areas should help reduce VMT by 2030. While mobility-on-demand strategies are expected to be adopted between now and 2030, this is primarily a longer-term emission reduction strategy. Land use policies that shift travel to cleaner shared mobility alternatives or reduce discretionary single occupant VMT provide significant community benefits such as air quality improvements and reduce the number of ZEVs needed to meet GHG emission reduction requirements.

Vision for 2050

By 2050, the transportation sector will need to shift nearly completely to ZEVs while substantially increasing the use of low-carbon transportation modes like public transportation, walking, and biking that reduce the number of personal vehicle trips. LDVs and a large majority of MHD vehicles will be ZEVs. Marine operations and port facilities are envisioned to be 100% electric by 2050. Some segments of hard-to-electrify subsectors, such as aviation, freight rail, and some MHD vehicles are expected to rely on green hydrogen and renewable biofuels (renewable diesel and renewable jet fuel) as needed. A large-scale investment in expanded public transportation and complementary modes of transportation like shared mobility, biking and walking infrastructure, and smart growth (higher density, mixed use development centered around low-carbon transportation options) will help make it easier for New Yorkers to travel without using a personal car. Trips are expected to be shorter, on average, because people will have easier access to jobs, schools, and services. Transportation system investments will reflect community needs and be appropriate for the people they serve.

Achieving this 2050 vision will require a mix of regulatory action and investment to achieve widespread ZEV adoption and additional incentives may be required to retire older internal combustion vehicles. The

expansion of transportation options and smart growth development practices will rely on extensive investments at the state and local level alongside collaborations between state and local authorities to revise land use rules and coordinate on plans that create an integrated system for travelers choosing low-carbon transportation modes. Public-private collaboration and broad industry action are critical to bring the level of investment needed and to ensure New Yorkers have climate friendly transportation options available. Market-based policies will help fund the transition and send appropriate price signals.

Importantly, to achieve the 2050 vision, early action and investment will be needed in the early 2020s to ensure the availability and affordability of the future fuels and technologies, including but not limited to green hydrogen production, delivery, and applications; renewable jet fuel or zero-emission solutions; MHD ZEV engines; and infrastructure to support large-scale electrification including heavy freight solutions.

Existing Sectoral Mitigation Strategies

New York uses less energy per capita for transportation purposes than any state in the nation due in large part to the extensive investment and utilization of public transportation services and compact land use patterns in the State's larger urbanized areas.[113] While these services help the State avoid more than 17 million metric tons of GHG emissions each year, much more needs to be done to meet the Climate Act GHG emission reduction requirements. There are currently over 80,000 EVs on the road in the State and the number is rapidly growing, with sales in the first half of 2021 (approximately 18,000 EVs) exceeding the full-year sales in any previous year.[114]

New York's ongoing strategies to promote the transportation emissions reductions include:

- In 1990, DEC adopted California's Low Emission Vehicle program, requiring all new vehicles sold in the state to meet California emissions standards, which are more stringent than federal standards. The goal of the Low Emission Vehicle program is to reduce emissions of smog-forming pollutants including hydrocarbons, carbon monoxide, and oxides of nitrogen. Reducing engine pollution protects the environment and the health of the state's residents.
- In 2013, the State initiated two major actions in transportation decarbonization programs. First, the State signed the light-duty ZEV memorandum of understanding, which formed the Multi-

[113] US Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=44956

[114] Atlas Public Policy, EValuateNY tool, https://atlaspolicy.com/evaluateny/, accessed October 2021

State ZEV Taskforce, a coalition of states working together to advance the deployment of ZEVs through policy research and marketing campaigns. Second, the State launched Charge NY, a series of initiatives that, over time, grew to include the Drive Clean Rebate program, offering up to $2,000 for EV purchases or leases; the New York State Truck Voucher Incentive program, offering incentives of up to $385,000 for the purchase or lease of electric trucks and buses; the Charge Ready NY program, offering $4,000 per Level 2 charging port; and awareness and educational campaigns.[115]

- In addition to state-level initiatives, many local-level jurisdictions and organizations—including counties, cities, utilities, and ports—are aggressively pursuing climate action and transportation GHG emissions reduction. For example, New York City is a member of the C40 Cities Climate Leadership Group that implemented a 2050 carbon neutrality goal (One NYC 2050 2020) and has already purchased more than 2,000 EVs for its fleet (NYC Sustainability Office 2020).
- To advance light-duty EV adoption, the state launched the Clean Fleets NY program in 2015, which supports deployments of EVs in state government fleets. In 2018, the NYPA launched EVolve NY program, which complements Charge NY 2.0 with an additional $250 million investment in EV charging infrastructure, services, and consumer awareness efforts. In 2019, began a $31 million program to address demand charges for DC fast charging devices, investor-owned utilities began offering a per plug incentive that tapers down over seven years.
- Through the New York Truck Voucher Incentive Program, the State aims to accelerate the deployment of all-electric and alternative fuel trucks and buses in MHD vehicle classes throughout the State. NYSERDA administers the program, which currently offers $53.9 million in funding and uses funds from the Volkswagen settlement overseen by DEC and the Congestion Mitigation and Air Quality Improvement program overseen by the New York State Department of Transportation (DOT). New York also directed Volkswagen funds ($9.9 million) to the New York City Clean Trucks Program, which replaced diesel trucks in New York City industrial business zones that are within defined environmental justice areas.
- In July 2020, New York announced two new sweeping programs. First, New York was one of 15 states to sign a MHD ZEV memorandum of understanding, with the goal of having 30% of MHD vehicle sales be ZEVs by 2030 and 100% by 2050. Second, New York announced a $701 million

[115] The PSC made a declaratory Ruling that it did not have jurisdiction over (1) Charging Stations; (2) the owners or operators of Charging Stations, so long as the owners or operators do not otherwise fall within the Public Service Law's (PSL) definition of "electric corporation;" or (3) the transaction between such owners or operators of Charging Stations and members of the public.

Make-Ready program, through which investor-owned utilities pay up to 100% of the costs of electric facilities necessary to make sites ready for EV charging of 850,000 LDVs by 2025.

- NYSERDA and the electric utilities are required by the EVSE Make-Ready order of 2020 to undertake feasibility studies for MHD fleets, including for school districts & transit agencies, to identify benefits, costs, logistical challenges, financing options, other barriers to electrification. By bearing these soft costs, the state is providing fleet managers with the financial information necessary to make the case for investment in zero emission fleets.
- Clean Air NY is a marketing and outreach program in the New York City metro area sponsored by DOT to educate travelers about the small changes they can make every day in their transportation choices. The goal is to reduce the number of VMT and improve air quality. The year-round program, formerly called Ozone NY, includes Air Quality Action Day notifications, indicating unhealthy levels of particulate matter and/or ozone as forecast by DEC.
- The 2011 New York State Complete Streets Act requires agencies to consider the convenience and mobility of all users, including pedestrians and bicyclists, when developing transportation projects that receive state and federal funding. This initiative presents an opportunity to expand upon existing programs and collaborate with bicyclists, pedestrians, people with disabilities, and others to identify best practices and designs for transportation facilities.
- The State uses federal funding through the Transportation Alternatives Program and the Congestion Mitigation and Air Quality Improvement Program, which is available to state and local governments for zero emission transportation-related projects/programs (active transportation), and projects/programs to help address the requirements of the Clean Air Act.
- Active transportation safety is promoted through projects developed under the state's Pedestrian Safety Action Plan. This five-year, multi-agency initiative provides $110 million to improve safety for pedestrians through infrastructure improvements, public education efforts, and enforcement across upstate and Long Island. The plan calls for a systemic approach to proactively address widespread safety issues and minimize the potential for crashes by implementing low-cost improvements throughout the roadway network.
- The State provides nearly $6 billion in direct and state authorized support for public transportation services, more than 46 other states combined. This support is intended to maintain and enhance service levels; ensure passengers fares are reasonable and equitable; and support environmental/climate and economic goals. Due in large part to downstate transit use, the state's per capita motor fuel consumption is the lowest in the nation.

- New York is also supporting municipally sponsored public transportation services transition to ZEVs through a multi-year funding commitment to provide the incremental cost of procuring all-electric buses.

These ongoing GHG emission mitigation and air quality improvement strategies contributed to New York's transportation sector progress over the last decade. The variety of these current strategies underscores the need to consider a wide range of new and enhanced strategies to further improve air quality and reduce GHG emissions. It will take a variety of strategies working in concert to limit the negative effects of climate change and create a sustainable transportation system in New York that serves all its users.

Key Stakeholders

Key stakeholders responsible for the successful implementation of proposed transportation sector strategies include:

- **Transitioning to ZEVs and equipment:** DEC, NYSERDA, DOT, DPS, New York City Department of Buildings, New York State Department of Motor Vehicles, New York State Office of General Services, DOS, New York State Education Department, NYPA, Dormitory Authority of the State of New York (DASNY), NY Green Bank, PANYNJ, MTA, New York City, utility companies, automotive original equipment manufacturers, EV charging station providers, car and truck dealers, port operators, transit agencies/authorities/municipal sponsors, and the New York Legislature
- **Enhancing public transportation and mobility alternatives:** NYSERDA, DOT, DPS, New York State Office of General Services, DOS, NYPA, MTA, utility companies, bus manufacturers, and transit agencies/authorities/municipal sponsors
- **Reduce VMT:** DEC, NYSERDA, DOT, DPS, DOS, NYSTA, NYPA, ESD, MTA, New York City, New York State Council on the Arts, transit agencies/authorities/municipal sponsors, local governments, companies providing mobility services, major New York employers, and the New York Legislature
- **Market-Based Solutions and Financing:** DEC, NYSERDA, DOT, DPS, New York State Department of Motor Vehicles, New York State Education Department, New York Department of Tax and Finance, NY Green Bank, and local governments

11.2 Key Sector Strategies

The key strategies within this sector are organized into four themes, as shown in Table 9.

Table 9. Transportation Sector Key Strategies by Theme

Theme	Strategies
Transitioning to ZEVs and Equipment	T1. Light-Duty ZEV Adoption T2. Adoption of Zero-Emission Trucks, Buses, and Heavy Equipment
Enhancing Public Transportation and Mobility Alternatives	T3. Community-Based Service Enhancements T4. Customer Convenience and Service Connectivity T5. Fleet Modernization and Electrification
Smart Growth and Mobility-Oriented Development	T6. Mobility-Oriented Development T7. Smart Growth Public Education and Awareness T8. Expanding the Availability of Low-Carbon Active Transportation Alternatives T9. New Technology Integration
Market-Based Solutions and Financing	T10. Transportation Sector Market-Based Policies T11. Unlock Private Financing T12. Lower Carbon Renewable Fuels

Recognizing that there is no one-size-fits-all statewide strategy for effectively reducing emissions from the transportation sector and transitioning to zero-emission technologies, the Council expects many of the strategies necessary to achieve the Climate Act's ambitious requirements and goals will be informed through extensive engagement and outreach with affected communities, with an emphasis on overburdened and LMI areas.

Transitioning to Zero-Emission Vehicles and Equipment

Transitioning the transportation sector to zero-emission technologies is central to achieving the State's GHG emission reduction requirements. In most cases this means replacing existing vehicles that run on gasoline or diesel fuel with either battery electric, hydrogen fuel cell or future zero-emission propulsion technologies. Other advanced clean fuels will play a role in decarbonizing hard-to-electrify segments of the transportation sector.

On September 8, 2021 Governor Kathy Hochul signed legislation establishing a goal for all new LDVs and off-road vehicles sold in the State to be zero-emission by 2035 and all new MHD vehicles to be zero-

emissions by 2045.[116] To help meet the State's Climate Act requirements and goals, New York should take regulatory and programmatic actions to achieve these goals. The strategies proposed aim for an even more rapid transition to ZEVs, achieving close to 100% ZEV sales for LDVs by 2030, 50% ZEV sales of medium-duty vehicles by 2030, and 80% ZEV sales of heavy-duty vehicles by 2035, which the integration analysis indicates will position the state to meeting the Climate Act requirements.

The strategies to achieve these goals involve expanding light-duty ZEV adoption and converting trucks, buses and other MHD vehicles to ZEVs.

T1. Light-Duty Zero Emission Vehicle Adoption

There are approximately 9 million LDVs in New York, which make the emissions from LDVs the largest component of transportation emissions.[117] Since 2010, sales of light-duty ZEVs have increased and in 2021 account for more than 3% of all LDV sales and about 1% of all LDVs on the road. Light-duty ZEVs have come down in price compared to their petroleum-fueled counterparts but are still comparatively more expensive; they are expected to reach price parity from a total cost of ownership perspective in the next two to four years and from a purchase price perspective later in the 2020s. Most light-duty ZEVs are expected to be battery electric, but hydrogen fuel cell vehicles are emerging into this market as well. A key challenge is that most of these vehicles are owned by individuals, who will each have to make their own purchase decisions if the State is to meet its Climate Act requirements and goals. Achieving the aggressive transition in this market will require a mix of regulations, incentives (which will require identifying new sources of funding), and removal of market barriers and depends on industry greatly accelerating the expansion of production capacity for these vehicles. Incentives for EVs and charging stations are expected to be needed primarily over the next five to ten years, as the market for ZEVs reaches maturity. Enhanced incentives for LMI consumers will help achieve the air quality benefits of these vehicles in disadvantaged communities. Incentives for hydrogen fuel cell vehicles may be needed for longer, as they are expected to take longer to enter the market in significant quantities.

The CJWG enthusiastically encourages a rapid transition to ZEVs, although it cautioned that focusing on providing access to transit and lower-cost options for transportation, rather than just personal vehicles, is critical for LMI New Yorkers. The CJWG also expressed concern about investment in EVs leaving the State. Of course, most of the billions of dollars that New Yorkers spend on petroleum-based fuels each

[116] Chapter 423 of the Laws of 2021.

[117] Atlas Public Policy, EValuateNY tool, https://atlaspolicy.com/evaluateny/, accessed October 2021

year leaves New York; accordingly, the State should continue supporting the development of businesses in the ZEV supply chain to ensure that the ZEV transition is economic benefits the state's residents economically.

Components of the Strategy

- **Adopt California's Advanced Clean Cars 2 Regulations:** California is currently developing the Advanced Clean Cars 2 regulations that are expected to require 100% light-duty ZEV sales by 2035. DEC should adopt these regulations once they are finalized in California. California is also pushing to electrify for-hire vehicles through a clean-miles standard, which the State could also adopt or take other approaches to electrifying these vehicles, such as providing targeted incentives for fleet ZEV purchases and charging/fueling stations.
- **Provide enhanced ZEV purchase incentives:** ZEVs are approaching price parity with petroleum-fueled vehicles and the price of battery EVs is expected to eventually fall below that of their petroleum equivalents. Offering strategic incentives will accelerate ZEV production, price parity, and purchases. New York should enact legislation to establish a "feebate" program that would offer direct rebates for ZEV purchases supported by imposing a fee on purchases of fossil fuel vehicles. The fee and rebate levels should be dynamic in response to market conditions and ambition levels. Such a program can be designed to be revenue-neutral and can incorporate other policy goals, such as higher rebates for LMI customers and exemptions from the fee for lower-priced vehicles purchased largely by LMI consumers. Feebates should be applied to new car sales, but there should be an additional rebate for used ZEVs targeted toward LMI customers, which could be paired with affordable financing options. Although each scenario under consideration relies heavily on LDV electrification, the two scenarios that rely more heavily on expedited electrification will require the establishment of additional incentives to retire internal combustion vehicles early.
- **Enhance ZEV awareness and reduce sales barriers:** New York should enact legislation to expand direct-to-consumer sales of ZEVs by manufacturers, which can serve to increase the availability and sales of ZEVs in the state; the State should provide dealer incentives for franchise car dealers to sell ZEVs; and NYSERDA should partner with industry participants and stakeholders to fund consumer engagement activities to increase consumer interest in ZEVs.
- **Invest in and remove barriers for ZEV charging and fueling infrastructure:** To support the level of ZEV adoption anticipated by 2030, New York must quickly increase the number of EV charging stations and hydrogen filling stations in the State. New York should fund rebates or investment in EV charging stations and hydrogen filling stations, either directly through programs

run by NYSERDA and/or NYPA or through market-based mechanisms like a clean fuel standard that would generate resources for ZEV infrastructure. As part of the State's focus on investments in Disadvantaged Communities, programs in this area should focus on charging at multi-unit dwellings, fast charging and hydrogen fueling stations, and market segments that have been slow to attract private investment. DOS should incorporate EV charging into building codes to ensure new construction is EV-ready.

- **Enact utility rate design changes:** The PSC should direct utilities, as appropriate, to implement programs that offer lower rates for or otherwise encourage off-peak charging and/or controlled, managed charging. The PSC should further examine the effectiveness of its per plug incentive program to determine if it offers sufficient opportunities to reduce operating costs that support the near-term build-out of public and fleet charging infrastructure to make this type of charging more cost effective when utilization is low or whether a change should be considered in the structure of demand chargers that is cost-based and nondiscriminatory. These changes will be relevant to both LDVs and MHD vehicles.

T2. Adoption of Zero-Emission Trucks, Buses, and Heavy Equipment

Converting New York's trucks, buses, and heavy equipment (including construction and farm equipment) to zero-emissions technologies plays a dual role of both reducing GHG emissions from a major source and reducing local air pollution from one of the most significant sources of poor air quality and adverse health impacts. Trucks and buses and off-road equipment are just starting to transition from diesel fuel to electricity as more options become available, but electric trucks, buses, and equipment are still much more expensive than their diesel counterparts. The transition to ZEVs for this subsector will entail a mix of battery electric and hydrogen fuel cell vehicles, which are just beginning to emerge into the market. Achieving the aggressive transition in this market will require a mix of regulations, incentives (which will require identifying new sources of funding), and removal of market barriers and depends on industry greatly accelerating the expansion of production capacity for these vehicles. Incentives for EVs and charging stations are expected to be needed primarily over the next ten to 15 years, as the market for ZEVs reaches maturity. Incentives for hydrogen fuel cell vehicles may be needed for longer, as they are expected to take longer to enter the market in significant quantities.

Diesel trucks and port equipment are one of the largest sources of local air pollution in Disadvantaged Communities. Although they comprise only a small portion of total vehicles in the State, diesel trucks and buses are responsible for 30% of total particulate matter and NO_X emissions from mobile sources.

Replacing diesel trucks and port equipment with ZEV trucks and equipment would have a substantial impact on improving air quality statewide, especially in Disadvantaged Communities.

The CJWG enthusiastically encourages a rapid transition to ZEVs, especially for MHD vehicles. Consistent with CJWG input, this plan prioritizes MHD ZEV incentives in air pollution-overburdened communities and an accelerated transition of the state's fleet vehicles to ZEVs.

Components of the Strategy

- **Adopt California's Advanced Clean Trucks regulations:** In 2020 California promulgated the Advanced Clean Trucks regulations that require an increasing percentage of new zero-emission MHD truck sales annually through 2035. In September 2021, DEC proposed to adopt the Advanced Clean Trucks regulation under 6 NYCRR Parts 200 and 218.[118] In accordance with the legislation signed by Governor Hochul, DEC should finalize the adoption of these regulations. DEC should also consider adopting additional regulations, such as California's proposed Advanced Clean Fleets regulation currently under development, that would provide a regulatory framework for 100% MHD ZEV sales by 2045 or earlier (e.g., Advanced Clean Fleets would require 100% MHD ZEV sales by 2040). These regulations could be targeted to the type of fleets operating in overburdened communities and, like California, exclude smaller fleets largely operated by small businesses.
- **Provide enhanced ZEV purchase incentives:** ZEV trucks, buses, and off-road vehicles are significantly more expensive than diesel equivalents today. While the cost of ownership is becoming more cost-competitive, targeted incentives will be needed to facilitate the transition to emerging ZEV technologies. The state should fund direct incentives supporting the purchase of ZEV trucks and buses, with a focus on fleets operating in LMI and overburdened communities, small fleets, and school buses as well as off-road vehicles and equipment such as airport ground support equipment, port cargo handling equipment, construction, and farm equipment. The state should also provide incentives or offer buybacks for small engines, including electric yard and garden equipment and small marine vessels, and encourage local electrification requirements.
- **Require ZEV equipment use for state fleet and contractors and at targeted facilities:** To further encourage ZEV adoption, New York should enact legislation that establishes procurement and contracting rules to increase the percentage of zero-emission equipment and vehicles in

[118] https://dos.ny.gov/system/files/documents/2021/09/090821.pdf

government fleets and used for state-funded projects to be ZEVs (including contractors and subcontractors), based on production and availability. DEC should also adopt regulations similar to California's Advanced Clean Fleets proposal that require MHD trucks in use at, or accessing, certain types of facilities such as ports or intermodal railyards to be ZEVs by a set date. The date should be determined based on truck vocation, product, and related infrastructure availability.

- **Invest in ZEV charging or fueling infrastructure:** Similar to LDV infrastructure, the State should provide rebates or direct investment in EV charging stations and hydrogen filling stations, where market support is needed. Preference for investments would be provided to fleets adversely impacting LMI communities that have been disproportionately burdened by the impacts of air pollution. DPS should continue to work with the utilities to plan for expected service levels needed to support the electrification of MHD fleets, especially in Disadvantaged Communities where such depots tend to cluster.

Enhancing Public Transportation and Mobility Alternatives

One of the more impactful supporting strategies for achieving the Climate Act's energy efficiency, housing, and land use GHG emission reduction requirements is through enhancing the availability, accessibility, reliability, and affordability of public transportation services with an emphasis on unserved and underserved communities. The strategies to achieve these goals involve service enhancements, MOD, convenience and connectivity, and fleet modernization. For the purposes of the scoping discussion, public transportation includes but is not limited to transit, micro-transit, shared mobility, and longer distance passenger rail services.

T3. Community-Based Service Enhancements

MTA enhancements will focus on policies and programs that support system reliability, resilience, and network expansion projects identified in their current five-year capital plan/twenty-year needs study. Recognizing that the service needs of communities will vary statewide, enhancements are intended to be locally derived and tailored to achieve the maximum utilization and GHG emission reductions. This may include but not be limited to increasing the number of routes, increasing service frequency, increasing the number of scheduled stops to facilitate last mile connectivity, introducing demand response services, partnering with mobility providers, providing direct connectivity to longer-distance bus and passenger rail services, or a combination of these and other service modifications. Providing and expanding access to public transportation in the context of business location and economic development will help provide access to jobs and reduce the time and expense to commute to places of employment.

Feedback from the CJWG included the need to provide more detail on what specific public transportation enhancement were proposed and how enhancements would be identified and accomplished. As detailed below, these issues are intended to be addressed through context appropriate community-based discussions. The CJWG emphasized the need to think beyond traditional urban public transit and enhance inter-regional rail transportation.

Downstate services provided by municipalities other than the MTA is defined as services provided, directly or under contract by municipalities in the Metropolitan Commuter Transportation District as designated in Section 1262 of Public Authorities Law.

Components of the Strategy

- **Identify, Plan, and Implement Service Enhancements:** The State should work with communities and service providers to design strategies that increase utilization of public transportation alternatives. Public transportation service enhancements are intended to be further informed through community-based discussions. For example, availability/accessibility may refer to an increase of service hours/frequency; an increase in routes; and/or an increase in the number of stops along a route. It is anticipated that a combination of approaches will be required in most communities.

In addition to state agencies identified as key stakeholders for the transportation sector, others responsible for the implementation of these strategies include the federal departments of Transportation, Housing and Urban Development, Energy, and the EPA.

T4. Customer Convenience and Service Connectivity

In addition to providing high-quality amenities at public transportation facilities/stops, including sidewalks, seating, lighting, electronic customer information (next-bus); the state should assess ways to implement strategies for making public transportation easier to use and more competitive on a travel time basis, including simplified and integrated fare media; dedicated bus lanes and intelligent transportation/bus signal prioritization; and deploying new phone-based applications technologies that makes public transportation more logical/easier to understand. These enhancements will facilitate increased use of public transportation in support of the goal of reducing VMT. Current efforts underway in the state to enhance convenience and connectivity include the implementation of micro-mobility services in the Capital Region; the realignment of services to support jobs and job training in the Finger Lakes Region; and the deployment of new integrated service, trip planning, and fare payment apps in the Southern Tier Region.

The CJWG supported increased investments in enhanced public transportation alternatives and noted that doing so creates jobs in local communities offering employment opportunity for disadvantaged workers. In addition, the CJWG suggested to incentivize hiring of disadvantaged workers in transit manufacturing by enabling companies to get a credit for setting aside a certain proportion of their workforce for hiring them.

Components of the Strategy

- **Improve Public Transportation Ease of Use:** The State should facilitate development/ implementation of strategies for making public transportation easier to use, this includes working with the public and private sector on a simplified and integrated statewide fare media and deploying new phone-based applications technologies that makes public transportation more logical/easier to navigate.

T5. Fleet Modernization and Electrification

Recognizing that bus maintenance/service facilities are historically more likely to have been located near or within LMI communities, the state is committed to accelerating the deployment of zero-emission buses, which will mitigate GHG emissions and noise pollution. As part of this transition, the state will support electrification of buses and other service vehicles appropriate for the communities being served.

The CJWG requested more detail to confirm what "make ready costs" include. As described below, the term "make ready costs" in this context is intended to describe the utility infrastructure costs associated with bringing the power needed/building modifications to bus support facilities to facilitate electric bus charging.

Components of the Strategy

- **Transition to Zero Emission Public Transportation Fleets:** The State should work with municipally-sponsored public transportation systems on a plan to transition to all-electric/zero-emission public transportation vehicles at defined replacement schedules appropriate for the transit provider.
- The State has already taken action to implement this strategy by
    - Committing more than $100 million toward the electrification of 25% of the five largest fleets, outside the MTA, by 2025 and 100% by 2035. MTA has committed to purchase only electric buses after 2029 and to fully electrify its fleet by 2040.

- Directing a significant portion of $45 million in funding available through the Volkswagen Settlement Funds to assist public transportation providers with the replacement of existing diesel buses with more than 100 all-electric transit buses.
- Expanding Charge Ready NY incentives for disadvantaged communities and enhancing options for electric transit bus procurements.
- Supporting the deployment of all electric transit buses through the New York Truck Voucher Incentive Program (NYTVIP).
- Improving electric fleet economics for developers by supporting the "Make-Ready" program, which promotes EV charging station deployment.

Barriers to implementation include funding as well as federal "payback" if vehicles financed with federal funds are replaced prior to the end of the Federal Transit Administration–rated service life.

In addition to state agencies identified as Key Stakeholder in Section 11.1, others responsible for the implementation of these strategies include the United States Department of Transportation and the municipal owners of the vehicles and infrastructure.

Smart Growth and Mobility-Oriented Development

Smart growth land use patterns facilitate reductions in GHG emissions in the transportation sector by reducing VMT, increasing the viability and practicality of low-carbon transportation modes, and decreasing the travel distance between locations through a denser concentration and mix of residential and commercial development. Personal travel is often enhanced by the increased availability of mobility alternatives, including walking, biking, and public transportation. Taking a holistic approach to community development and MOD can help expand transportation options and economic opportunity. Strategies like MOD and expanded mobility options reduce the environmental footprint of transportation on communities and provide increased access to existing services such as healthcare, retail, hospitality, and entertainment while attracting new services, and can be designed to encourage mobility-rich affordable neighborhoods.

Smart growth strategies to reduce transportation GHG emissions fall within four categories: MOD, public education and awareness, expanding the availability of low-carbon transportation alternatives, and new technology integration. A broader set of smart growth strategies and recommendations are contained within Chapter 19 (Land Use).

T6. Mobility-Oriented Development

To reach GHG emissions reduction requirements, the State should place greater emphasis on programs and projects that that enable greater use of public transportation and other low-carbon mobility alternatives and investments that are informed by criteria that maximize sustainable land use/development patterns and climate outcomes. Because smart growth and new development happens over decades, starting as early as possible is important. Strong collaboration between the state and local governments is critical for these strategies to be effective, as most land use decisions fall under the purview of local governments. These strategies may not be applicable in every community, but many different variations on MOD are possible in communities of different sizes.

The CJWG has been supportive of the expansion of low-cost transportation options accessible to underserved communities, a key element of MOD.

While the State currently incorporates public transportation needs into efforts to attract and retain businesses, New York should implement incentives and policies for businesses and localities for development located adjacent to and integrated into public transportation services, including tax credits for businesses that accommodate non-vehicular commuting, such as Employee-Based Trip Reduction programs; low-/no-cost transit passes for employees; micro-transit options for employees; ride-sharing programs; bike-sharing; and cycling accommodations.

Examples of integrated supportive policies and incentives to facilitate MOD include:

- **Capital District Transportation Authority:** Recognizing that there is no one size fits all mobility solution, working with the communities that make up the multi-county transportation district, Capital District Transportation Authority has implemented an innovative and diversified range of mobility alternatives, including several high frequency/high quality bus rapid transit lines; regional ride-matching; bicycle and electric scooter sharing; and micro-transit services. The goal is to support rezoning and development that is occurring within the central business districts of Albany and Troy and to promote sustainability and environmental stewardship.
- **MTA/Developer Collaboration on One Vanderbilt Development Project (adjacent to Penn Station):** MTA worked with City Zoning and the developer early to secure transit access improvements (such as easements, stairways, and elevators) at the developer's expense in exchange for added density.
- **Niagara Frontier Transportation Authority Metro Amherst Extension:** The Niagara Frontier Transportation Authority and Town of Amherst planners are developing proposed plans and zoning to promote both TOD and MOD along the proposed extension of the City's Metro light rail system into the town.

Components of the Strategy

- **Coordinate investments in MOD:** New York should establish an inter-agency, multi-stakeholder, multi-disciplinary strategy to coordinate investments in and around mobility centers, which should include DOS, DOT, ESD, DASNY, DEC, NYSERDA, and other relevant agencies.
- **Tie incentives for business development to mobility access:** ESD should expand and institutionalize its initiatives to incorporate public transportation needs into efforts to attract and retain businesses. This includes implementing incentives and policies for developments that are located adjacent to and integrated into public transportation services, including incentives for businesses to accommodate non-vehicular commuting, such as employee-based trip reduction programs; low-/no-cost transit passes for employees; micro-transit options for employees; ride-sharing programs; bike-sharing and scooter-sharing; and cycling accommodations.

- **Revise design manuals:** To further guide MOD, DOS should facilitate, in cooperation with municipalities, the reimagining of the design manual used by local governments and developers for the construction of buildings, roadways, parking, and bicycle and pedestrian amenities. This updated manual should address both public infrastructure and buildings and how they can be designed to support clean transportation options. DOS should support municipalities in eliminating or reducing parking minimums and maximizing access to other mobility alternatives.

Examples of such incentives currently in place include:

- **Onondaga Industrial Development Authority:** Developers seeking tax credits receive preference for proposals that incorporate transit-accessibility into their proposals. If a development requires transit service, they must address the issue in their proposal before submitting a request for a tax incentive.
- **Buffalo Green Code's Transit-Supportive Development Incentives:** The City's form-based code will grant a "zero-parking" waiver to projects that meet the criteria for being "transit-supportive," developers must also submit transportation demand management plans to qualify.

- **Designate priority development areas:** DOS and ESD should designate priority development areas to concentrate development and make it easier to build in areas that facilitate low-carbon transportation modes. Development incentives should focus on building transportation-related infrastructure in these areas. Such an initiative would provide the greatest climate and public health benefits when combined with other Climate Act strategies, including housing and power generation. Additionally, such an effort should consider and not conflict with New York State Homes and Community Renewal (HCR) Well-Resourced areas.

T7. Smart Growth Public Education and Awareness

Public perception is critical to understanding and expanding smart growth. There are common misperceptions about its principles and their effects on municipalities, particularly density, mixed-uses, mixed income/affordable housing, and sometimes transit itself. Helping the public understand the benefits of smart growth and public transportation to the climate, energy, socioeconomic equity, fiscal, economic, and public health removes some of the many barriers to successfully completing these projects. Emphasizing the links between transportation investments (particularly public transportation) and land

use and development outcomes, particularly as it relates to socioeconomic equity, will help generate support for these measures.

The CJWG has been supportive of smart growth and the many benefits that flow from this strategy. The CJWG, along with the Council, recognizes that these types of projects require community buy-in, which only comes through greater public education and awareness.

Components of the Strategy

- **Define benefits of smart growth:** DOS and DOT should produce research and materials that demonstrate the links between planning and transportation in New York, including impacts on local finances and equity. This will include developing fiscal impact analyses of smart growth compared with sprawl, regarding both public infrastructure investments for each and tax revenues generated. The agencies should also conduct additional analysis on the equity impacts of Smart Growth and ways to increase affordability of smart growth developments.
- **Conduct public education campaign:** Led by DOS, the State should develop and launch an expansive, multi-dimensional, grass-roots public education campaign on the links between smart growth, transportation, transit, and housing; their roles in reversing climate change; best practices for sustainable smart growth actions at the local level; and the many benefits of smart growth. These materials will be developed in concert an on-line, iterative, interactive Sustainable Development Handbook.

T8. Expanding the Availability of Low-Carbon Transportation Alternatives

MOD and priority development areas are highly dependent upon the availability of low- and zero-emission transportation alternatives to complete the first mile/last mile of trips. This includes prioritizing the availability of safe and accessible pedestrian and bicycle amenities, high quality and frequent transit, and mobility-on-demand services. As part of future investments, agencies and authorities should be required to prioritize low- and zero-emission transportation infrastructure in all activities, where feasible.

The technology surrounding low- and zero-emission first-mile/last-mile mobility will help guide individual choice. As such, the state should facilitate the development and deployment of apps to make mobility alternatives and multi-modal trips more attractive, accessible, and user-friendly.

The CJWG has been supportive of the expansion of low-cost transportation options accessible to underserved communities, a key element of this strategy.

Components of the Strategy

- **Update the Smart Growth Public Infrastructure Policy Act:** The State should enact legislation to amend and strengthen the state's Smart Growth Public Infrastructure Policy Act (ECL, Article 6) to more effectively avoid new state infrastructure spending that would promote sprawl and define and prioritize priority development areas, such as TOD. This is discussed further in Chapter 19 (Land Use).
- **Fund low-emission zones and car-free streets:** The State should prioritize investments in local projects that establish low-emission transportation zones, car-free streets, and similar concepts that encourage travelers to take alternative transportation modes and support the infrastructure required to shift freight to lower-emission modes, like rail, cargo bikes, and electric trucks
- **Fund mobility options:** The State and metropolitan planning organizations (MPOs) should prioritize, incentivize, and expand access to funding for bike, pedestrian, transit, and complete streets projects that serve employment and population centers.
- **Expand partnerships with businesses:** ESD should encourage businesses seeking economic development incentives (local or state) to consult transit agencies early when seeking to locate or expand in areas with existing multi-modal options and to provide services for employees (employee-based trip reduction programs, transit/micro-transit services, ridesharing, bike-sharing, cycling accommodations, free/reduced transit passes). DOS and DOT should provide technical assistance to these businesses and New York should offer local and state tax credits for businesses that accommodate employee public transportation and transportation demand management alternatives and for employees who use alternative mobility options.

T9. New Technology Integration

New mobility solutions also require a rethinking of the technology people use to travel and access transportation services. Emerging technologies like automated vehicles (AVs), shared mobility services, and Internet-of-Things (IoT)–enabled infrastructure could be used to reduce energy use and emissions from transportation if used in a coordinated and constructive manner. Setting the right rules for technology and data use and investing in demonstrating technologies that enable low-carbon modes of transportation can help enable equitable, clean transportation solutions.

Components of the Strategy

- **Support intelligent transportation systems (ITS) and AVs that save energy:** NYSERDA should invest in RD&D and demonstrations of emerging ITS, connected vehicles and AVs, and

fund the broader adoption of technologies that prove effective in improving transportation system efficiency, such as smart parking systems, adaptive traffic lights, IoT-enabled streetlights. New York should enact policies discouraging "empty" AV miles traveled and requiring AVs used as for-hire vehicles to be ZEVs.

- **Make data accessible and secure:** DOT, New York State Thruway, and ITS should support the adoption of open-source technologies and standard data collection protocols for transportation data and connected infrastructure. ITS should convene an interagency group to develop strategies to combat cybersecurity risks associated with new transportation technologies, such as AVs and EV charging.
- **Enable user-friendly apps through data sharing with transit operators:** MTA and other transit operators should facilitate the development of electronic mobility platforms offering seamless multi-modal trip planning and payment options to make public transportation more attractive, accessible, and user-friendly.

Market-Based Solutions and Financing

The strategies and policies referenced in this Chapter for decarbonizing the transportation sector will require substantial private and public investment. These investments should be facilitated, in part, through market-based and other supportive policies that generate resources necessary to implement investments required to achieve the Climate Act requirements and goals. Some of the recommended policies animate the flow of private capital while others provide a source of public funding. These policies can also provide a market-signal encouraging private action that reduces emissions, from increased use of public transportation to purchase of lower-emitting vehicles. The strategies to achieve these goals include transportation sector market-based policies, unlocking private financing, and developing a clean fuel standard.

T10. Transportation Sector Market-Based Policies

Market-based policies focused solely on the transportation sector can provide the dual benefits of discouraging more costly carbon-intensive behavior and providing a revenue source for investment in other strategies. One such policy in the development process is the implementation of congestion pricing in the Manhattan Central Business District. Congestion pricing, which reduces emissions by pricing driving and, through a system of variable tolling, provides a funding source for enhancements in the region's low carbon public transportation system. Other market-based policies recommended for adoption are described below.

Two policy mechanisms, cap-and-invest and carbon pricing, can be adopted by sectoral or economy-wide policies. Numerous stakeholders throughout the Scoping Plan development process have recommended participation in the multi-jurisdiction policy for low-carbon transportation by adopting the TCI cap-and-invest program.

Other stakeholders, including members of the CJWG, oppose participation in TCI program, recommending instead proposed legislation that would adopt an economy-wide carbon price. Given the multi-sector implications, these potential policies are addressed along with other economy-wide market-based approaches in Chapter 17 (Economy-Wide Strategies).

Components of the Strategy

- **Variable Pricing/Parking Policies:** Similar to congestion pricing, these policies discourage driving into and parking in central cities through a system of fees, the collection of which can be used to support alternatives to driving such as public transportation and cycling infrastructure. Pricing policies could include variable fees that discourage parking at peak times or demand parking policies, which limit parking to certain users or vehicles, including ZEVs. Generally, these policies would be adopted by municipalities, but the State can play a supportive role through, for example, development of model code language.
- **Vehicle Registration Fees:** The State should enact legislation establishing a system of registration fees that would discourage the purchase and continued use of more-carbon intensive vehicles. These fees would vary based on emissions or attributes related to emissions such as a vehicle's weight and/or drive train. If accompanied by incentives for lower-emitting vehicles, this approach would resemble the feebate program discussed above under the ZEV strategies.
- **Mileage-Based User Fees:** The State should enact legislation to establish a per mile fee system to fund investment in transportation infrastructure. This system would reduce emissions by discouraging driving, although consumers are generally quite price insensitive to such systems. Thus, although mileage-based users fees could effectively replace declining gas tax revenues, they may not have a significant impact on incentivizing ZEVs or lowering emissions.
- **Tax Increment Financing/Special Assessment Districts:** Municipally adopted special assessment districts provide a mechanism to finance public transportation investments. For example, New York City funded investment in the extension of the 7-Line with assessments on properties in the Hudson Yards redevelopment project.

T11. Unlock Private Financing

The use of EVs yields substantial savings in fuel consumption and reduced maintenance over the life of the vehicles. Analyses indicate that the total cost of ownership of ZEVs, both LDVs and MHD vehicles, is nearing parity, which will be achieved across all vehicle classifications by the end of this decade. But the higher initial cost of ZEVs presents an obstacle to purchasers unable or unwilling to bear the higher initial cost to reap savings in the longer term.

The CJWG is supportive of measures to accelerate truck and bus electrification and provide financing opportunities to those who generally lack access to affordable capital, which is the focus of this strategy.

Components of the Strategy

Several financial strategies can be utilized to reduce the obstacles posed by the higher initial cost:

- **Establish a First Loss Protection product based on existing financial market instruments and practice:** The purchase of ZEVs can be facilitated by increasing the availability of low-cost capital/bank loans to fund the higher upfront costs of commercial ZEVs. One area of uncertainty that inhibits banks and other financial institutions from financing the purchase of ZEVs, however, is uncertainty about the residual value of the vehicles being purchased. New York should identify a state agency or authority to guarantee at least a portion of the residual value of the ZEVs being financed at the end of the loan term (such as First Loss Protection). Providing that certainty will help unlock the lowest cost private financing needed, further reducing upfront costs to enable the purchase of ZEVs in place of fossil fuel-powered vehicles.
- **Offer fleet feasibility studies**: NYSERDA and the electric utilities should undertake feasibility studies for MHD fleets, including school districts & transit agencies, to identify benefits, costs, logistical challenges, financing options, other barriers to electrification. By bearing these soft costs, the state should provide fleet managers with the financial information necessary to make the case for investment in zero emission fleets.
- **Expand NY Green Bank's mission:** The State should enable the NY Green Bank to take on different types of investment opportunities in defined categories of electrification financing, potentially including EV charging infrastructure as well as fleets.

T12. Lower Carbon Renewable Fuels

The strategies described above will reduce the State's reliance on fossil fuels for transportation as expeditiously as possible. For harder to electrify vehicles and equipment, the scenarios identified for

meeting the Climate Act GHG emission reduction requirements rely, in part, on the increased use of lower carbon renewable fuels, including renewable diesel, renewable jet fuel, and/or green hydrogen. Given the service life of current vehicles and equipment under the most aggressive scenarios identified for transitioning to zero-emission technologies, fossil fuels are expected to constitute most of the fuel mix until the mid- or late 2030s. Substituting sustainable renewable fuels for a portion of this remaining fossil fuel combustion will reduce GHGs and other emissions.

The CJWG opposed policies supporting renewable fuels on the grounds that they still release harmful air pollutants, particularly in areas overburdened with diesel emissions, and that the State should focus instead on expeditiously electrifying vehicles and the use of hydrogen fuel cells. Because this Plan expedites electrification as much as reasonably feasible, any GHG emission reductions from the use of renewable fuels are in addition to the emission reductions from accelerated electrification. Although the CJWG is correct that renewable fuels still emit air pollutants, some renewable fuels have lower emissions of particulate matter.

Components of the Strategy

- **Clean Fuel Standard:** The State should enact enabling legislation directing DEC to adopt a clean fuel standard. A clean fuel standard would facilitate decarbonization of transportation fuels by requiring the providers of fossil fuels to reduce the carbon content of the fuels they provide by either blending lower carbon fuels or by acquiring credits from providers of lower-carbon fuels into the stream of commerce. Since electricity in the state is an increasingly low carbon fuel, a clean fuel standard will support decarbonization as petroleum fuel providers finance the use of electricity for transportation use. DEC should structure the clean fuel standard to reward public transportation providers statewide for emission reductions from electrified transit, providing them with resources to accelerate zero-emission rollingstock and infrastructure enhancements. Legislation could be structured to allow aviation fuels to voluntarily opt into the program, reducing emissions in this difficult-to-electrify subsector. Decisions regarding the carbon intensity of alternative fuels will provide market signals that promote the use of those fuels that have a lower fuel cycle carbon intensity.
- **Clean Fuel Infrastructure**: The State should fund incentives for infrastructure for cleaner fuels, such as green hydrogen, where market support is needed.

Chapter 12. Buildings

12.1 State of the Sector

Overview

New York's residential and commercial buildings sector encompasses over 6 million buildings, which are home to 7.4 million households and encompass over 5 billion square feet of commercial and institutional space where New Yorker's work, learn, gather, and access essential services. The State's large geography, varied climate, and vibrant economy drives a diverse buildings mix. New York City and the downstate region are characterized by a mixed-humid climate zone (Climate Zone 4), higher cost of real estate, a high proportion of multifamily housing and leased space, and predominantly urban areas with taller buildings. The upstate region is characterized by colder climates (Climate Zones 5 and 6) which are both cool and humid, lower cost of real estate, smaller cities and towns with more suburban and rural areas, and predominantly low-rise buildings. Statewide, New York's residential and commercial buildings are older than the national average, pointing to opportunities for upgrading buildings in ways that improve both quality of life and energy performance. Additionally, nearly half (48%) of households statewide are LMI households, underscoring the importance of careful attention to housing and energy affordability.

Residential and commercial buildings use energy for HVAC, water heating, lighting, refrigeration, cooking, computer and office equipment, and other small appliances. Direct GHG emissions from the buildings sector come from burning fossil fuels onsite in residential and commercial buildings – primarily for space and water heating–and associated upstream emissions.

Emissions Overview

The buildings sector was the largest source of emissions in 2019, responsible for 32% of emissions statewide, which includes the combustion of fossil fuels in residential (34%) and commercial buildings (19%), emissions from imported fuels (33%), and HFCs released from building equipment and foam insulation (14%). The fuels used in buildings today include natural gas, distillate fuel (heating fuel #2), wood, propane, kerosene, and residual fuel.

Decarbonizing building operations describes the elimination of GHG emissions from building end-uses through improving the building envelope and switching from equipment and systems powered by burning gas, oil, or other fossil fuels to highly efficient equipment and systems powered by emissions-free energy sources. Specifically, electrification of space and water heating with high efficiency heat pumps is a viable, cost-effective approach to decarbonization for nearly all buildings in New York. The Integration Analysis indicates that electrifying over 90% of building space statewide by 2050 is the scale of transformation needed to meet the Climate Act requirements. This approach depends upon 100% zero-

emissions electricity by 2040 and making energy efficiency improvements in all buildings, with the emphasis on improvements to building envelopes (air sealing, insulation, and replacing poorly performing windows) to reduce energy demand by 30% to 50%. Smart controls and load flexibility also are important to minimize the impact of large-scale building electrification on the State's electric grid. In addition, embodied carbon associated with building construction can be reduced through building reuse and through using lower carbon materials or carbon-sequestering products.

Vision for 2030

By 2030, one to two million energy efficient homes should be electrified with heat pumps; and heat pumps should provide space heating and cooling for ten to twenty percent of commercial space statewide. Heat pumps should become the majority of new purchases for space and water heating by the late 2020s. More than 250,000 New York homes and thousands more commercial buildings each year are expected to be retrofitted or constructed to be all-electric and energy efficient, which is more than a ten-fold increase from the roughly 20,000 homes that adopted a heat pump as the primary heating and cooling system in 2020. To achieve this dramatic growth, New York State should invest in a significant scale-up of financial support for energy-efficient building envelope upgrades and electric heat pumps, with priorities afforded to disadvantaged communities. State codes should require new construction to be highly efficient, all-electric, and resilient to the effects of climate change. State regulations should be in place to phase out fossil fuel use in existing buildings by requiring zero emissions equipment and appliances at the time of replacement and by setting energy efficiency performance standards for large existing buildings. Regulations will send a clear policy signal, with compliance dates that allow regulated entities to plan and build capacity while regulators protect low-income households from cost burdens. Support for job growth and training in electrification and energy efficiency services provides both new and incumbent workers with opportunities in the clean energy economy, with tens of thousands of new jobs in energy efficiency and clean energy industries to retrofit millions of buildings. Throughout this transformation and through the strategies in this Plan, LMI households and frontline communities will be protected from displacement and threats to affordability.

Vision for 2050

By 2050, 85 percent of homes and commercial building space statewide should be electrified with energy efficient heat pumps. New York should have advanced a managed, phased, and just transition from reliance on fossil gas and the gas distribution system in buildings to a clean energy system (see Chapter #19). Embedded subsidies for fossil fuels have been eliminated, and energy efficient, zero emissions buildings are the most cost-effective option in a clean energy economy supporting secure jobs and

demonstrating leadership in innovation. Investments in research and development have brought affordable batteries, grid-interactivity, ultra-low GWP refrigerants, and advanced technical solutions for the hardest-to-electrify building types to market. All New Yorkers benefit from a just transition that supports vibrant, healthy communities and repairs structural inequalities including unequal access to housing, credit, economic opportunities, environmental resources, and a clean and healthy environment.

Existing Sectoral Mitigation Strategies

Catalyzing energy efficiency and electrification of space and water heating in buildings is a pillar of New York's climate and equity agenda. The New Efficiency: New York strategy demonstrates the State's commitment to reducing energy waste, fossil fuel use, and GHG emissions in the buildings sector – and to doing so in a manner that advances equity, creates clean energy jobs in communities statewide, supports energy affordability, prioritizes benefits to disadvantaged communities, and expands access to comfortable, healthy, and energy-efficient homes and businesses. New York invests over $1 billion in public funds annually for state and utility-administered grant and market development programs focused on energy efficient buildings. This includes a coordinated, statewide framework to benefit LMI New Yorkers and the launch of the New York State Clean Heat initiative. The State's clean energy workforce training initiative helps to equip the current and future workforce while increasing industry diversity and job opportunities in line with a just transition. Another long-standing priority is catalyzing innovation and bringing leading technologies and companies to New York, for example, through public-private partnerships that spur scalable demonstration projects for visionary, low-carbon buildings.

DEC has adopted regulations that prohibit certain HFCs in specified uses (such as commercial refrigeration and large air-conditioning equipment) (6 NYCRR Part 494). Additionally, there have been legislative proposals to strengthen state building codes and energy efficiency standards. Such legislation should be enacted as soon as possible to enable regulatory action.

Yet the speed and scale of action to decarbonize buildings must accelerate dramatically. Meeting New York's ambitious climate requirements and goals in the residential and commercial buildings sector requires multi-pronged policy action, including new regulations and a major scale-up of public investments, to break through thorny market barriers and to manage significant risks to achieving the necessary equity and emissions reduction outcomes. The strategies recommended for the buildings sector work to achieve the Climate Act's energy efficiency goal for 2025, and critically, to spur more rapid and widespread end-use efficiency and electrification in buildings.

Key Stakeholders

Collaboration is critical among multiple state agencies, local governments, consumers, non-governmental organizations (NGOs), New York's electric and gas utilities, affected workers and unions, and industry actors including the construction and building improvement industry, real estate actors, and clean energy businesses. Stakeholder engagement must include meaningful involvement of households, businesses, and community-based organizations from frontline communities, LMI households, public housing authorities and residents, environmental justice organizations, and affordable housing groups.

12.2 Key Sector Strategies

The key strategies within this sector are organized into four themes, as shown in Table 10.

Table 10. Buildings Sector Key Strategies by Theme

Theme	Strategies
Adopt Zero Emissions Codes and Standards and Require Energy Benchmarking for Buildings	B1. Adopt Advanced Codes for Highly Efficient, All-Electric, and Resilient New Construction B2. Adopt Standards for Zero Emissions Equipment and the Energy Performance of Existing Buildings B3. Require Energy Benchmarking and Disclosure
Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization	B4. Scale Up Public Financial Incentives B5. Expand Access to Public and Private Low-Cost Financing B6. Align Energy Price Signals with Policy Goals
Expand New York's Commitment to Market Development, Innovation, and Leading-by-Example in State Projects	B7. Invest in Workforce Development B8. Scale Up Public Awareness and Consumer Education B9. Support Innovation B10. Reduce Embodied Carbon from Building Construction
Transition from HFCs	B11. Advance a Managed and Just Transition from Reliance on HFC Use

Adopt Zero Emissions Codes and Standards and Require Energy Benchmarking for Buildings

When new buildings are constructed, clear and cost-effective opportunities exist for decarbonizing building operations and reducing embodied carbon emissions, which will have long-term impacts throughout the construction market. Advanced codes will minimize the near-term installation of additional fossil fuel equipment and ensure that new buildings going forward are resilient to the impacts of climate change.

In existing buildings, the best opportunity for energy improvements is during routine home and capital improvements and when HVAC equipment retire out of service. Since HVAC service lives range from 15

to 30 years, seizing the opportunities to electrify New York's over 6 million buildings by 2050 requires near-term action.

Electrification and efficiency improvements in existing buildings present a larger challenge of sheer scale. DEC should adopt regulations that will bring about the end of fossil fuel combustion in buildings by prohibiting replacement of fossil fuel equipment at end of useful life. Building performance standards also will compel efficient operation of buildings and capital investments in high-performance building envelopes and efficient HVAC systems.

These regulations and complementary market support must be thoughtfully designed to drive adoption of highly efficient heat pump systems that are coupled with measures that reduce thermal energy demand, rather than uptake of inefficient alternatives such as electric furnaces or boilers. If not managed, there is a risk that consumers could install inefficient electric equipment in inefficient buildings to minimize upfront costs; but this would result in unaffordable electric bills for building occupants and, if widespread, excessive system peak electricity demands that would be extremely costly to meet. Put simply, policy action to decarbonize buildings must address both energy efficiency and electrification.

Advancing equitable outcomes for lower-income households and disadvantaged communities also demands careful design of regulatory actions and complementary strategies. The CJWG expressed support for regulatory sunset dates for combustion equipment in buildings provided that these regulatory actions are coupled with additional goals and public investments to benefit disadvantaged communities. This Scoping Plan endorses this condition for regulatory action and proposes complementary strategies to minimize the risk of negative impacts on lower-income and vulnerable households while prioritizing investments that benefit affordable housing and Disadvantaged Communities.

Given the increased frequency of extreme weather events increasing the probably and scale of electric grid outages, it is critical to consider and manage risks to resilience when electrifying the heating systems of buildings. Flexible technologies and grid-interactive appliances that actively manage building energy consumption can enhance grid reliability and resilience, and a high-performance building envelope prolongs passive survivability. Additional resilience strategies include onsite renewable energy, energy storage, and EV battery-interactive capabilities; moreover, this is a priority area for public investment in research, solution development, and demonstration projects.

B1. Adopt Advanced Codes for Highly Efficient, All-Electric, and Resilient New Construction

This Scoping Plan recommends adopting all-electric State codes on an accelerated timeframe (and somewhat sooner than was recommended by the Energy Efficiency and Housing Advisory Panel), as an important policy lever that can contribute to the rapid transformation presented in the Integration Analysis. Meeting the proposed 2024 date for low-rise construction code is predicated on New York State passing legislation by early 2022, which would direct and enable the subsequent regulatory action.

Components of the Strategy

DOS and the NYS State Fire Prevention and Building Code Council (Code Council), in collaboration with DEC, NYSERDA, local governments, and interested stakeholders, should adopt codes and standards for new construction (and additions and alterations as applicable) of residential and commercial buildings to be built to a highly efficient, zero emission standard, and incorporate requirements for building resilience. The State should enact legislation to enable this regulatory action.

- **Update regulations to improve energy efficiency and resiliency:** As soon as possible, the State should enact legislation to revise the Energy Law relating to the State Energy Code 10-year cost effectiveness criterion to require an assessment over a longer time horizon with consideration for equipment lifecycle or societal effects. DOS and the Code Council should then amend codes that are presently in effect.
    - Adopt highly efficient State Energy Code for new construction (and additions and alterations as applicable) of residential and commercial buildings.
    - Adopt building resilience features into state codes to require solar wherever the opportunity exists and is feasible (with allowances for green roofs and other uses of rooftop space); grid-interactive electrical appliances as feasible (such as batteries and hot water heaters); energy storage readiness; electric readiness for space conditioning, hot water, cooking, and dryers; and EV readiness where parking is provided.
- **Adopt regulations to end on-site emissions:** As soon as possible, the State should enact legislation that aligns State Energy Code and Uniform Code with Climate Act goals, including by adding consideration of GHG emissions to Energy Code. DOS, NYSERDA, and the Code Council should then advance all-electric code provisions that set emissions limits on equipment for space conditioning, hot water, cooking and appliances. Until all-electric codes are adopted statewide, NYSERDA should encourage local governments to adopt NYStretch Energy Code. The State also

should provide additional funding for local code enforcement (staff, training, materials) and a credentialing program for Energy Code inspectors.

- 2024: Adopt all-electric state codes that prohibit gas/oil equipment for space conditioning, hot water, cooking, and appliances for new construction of single family and low-rise residential buildings (and additions and alterations as applicable).
- 2027: Adopt all-electric state codes that prohibit gas/oil equipment for space conditioning, hot water, cooking, and appliances for new construction of multifamily buildings over 4 stories and commercial buildings (and additions and alterations as applicable).

B2. Adopt Standards for Zero Emissions Equipment and the Energy Performance of Existing Buildings

Among the 6.1 million existing buildings in New York, single-family homes and other low-rise residential buildings (up to 3 stories) are relatively straightforward to upgrade and convert to zero emissions heating and hot water systems. Larger, complex building typologies may necessitate more flexibility in both timing and technological solutions, and affordable housing will need compliance paths that protect tenants.

For existing buildings, New York should require the sale and installation of energy efficient and zero emission new equipment for space heating and hot water, when replaced at the end of useful life in residential and commercial buildings. The State should further require efficiency upgrades for large buildings through a building performance standard. In the development of codes, standards, and regulations, provide for compliance pathways for existing buildings to account for extenuating circumstances (including, but not limited to, housing affordability-related matters and health and safety/emergency needs).

Components of the Strategy

NYSERDA, DOS, and DEC should work together to implement standards for building performance, appliances, and equipment. These regulations should be coordinated with action taken by the PSC and DPS to regulate gas utilities. The State should enact legislation to enable these regulatory actions.

- **Regulations to improve energy efficiency in existing buildings:** As soon as possible, the State should pass legislation that enables the establishment and enforcement of efficiency standards for appliances that are sold, leased, or installed in New York State, in order to reduce energy consumption, reduce water consumption, reduce GHG emissions, and/or increase demand flexibility associated with the regulated products. NYSERDA should then set energy efficiency standards for the

sale of appliances, in coordination with DOS for enforcement. Subsequent to enabling legislation, NYSERDA also should set energy efficiency standards for buildings, in coordination with DOS and local code officials for development and enforcement.

  - As soon as possible, the State should adopt energy efficiency standards for appliances that are exempt from federal preemption (such as computers, monitors, fluorescent and LED light bulbs, and air purifiers).
  - 2027: Require existing properties larger than 25,000 sq. ft to upgrade to energy efficient lighting in all commercial spaces and common areas.
  - 2030: Adopt an energy efficiency performance standard for existing commercial and multifamily properties larger than 25,000 sq. ft. (with credit for building electrification). Compliance standards will be informed by statewide benchmarking data and seek alignment, where appropriate, across state and local government requirements (such as New York City local laws). A phased-in building performance standard could become effective starting in 2027.

- **Zero emissions standards to phase out fossil fuel combustion equipment:** NYSERDA should set zero emissions standards for the sale of building equipment, in coordination with DOS for enforcement. DEC should set and enforce zero emissions standards tied to the operation of large fuel burning equipment.

  - 2024: The PSC should prohibit utilities from providing new gas service to existing buildings.
  - 2030: Adopt zero emission standards that prohibit gas/oil replacements (at end of useful life) of heating and cooling and hot water equipment for single-family homes and low-rise residential buildings with up to 49 housing units.
  - 2035: Adopt zero emission standards that prohibit gas/oil replacements (at end of useful life) of heating, cooling, and hot water equipment for larger multifamily buildings (4 stories and higher or 50 or more housing units) and commercial buildings.
  - 2035: Adopt zero emission standards that prohibit gas appliance replacements (at end of useful life) for cooking and clothes drying.
  - 2035: DEC should adopt zero emissions standards that prohibit gas/oil use in large fuel burning equipment. The standards should be enforced under a new emissions enforcement regime of large combustion equipment that typically heat buildings 50,000 sq ft or more in floor area, thereby requiring early retirement.

B3. Require Energy Benchmarking and Disclosure

Energy consumption benchmarking provides building decision-makers with information to improve building operations and investment decisions, and the data collected statewide will inform building performance standards. Lack of awareness in the market may limit the effective use of benchmarking data. Education will be needed for consumers, brokers, and building owners on how to use the energy usage and benchmarking information.

The State must also mitigate against and monitor for potential harm to Disadvantaged Communities. Disinvestment could occur if disclosure or labeling of energy performance makes properties less attractive to potential renters and buyers, or conversely, demand for efficient buildings could price people out of the market for healthy housing in their community. Adequate technical and financial assistance for LMI homeowners and building owners will be needed in disadvantaged communities to scope and finance energy upgrades. As was emphasized by the CJWG, energy affordability is a challenge for many LMI households and required energy disclosure provides important information when buying or renting a home, including ongoing energy costs, which informs decision-making and budgeting. The State will ensure consistency and alignment, across state and local government requirements (such as New York City local laws), including in reporting templates and timeframes.

Components of the Strategy

NYSERDA, DOS, the Department of Taxation, and the Attorney General's office should work together to implement and enforce energy benchmarking and disclosure requirements, in coordination with PSC direction to utilities under its jurisdiction. The State should enact legislation to enable these regulatory actions.

- Require energy consumption information and disclosures:
    - 2023: Commence a statewide energy benchmarking and disclosure program that requires owners of multifamily and commercial properties larger than 10,000 sq. ft. to annually report whole building energy and water consumption data to NYSERDA for public disclosure. NYSERDA should lead implementation, with support from the Department of Taxation and the Attorney General's office. Also, the PSC should require electric, gas, and water utilities to provide automatic aggregated whole building uploads of utility customer data directly to EPA's Energy Star Portfolio Manager.
    - 2025: Require multifamily and commercial properties larger than 25,000 sq. ft. to undertake a comprehensive building energy assessment (audit) at least once every ten years that evaluates

the building's systems and identifies opportunities to invest in energy efficiency upgrades, electrification or electrification-readiness for building systems, and resilience measures. Filing an assessment report with NYSERDA would be required on a cycle established by the State or at the time that a building permit is needed for specified work that must conform to Code, whichever comes first. NYSERDA should lead implementation, in close coordination with DOS and local code officials for development and enforcement.

- 2025: Require owners of all single-family and multifamily residential and commercial buildings to obtain and publicly disclose, as part of sale or lease listing of a building, housing unit, or commercial space, the prior-year energy consumption of the building, unit, or space (at least 12 consecutive months of energy bill data).
- 2027: Require owners of single-family buildings to obtain and disclose an energy performance rating (such as a Home Energy Rating System index) as part of sale listing.

Scale Up Public Financial Incentives and Expand Access to Public and Private Low-Cost Financing for Building Decarbonization

A substantial infusion of both public resources and private capital will be needed to pay for the building upgrades necessary to decarbonize buildings, while also expanding access to safe and healthy housing and bolstering resilience to climate impacts. The Integration Analysis indicates that to meet New York's GHG emission reduction requirements, more than 250,000 housing units each year will need to adopt electric heat pumps and energy efficiency measures from the late 2020s onward – more than a ten-fold increase from current market activity – with a comparable pace of transformation in the commercial sector. Across the residential and commercial buildings sectors, annual investment costs for these upgrades are projected to grow over time from roughly $5 billion in 2030 to $30 billion in 2050, based on the incremental cost of building electrification and shell improvements made in each year. This investment will expand jobs in energy efficiency and building electrification statewide. Yet this investment remains a fraction of other building-related expenditures in New York, which annually include roughly $60 billion in buildings investments and over $30 billion on energy costs across the residential and commercial buildings sectors. Significant opportunity exists to re-direct existing spending toward a more sustainable buildings sector.

B4. Scale Up Public Financial Incentives

Financial incentive programs will need to scale up dramatically to motivate millions of homeowners and building owners to install high efficiency electric heat pumps and make energy efficiency improvements such as sealing air leaks, adding insulation, and using building controls. This is because for most existing homes and buildings, the current upfront costs of building electrification upgrades can be significantly higher than fossil fuel equipment replacement in-kind; and based on current energy rates, utility bill

savings do not always offer a clear economic return on investment. Although many energy efficiency upgrades are cost-effective, these projects can be disruptive for occupants or simply not a priority for owners. Some housing is unsafe and unhealthy due to years of underinvestment, such that costly repairs are needed before making energy improvements.

Given the scale of the challenge, public funding must be used strategically to accelerate market adoption, help LMI consumers, and advance equity. Expansion of financial incentive programs to motivate early adoption in market-rate housing and commercial buildings will be needed for at least the coming decade. This support should target existing buildings rather than new construction and eventually phase out (once efficient, zero emission codes and standards go into effect).

Dedicated financial support programs for LMI households, affordable and public housing, and Disadvantaged Communities are essential to enable these households to make and benefit from energy upgrades, with careful attention to impacts on housing and energy affordability. For these households and buildings, grant funding will need to cover most or all the near-term cost premium for building electrification and efficiency upgrades, considering economic realities and to remedy unjust patterns of redlining and underinvestment in disadvantaged communities. Relatedly, New York has established an Energy Affordability Policy that sets the goal of limiting energy costs for low-income households to no more than 6% of their income. The existing low-income energy bill discount programs administered by the major electric and gas utilities should be expanded. Over the longer-term, regulatory requirements must be coupled with ongoing public financial support for poor and working-class households. Thoughtful policy and programmatic design and coordination of funding sources will be essential to support affordability, safe and healthy housing, consumer protections, and economic opportunities that benefit disadvantaged communities.

A salient challenge is identifying and securing sufficient new sources of funding, and relatedly, broadening funding sources beyond the charges now levied on electricity and gas ratepayers. Economy-wide approaches may be appropriate to raise new public resources to support the Scoping Plan. A new sector-specific funding mechanism could involve levying a “feebate” on fossil fuel equipment and allocating the revenues to support building decarbonization. Political will is needed to marshal additional ratepayer, State, and federal funding at the needed scale.

In the buildings sector, specific opportunities exist to leverage federal funding, in particular for affordable housing and low-income households. For example, the EmPower New York program and the federal

Weatherization Assistance Program both provide no-cost energy efficiency solutions to income-eligible New Yorkers; these programs can help improve the conditions in existing homes, make homes electrification-ready in some instances, and provide a network of contractors and non-profit community-based organizations to support low-income communities. Yet even summed together, these programs currently serve on the order of 20,000 to 30,000 homes per year, which is a fraction of the scale needed to meet the Climate Act goals and requirements. Scaling up funding and revising Weatherization Assistance Program guidelines to allow for electrification could better serve disadvantaged communities through existing program infrastructure.

The CJWG emphasized that regulatory action to phase out fossil fuel equipment in buildings is inadequate without added policy goals and public investments to benefit Disadvantaged Communities. The strategies proposed here are consistent with the CJWG's call to front-load and prioritize public investments in efficient appliances and zero emissions heating, cooling, and cooking equipment in Disadvantaged Communities so that poor and working-class households are not left behind. Informed by input from the CJWG, the proposed strategy components include attention to New York's existing energy affordability goal, the needs of public housing, and the health benefits associated with building decarbonization. The CJWG further called for additional actions around consumer protection, including "claw back provisions" as part of public subsidies to private landlords to defend against rate increases, gentrification, and displacement. This specific recommendation is not reflected in the proposed strategy because such provisions merit careful consideration in program design.

Components of the Strategy

Significant coordination will be needed among state and local agencies and utilities, notably to support low-income households and disadvantaged communities, with state leadership from the PSC and DPS, NYSERDA, HCR, NYPA, and New York State Office of Temporary and Disability Assistance (OTDA).

- **Scale up incentives for building decarbonization:** Scale up direct cash incentives for energy efficiency, electrification, and electrification-readiness in residential and commercial buildings. In incentive program design, place an emphasis on ease of access to available and relevant resources for consumers and installers, particularly for LMI households and buildings in Disadvantaged Communities that may access resources from multiple programs. Design programs to support comprehensive building retrofits as well as portfolio- and community-scale solutions, where hundreds of homes and businesses are contracted for energy upgrades to more efficiently manage and deliver projects, reduce unit costs, incorporate place-based strategies, and drive scale and

momentum (as compared to one-off projects). Where incentives are offered through utility companies, develop a coordinated statewide program to provide a consistent experience and incentive structure that helps installers reach more customers, with a priority to LMI households and disadvantaged communities.

- **Align regulatory frameworks:** Identify and pursue modifications to regulatory frameworks for energy efficiency and building electrification programs to further align the programs with Climate Act goals and requirements. This includes, but is not limited to, attention to accounting holistically for the societal costs and benefits of building energy upgrades, including health impacts associated with outdoor and indoor air quality and thermal comfort.
- **Prioritize LMI households, affordable housing, and disadvantaged communities:** Create dedicated direct cash incentives and financial support mechanisms for energy efficiency and electrification for LMI households, affordable housing, public housing, and disadvantaged communities. Develop new partnerships to effectively deliver programs (such as through housing agencies, community development financial institutions, and local community-based organizations) and adopt inclusive engagement processes that incorporate disadvantaged communities and LMI households in program design. Account for New York's existing Energy Affordability Policy, which seeks to limit energy costs for low-income households to no more than 6% of their income, as well as a household's cumulative cost burden related to housing, energy, transportation, and healthcare when assessing affordability impacts.
- **Prioritize public housing:** Support and accelerate efficiency, electrification, and resilience in public housing, particularly in New York City Housing Authority buildings and in other Public Housing Authority developments statewide, with attention to the special needs of and jurisdictional issues that affect the state's public housing stock. Support resiliency centers in public housing developments that provide safe temperatures, back-up power (including solar-storage pilots), and community spaces to coordinate disaster relief. Leverage available federal funding and additional funding sources to support deeper retrofits and electrification.
- **Fund non-energy improvements when necessary:** Create a new "Retrofit and Electrification Readiness Fund" for LMI households, affordable housing, rent regulated housing, public housing, and residential buildings in disadvantaged communities to cover costs of non-energy building improvements that are necessary to install energy measures and broadband installation costs when funding energy projects.
- **Leverage funding for healthy homes:** Leverage healthy homes services and funding across housing, health, and energy improvements for low-income households to fund green and healthy housing retrofits. Near-term actions can expand use and coordination of both state and federal

funding (such as use of Weatherization Assistance Program funds for health and safety improvements), build on the ongoing pilot to leverage New York Medicaid's Value-Based Payment program for Managed Care Organizations to contribute to healthy housing services and home energy efficiency improvements, and engage with non-profit hospitals in community health needs assessments.

B5. Expand Access to Public and Private Low-Cost Financing

Mobilizing and focusing private capital at scale will be essential to construct, upgrade, and operate highly efficient, electrified buildings. Modernizing codes and standards to require electrification and efficient construction will drive such investment via existing market activity and the cycle of routine building improvements. Also needed are low-cost financing products for energy efficiency, electrification, electrification readiness, solar PV, energy/thermal storage and related improvements so that single-family, multifamily, and commercial and institutional building owners can access low-cost capital at the scale needed to pay for the building upgrades necessary for decarbonization.

At present, there is a general lack of lender interest and awareness around financing building electrification and energy efficiency projects, as well as perceptions of risk in underwriting based on energy performance. New York should help to address this barrier through lender education and outreach, and by making available case studies and modeling tools so that lenders can appropriately underwrite to energy performance standards and applicable regulatory requirements. Another important role for the state is to provide for consumer protection in connection with financial products and services, particularly for products that target LMI consumers. Additionally, the NY Green Bank, HCR, state and local revolving loan funds, and possibly electric/gas utilities offer important mechanisms to strategically deploy public financial resources in ways that can leverage private capital and accelerate the transition to a decarbonized, resilient building stock.

Reflecting on input from the CJWG, the proposed strategy places priority on consumer financing made available by community development financial institutions and credit unions.

Components of the Strategy

Action and coordination across a range of state agencies and stakeholders is likewise important to expand access to low-cost financing for building electrification and efficiency upgrades, with leadership from HCR, the NY Green Bank and NYSERDA, DFS, DASNY, and NYPA.

- **Integrate energy requirements and resources into affordable housing deals:** Continue to scale up energy and green requirements in affordable housing deals while ensuring that sufficient resources are available to maintain, preserve and produce housing that is clean, safe and affordable. For example, by no later than 2023, all new construction projects that receive Tax Credit funding through HCR should be required to be high-performance and all-electric buildings. Continue to streamline access to all incentives and resources for regulated affordable housing building decarbonization to go through housing agencies making projects affordable, to also make projects energy efficient, all-electric or electric-ready, and resilient.
- **Integrate energy performance into underwriting:** Provide support for lenders to underwrite to energy performance standards and applicable regulatory requirements.
- **Expand access to financing:** Provide greater access to low-cost financing products for upgrades, including for low-income homeowners and buildings located in disadvantaged communities. Explore new mechanisms to deploy public financial resources to enable low-interest financing products coupled with credit enhancement or insurance. Prioritize support for financing products made available by community development financial institutions (CDFIs) and credit unions as part of the Community Reinvestment Act regulatory compact.
- **Expand energy savings performance contracting for public sector buildings:** The State should enact enabling legislation to expand the use of energy savings performance contracting to support implementation of emissions reduction upgrades in state and municipal buildings, P-12 schools, and other public facilities. Performance contracting is a financing mechanism in which efficiency upgrades are paid for through savings from reduced utility costs. Changes to existing statute should expand the energy savings performance contracting eligible list of measures, expand the allowable payback term for deep decarbonization performance contracts, allow some fast payback measures to help fund deferred maintenance needs, and allow a state agency or authority to request to keep a portion of cost savings that result from performance contracts. A new statute should allow Design/Build and integrated project delivery methods for public sector buildings that achieve deep decarbonization performance.
- **Create a revolving loan fund:** Create a revolving loan fund for building decarbonization and the reuse of buildings and building materials. For example, the Environmental Facilities

Corporation's (EFC) Clean Water State Revolving Fund provides a model for enabling public mandates to be coupled with access to low-cost capital. This would be implemented through a bond-issuing government authority.

B6. Align Energy Price Signals with Policy Goals

The low relative cost of fossil gas compared to electricity is a major barrier to building electrification. Over time, the costs of operating high efficiency electric heat pumps will need to become more attractive compared to heating with fossil gas. Chapter 18 explores options for a comprehensive economy-wide policy that would price carbon emissions and Chapter 19 addresses a managed transition of the fossil gas system. Such policy actions are expected to increase consumer energy prices for fossil fuels. Moreover, electric rate structures will need to evolve to be supportive of and appropriate for higher levels of electrification of buildings and vehicles, with attention to equitable rate design.

The CJWG called for a more expansive set of actions related to consumer protection than are proposed below, including a "Utility customer bill of rights" that would include a safety net style guarantee of renewable energy to every household.

Components of the Strategy

- **Price GHG emissions from fossil fuels:** If an additional carbon pricing mechanism is advanced for electricity, DEC and NYSERDA should evaluate options to adopt a comparable carbon price for fossil fuels. Carbon pricing should not raise the price of electricity relative to fossil fuels as this could create unintended incentives to choose fossil fuels for heating.
- **Align electric rates:** Consider the need for dynamic underlying electric rate structures and programs (such as dynamic load management) that provide appropriate price signals to customers to incentivize deployment and usage of DERs, including heat pump systems and load flexibility measures that are designed reduce building loads that are coincident with summer and winter system peaks. For low-income households, additionally consider subsidized rates or expanded bill discounts for households that adopt heat pumps.

Expand New York's Commitment to Market Development, Innovation, and Leading-by-Example in State Projects

In coordination with financial incentives and regulations, state support for market development and innovation is important for ensuring the delivery of building decarbonization solutions that perform well

and make our lives better. Areas of focus should include workforce skills and broad public awareness and engagement that motivates behavioral change.

The CJWG expressed broad support for market development and innovation investments as proposed here. The group called for attention to growing local supply chains and creating jobs in clean energy businesses that serve disadvantaged communities, as well as providing dedicated support to MWBE enterprises to innovate and actively participate in the transformation of the buildings sector.

B7. Invest in Workforce Development

Chapter 7 outlines critical actions to scale up workforce education, training, job placement, and development initiatives that equip New York's current and future workforce for the clean energy economy. Equally important, the chapter describes strategies to increase industry diversity and clean energy job placements for disadvantaged communities, low-income residents, veterans, workers in fossil fuel industries, and other priority groups.

Consistent with the just transition framework and implementation partners described in Chapter 7, equipping a workforce to design, install, inspect, maintain, and operate healthy, comfortable, zero emission buildings needs to include expanded or new training. For example, many heat pump installers today have knowledge gaps around best practices for sizing, selecting, and installing ASHPs in New York's cold climate, underscoring the importance of workforce development to support quality installations and build market confidence. Overall, there is a shortage of qualified, skilled professionals who are ready to deliver the unprecedented speed and scale of adoption of heat pumps and energy efficiency measures that is needed over this decade to meet New York's climate goals.

Components of the Strategy

NYSERDA, New York State Department of Labor, and ESD will lead implementation of workforce development actions, in coordination with educational institutions, training organizations, unions, industry actors, local governments and community-based organizations, workforce one-stops, and foundations.

- **Expand training:** Training for incumbent and new clean energy workers and adjacent industries needs to be increased dramatically, through investments in training infrastructure/delivery, career pathways, on-the-job-training, and industry partnerships. The state should support expanded or new training in the following priority areas:

- Training and resources for the local government workforce of code officials and building inspectors.
- Training and resources for contractors, technicians, and designers on sizing, selection, and installation of heat pumps and supporting measures.
- Training and resources for contractors, technicians, and designers to reduce HFC emissions, addressing both leak reduction and proper disposal of HFCs already in use in building equipment and the transition to low-GWP alternatives for building equipment and spray foam insulation.
- Continuing education on building decarbonization as part of existing or new licensing and/or registration requirements for architects, engineers, trades, contractors, building operators, and real estate professionals, such as brokers and inspectors.
- Training and resources for building operations, maintenance, and service workers, with attention to supporting retention of experienced building service workers.
- Training and resources for planners, designers, and planning boards to understand and engage in planning processes that will support this transition.
- Healthy homes training, to equip energy auditors and health and social workers who make home visits to identify health and safety issues and contractors to address these issues.
- Training and industry partnership to increase the number of qualified geothermal drillers.
- Training for workers in fossil fuel industries to transfer their skills to clean energy opportunities.

- **Curricula and career services:** Require building decarbonization curricula and career services in state-funded education including K-12, technical schools, apprenticeships, and engineering and architecture programs at public universities, and encourage these curricula at private universities.
- **Prioritize disadvantaged communities and other priority populations:** The state should prioritize disadvantaged communities and low-income residents for training and job placement by creating community-to-employment pipelines and career pathways that are informed by an analysis of the effectiveness of current on-the-job training investments. Good wages, benefits, local and targeted training and hiring will be ensured through Community Benefits/Workforce Agreements and On the Job Training Funding where appropriate, feasible and permitted by law. The state should leverage agencies' spending and regulatory influence to advance commitments around job access and job quality for Disadvantaged Communities. The state should increase ranks of MWBEs and SDVOBs and worker cooperatives through increased funding for workforce training, business development support, and certification assistance, so as to provide increased opportunities for MWBE and SDVOB utilization on state contracts, in accordance with Executive Law Article 15-A and 17-B.

B8. Scale Up Public Awareness and Consumer Education

With competing demands on our attention, there is low public awareness about New York's Climate Act in general, and more specifically, low awareness about steps to take to decarbonize buildings. Similarly, most people are not aware that using combustion appliances in their home – particularly fossil gas for cooking – has negative impacts on indoor air quality and their own health, while also contributing to outdoor air pollution and climate change. New York should expand its support for broad public awareness and consumer education, create strategic partnerships with trusted community leaders, and scale-up targeted outreach and decision-making support to increase market demand and accelerate the transition to low-carbon, energy-efficient, all-electric buildings.

Components of the Strategy

NYSERDA, the PSC and DPS, and utilities will lead these efforts, in coordination with local governments and community-based organizations and leaders.

- **Scale up campaigns:** Support and scale up multilingual public and consumer education efforts through large-scale, coordinated awareness, inspiration, and education campaigns. This would include traditional and broad reaching media, digital communication, "influencer" style campaigns, user-generated campaigns, virtual tours, and mailers. Campaigns would provide specific resources and tools for installers, distributors, the home-visiting workforce, and other supply chain actors to educate consumers.
- **Create strategic partnerships:** Create strategic partnerships that can have broad impact, including with trusted community leaders, religious leaders, and community-based organizations. Partner with utilities to promote decarbonization and to sunset messaging that promotes fossil gas as a "cleaner" choice. Other partners would include cooperative extensions, business councils, industry organizations and leading companies, unions, schools and teachers, film and public venues, and state and local elected officials. This work can build on experience from Heat Smart programs.
- **Prioritize disadvantaged communities:** Ensure messages, messengers, and media reflect disadvantaged communities in marketing efforts, and prioritize education and technical assistance for disadvantaged communities. Build on NYSERDA's development of regional Clean Energy Hubs and on the commitment of NYSERDA and the state's electric and gas utilities to maintain the New York Energy Advisor website as a "one-stop shop" source of information for clean energy, electrification, and energy efficiency programs for LMI households. Fund and expand

community hubs to offer education, resources, local contractors, technical assistance, and program navigator support.

- **Publicize leaders:** Publicize best practices for efficient building operations and recognize leaders and innovators in efficient operations that support building occupants. Create an incentive program/challenge to attract others or encourage others to sign a pledge to commit to neutrality.
- **Provide technical resources:** Provide technical assistance and resource toolkits for building decision-makers and residents including playbooks for low-carbon solutions in common building types, free in-home or virtual audits to homeowners, and capital planning support for large buildings. Provide information resources and tools to support tenant engagement. Demonstrate low-carbon solutions through challenges and case studies. Develop case studies showing the feasibility, performance, and costs for three paths to transition to highly efficient and all-electric buildings: full electrification, phased electrification, and electrification readiness.

B9. Support Innovation

For nearly all buildings in New York, technologies exist today that can dramatically reduce the building's energy use and, with zero-emission electricity, decarbonize the building. However, ongoing innovation with respect to technology, design and planning, and business models is needed to reduce the cost and increase the value of such upgrades in order to make their value proposition competitive with conventional building systems. RD&D also should be pursued to develop and deploy specific technologies, such as long-duration energy storage and ultra-low GWP alternatives to HFCs, including natural refrigerants, for spray foam insulation, HVAC, water heating, and refrigeration technologies. In these areas, federal government RD&D funding and leadership is critical.

Complementary RD&D investment by New York in building decarbonization solutions offers multiple benefits. These include a strong multiplier for jobs and economic development, in-state demonstration projects and case studies for emerging technologies in prevalent building types, and demonstration projects that are located in and benefit disadvantaged communities. The state should continue to support RD&D and help to bring new companies and manufacturers to New York that offer innovative solutions for highly efficient, all-electric, and resilient buildings; for grid-interactive buildings; and for reducing embodied carbon in buildings.

Components of the Strategy

NYSERDA and ESD will lead the state's RD&D investments, in coordination with SUNY, DEC, DPS, and the utilities.

- **Leverage Federal resources:** Advocate for, and leverage, federal and national laboratory resources focused on identifying and commercializing advancements in technologies for building decarbonization and building resilience.
- **Scale up tech transfer:** Scale up resources to identify and promote technology transfer for innovative building decarbonization technologies and design approaches that are in use internationally and could be transferred to the New York market. For example, support adapting technologies for U.S. and New York standards, in-state demonstrations, market research, partnering with New York entities, and manufacturing assistance.
- **Support minority- and women-owned and socially responsible business enterprises:** Provide support and outreach for MWBEs, cooperatives, and B Corps. For example, provide dedicated access to expert advisory services; internships, fellowships, and board placement in innovative companies and access to venture capital for underrepresented women and minority entrepreneurs, via New York Ventures.
- **Support NextGen building decarbonization solutions:** Continue to support RD&D, demonstrations, and technology transfer and commercialization for next generation HVAC systems, building envelopes, and design approaches that meet technical needs, deliver high performance, and lower costs. This includes continued improvement in cold climate performance across a range of heat pump products and sizes; improved domestic hot water heat pump technologies; solutions for harder-to-electrify buildings, including those on the Con Ed steam system; community thermal loops; advanced heat recovery and ventilation; improved thermal storage for HVAC applications; innovative materials, construction approaches, and manufacturing methods that improve building envelopes; and other technologies.
- **Support NextGen grid-interactive buildings solutions:** Support RD&D, demonstrations, technology transfer and commercialization, and development of standards across manufacturers and equipment for Grid-Interactive Efficient Buildings, to deliver energy efficiency, load flexibility, and modulation capabilities that contribute to efficient grid management and grid reliability. Support the development of market signals, including revenue streams for Grid-Interactive Efficient Buildings, via analysis of opportunities to provide grid services and electric/thermal services to neighboring buildings, assessment of market mechanisms for

supporting desired policy outcomes, and pilots and demonstrations to inform rulemaking and ratemaking.

- **Support RD&D for low-carbon fuels:** Assess and then support RD&D needs with respect to the potential for some use of low-carbon fuels in buildings (such as RNG, green hydrogen, wood, and/or high-percentage biodiesel blends) and bioenergy with carbon capture and storage for harder-to-electrify buildings, which may include campuses with district energy systems.
- **Support RD&D for building resilience:** Assess and then support RD&D needs with respect to building resilience, as New York looks toward both widespread building electrification and more frequent extreme weather. Related RD&D investments (also discussed in Chapter 13) include the flexibility and resilience of the electrical system and long-term energy and thermal storage solutions.

B10. Reduce Embodied Carbon from Building Construction

A specific area for RD&D and for the state to lead by example is to reduce the embodied carbon associated with building construction, which describes all the GHG emissions that result from the mining, harvesting, processing, manufacturing, transportation, and installation of the products and materials that are used in buildings, as well as end-of-life emissions associated with the disposal of those materials. The most impactful way to reduce embodied carbon is to reuse existing buildings where practical, rather than demolishing and constructing anew. When new construction or renovation occurs, smart and integrated building design processes can significantly reduce embodied carbon at little-to-no added cost of construction. Moreover, in-state manufacturing can grow to produce the low-carbon alternative products. However, there is currently a broad lack of awareness in the industry of embodied carbon impacts from products in use in buildings, including among designers, contractors, and manufacturers.

To lower the embodied carbon of products and materials used in the buildings sector and to create broad carbon literacy regarding the impact of these materials, New York should establish procurement requirements and design specifications for state-funded projects as well as support education, building reuse, building de-construction and material reuse, RD&D, and in-state manufacturing of alternative products. These efforts also will increase industry attention to carbon-sequestering products, such as sustainable wood products and hempcrete.

Components of the Strategy

Interagency coordination through the GreenNY Council will include DASNY, DEC, OGS, NYPA, NYSERDA, DOS, ESD, and other agencies. State agencies should also explore procurement specifications under Executive Order 4 and potential links to public bid process for construction projects.

- **Lead by example in state projects:** Drive embodied carbon reductions through design and procurement in state-funded new construction projects.
- **Make embodied carbon transparent:** In design specifications, require Environmental Product Declarations for structural building materials where available, and require the use of available modeling software and design tools for calculation of the project's embodied carbon budget.
- **Follow lower-carbon specifications:** Require that state-funded projects follow lower-carbon specifications (see GreenNY) for the most carbon intensive construction materials and products (such as concrete, foam insulations, glass, and window units).
- **Set reduction targets for projects:** Subsequently, set a target embodied carbon reduction level for projects that is below the established mean embodied carbon budget, as illustrated over the previous years.
- **Incorporate embodied carbon budgets into permitting:** Require an embodied carbon budget to be submitted as part of the permit process for all commercial and institutional new construction (and additions and alterations as applicable), immediately for state entities and no later than 2025 for local government entities. Provide state-funded training and resources for designers and for state and local permitting entities to check carbon budgets for completeness at first, and then for accuracy as the market improves in its abilities.
- **Encourage building reuse:** Identify and pursue financial incentives, changes to building codes, and other strategies to encourage building reuse, beginning in urban centers that are returning vacant buildings to use. Maintaining the existing building facade and architectural style can be an additional benefit to the embodied carbon reduction.
- **Support RD&D:** Support RD&D, demonstration projects, and technology transfer and commercialization for enhanced low embodied carbon construction, including preference for reuse of existing buildings. Showcase low embodied carbon designs and undertake industry outreach.
- **Expand in-state manufacturing for products:** Provide assistance to expand in-state manufacturing for products that are lower in embodied carbon or made of carbon sequestering materials (also known as biogenic or agriculture-based materials). The New York State Wood

Products Development Council (WPDC), SUNY College of Environmental Science and Forestry (ESF), and ESD are well positioned to provide and coordinate assistance.

- **Incorporate embodied carbon specifications into incentive programs:** In the design of energy efficiency incentive programs, incorporate lower-carbon specifications for the most carbon intensive products (such as foam insulations in homes).

Transition from Hydrofluorocarbons

B11. Advance a Managed and Just Transition from Reliance on Hydrofluorocarbon Use

HFC use is currently widespread in refrigeration and HVAC equipment, including in heat pumps that are being recommended to electrify space conditioning and water heating, and in foams that provide insulation for higher efficiency buildings.

Components of the Strategy

- **Provide education and training:** The state should provide resource toolkits, programs and incentives that make low-GWP refrigerant technologies and low-GWP alternatives available and affordable, including a focus on natural refrigerants. DEC should promulgate regulations regarding proper disposal of HFCs already in use in existing equipment and such regulations should be supported by training installers and contractors on handling, equipment maintenance, and disposal protocols,. NYSERDA should support design professional and workforce training and education around low-GWP refrigerants and alternatives, including natural refrigerants, in building equipment and in building/construction spray foam.
- **Update regulations, codes, and standards:** As soon as possible, update the relevant New York codes, including the mechanical code, to allow the use of low-GWP alternatives for HFCs. DEC should promulgate regulations requiring reclamation or destruction of refrigerants from appliances at end-of-life, with verification and reporting, and require leak detection for certain commercial refrigeration. Provide education and training, technical assistance, and economic support (such as, incentives to purchase leak detection and reclamation equipment, or compensation for refrigerant reclamation) to aid local industry with this transition.
- **Phase out high-GWP HFCs:** DEC should expand the scope of 6 NYCRR Part 494, which prohibits certain HFCs in refrigerator/freezers, chillers, commercial refrigeration, and aerosols/foams/solvents end uses, including through the establishment of a GWP threshold that decreases over time as low and ultra-low GWP options become available. DEC should align New York policy with anticipated federal (EPA) policy measures to meet HFC reduction requirements

as well as with other U.S. Climate Alliance states, to send a strong market signal to manufacturers and industry while mitigating costs of the transition.

- **Research health effects and environmental impacts:** Support further research into known data gaps, including an analysis of typical leak rates and charge size in heat pump technologies and research into long term health effects of exposure to new HFC-alternative chemicals in building materials.
- **Support RD&D:** Continue to support demonstration projects for low and ultra-low GWP refrigerants in HVAC and hot-water systems, and for refrigerant leakage detection and reduction strategies. Develop case studies in refrigerant management and alternatives to HFCs, including natural refrigerants, showing the safety, performance, and cost impacts.

Chapter 13. Electricity

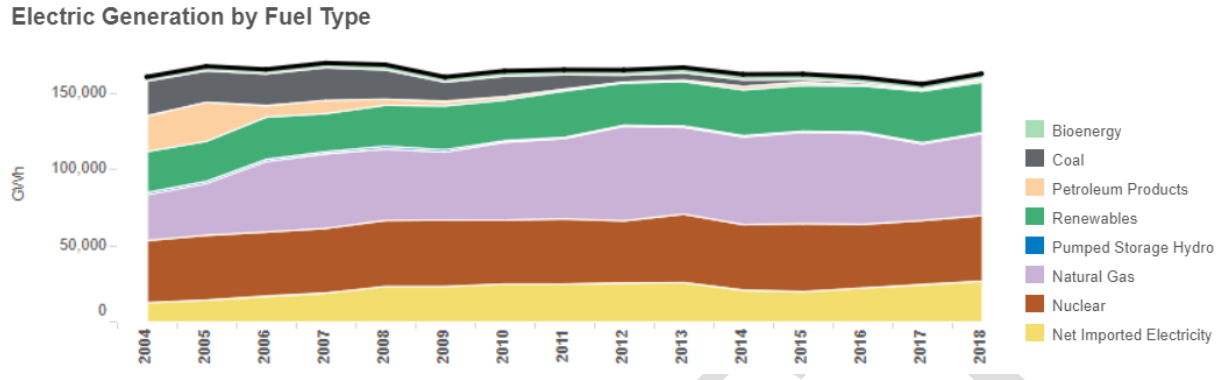
13.1 State of the Sector

Overview

New York's electricity sector is comprised of traditional fossil-fuel fired power generation facilities, hydropower and nuclear generation facilities, along with clean energy generation such as wind, solar, hydropower, energy storage, and transmission infrastructure. In 2017, renewable resources accounted for 11.3% of the state's electricity consumption. Nuclear generating resources and hydropower contributed about 50% of the electricity generation in the state, while wind and solar contributed approximately 3%. Natural gas, the principal fuel source in New York, contributed approximately 28.9% of statewide electricity. The reliance on coal has decreased significantly in recent years with the last remaining coal-fired power plant closing in 2020, following DEC's adoption of revisions to 6 NYCRR Part 251 to establish CO_2 emission limits for existing power plants.[119]

[119] NYSERDA. 2021. Patterns and Trends: New York State Energy Profiles, 2003–2017. https://www.nyserda.ny.gov/about/publications/ea-reports-and-studies/patterns-and-trends

Figure 51. Electric Generation by Fuel Type (2004–2018)



Source: Patterns and Trends – New York State Energy Profile

Vision for 2030

Emissions Overview:

The electricity sector comprised 13% of statewide emissions in 2019, including electricity generation within the state (44%), imported electricity (15%), emissions from imported fuels (41%), and the SF6 used in electricity distribution and transmission (<1%). Electricity sector emissions have declined 46% since 1990.

The Climate Act requires that 70% of statewide electricity come from renewable energy sources by 2030. The Climate Act also requires 6,000 MW of distributed solar by 2025 and 3,000 MW of energy storage be installed by 2030.[120] This can largely be accomplished by aggressive deployment of existing renewable energy technologies such as wind, solar, and battery storage. With the primary procurement mechanisms already established to do just that, the recommendations included here for 2030 look to accelerate the pace and reduce the cost of decarbonizing the electric grid. These include support for the CES and storage deployment, refined modeling to improve decision-making, improved coordination across state agencies, and increased availability of information.

Vision for 2050

By 2040, the Climate Act requires that the state achieve a zero-emissions electricity system as well as 9,000 MW of offshore wind by 2035. Doing this will require all of the actions identified for 2030 as well as a shift in focus toward developing technology and market solutions that better align with the state's

[120] In September 2021, Governor Hochul called for an expansion of the State's distributed solar program from 6,000 MW to 10,0000 MW and tasked NYSERDA and DPS with developing a distributed solar roadmap to chart a path to advance the expanded goal in a resilient, cost effective and responsible manner.

policy goals and allow for a rapid transition away from fossil fuel generation while maintaining reliability and affordability standards. Recommendations include advancing technologies, such as long-duration storage, as well as designing market mechanisms that do not disadvantage those clean resources needed to meet the requirements and goals. Renewable resources, such as offshore wind, solar, and hydropower, as well as energy storage, transmission upgrades, and other advanced technologies are also part of the 2040 vision for the electricity sector.

Existing Sectoral Mitigation Strategies

Prior to the adoption of the Climate Act, the state had existing policy mechanisms and programs in place working to achieve electricity system decarbonization, including NYSERDA's extensive procurement programs for land-based and offshore renewable resources. Many of these efforts continue and have been expanded upon where necessary to meet the increased goals in the Climate Act. For instance, in the Fall of 2020, the PSC implemented key provisions to align the Clean Energy Standard (CES) with the Climate Act and provide NYSERDA with the authorization to procure the renewable energy needed. These provisions included increased annual Tier 1 renewables procurement targets for NYSERDA to align with the 70 by 30 mandate, the adoption of the 9 GW offshore wind procurement target, and the creation of Tier 4 which looks to deliver renewable energy to New York City. Confirmed in the Order, NYSERDA procurement totals for Tier 1 will need to average almost 4,500 GWh annually over the 2021 to 2026 period to meet the 2030 Target (which includes calculation for load growth). These polices and procurement targets will be updated and adjusted over the course of the next decade by both NYSERDA and the Commission. The Climate Act requires the Commission to undertake a biennial review of the CES program adopted to meet both the 2030 and 2040 Targets, so that the Commission can adjust Program requirements as necessary.

In addition, the state also has environmental policies in place to address GHG emissions from the electricity sector. While Part 242, the CO_2 Budget Trading Program, or RGGI, implementing regulations have been in place since 2009, the most recent revisions extended the cap reductions out to 2030. In addition to reducing the RGGI cap by 30%, New York expanded the compliance obligation under these revisions to units less than 25W to pull in peaking units 15MW and larger. DEC also regulates, new, modified and non-modified existing major electric generating facilities under Part 251, CO_2 Performance Standards for Major Electric Generating Facilities. The most recent revisions to Part 251 were critical to ensuring the state met its commitment to eliminating coal from the electric generating sector by 2020. The regulations also ensure that any new and/or modified sources meet stringent CO_2 emissions standards.

Under the Clean Air Act, DEC has also been permitting and regulating emissions of co-pollutants from power plants for over 30 years to address the local and regional impacts from the emissions of particulate matter, NO_X, and SO_2.

While these primary policies and programs are established and set to deliver, there are also a number of additional enabling actions, described within, that can further facilitate achievement of the goals of reduced electricity sector emissions and increased penetration of renewable energy.

Current DEC regulations that target emissions of fossil fuel-fired facilities include:

- **Subpart 227-3 –** The "Peaker Rule" – Ozone Season Oxides of Nitrogen (NO_x) Emission Limits for Simple Cycle and Regenerative Combustion Turbines (peakers). Contains ozone season NO_x emission limits for affected sources for calendar years 2023 and 2025. Also contains provision to extend the compliance dates if NYISO or Local Distribution Owner determine there is a reliability need. Regulations adopted in early 2020.
    - For 227-3, the primary pollutant of concern is NO_x because the peakers regulated are an order of magnitude dirtier than clean combined cycle units. From a climate perspective the targeted peakers represent less than 3% of the CO_2 from all regulated electric generating units.
- **Part 242** – CO_2 Budget Trading Program. Part 242 is New York's regulation for implementing the RGGI program. The regulation was recently revised in December 2020 to further reduce the CO_2 emissions budget or cap by 30% through 2030 and expand applicability to peaking units. Another regional program review is scheduled to begin toward the end of this year.
    - Due to the recent expansion, Part 242 now covers more peaking units of 15 MW and above (previously 25 MW and above).
- **Part 251** – CO_2 Performance Standards for Major Electric Generating Facilities. The Department adopted revision to Part 251 to establish CO_2 emission rate limits for non-modified existing electric generating facilities. The current emission limits are 1,800 lbs/MWh or 180 lbs/MMbtu. The regulations were adopted in 2019.
    - Part 251 created CO_2 emission rate limits. Though this regulation helped to retire the last of New York's coal plants, currently all peaking units meet those rate limits.

Key Stakeholders

Key stakeholders include NYSERDA, DPS and the Commission, DEC, NYPA, LIPA, the NYISO, utility owners and operators, and both fossil and clean energy generation owners and operators. These groups will have to work together to ensure an effective and efficient transition to a zero-emissions electricity grid, while maintaining reliability and cost-effective implementation.

13.2 Key Sector Strategies

The key strategies within this sector are organized into three themes, as shown in Table 11.

Table 11. Electricity Sector Key Strategies by Theme

Theme	Strategies
Transforming Power Generation	E1. Retirement of Fossil Fuel Fired Facilities E2. Accelerate Growth of Large-Scale Renewable Energy Generation E3. Facilitate DG / DERs E4. Support Clean Energy Siting and Community Acceptance E5. Promote CCA
Enhancing the Grid	E6. Deploy Existing Storage Technologies E7. Invest in Transmission and Distribution Infrastructure E8. Improve Reliability Planning and Markets E9. Advance Demand Side Solutions
Investing in New Technology	E10. Explore Technology Solutions

Transforming Power Generation

With natural gas currently being the principal fossil fuel source for electricity generation in the state, a significant transformation of the power sector in necessary to meet the Climate Act's requirements of 70% renewable electricity by 2030 and 100% emissions-free electricity by 2040. To decrease the use of emitting fuels in the electricity sector, New York must deploy clean energy resources such as land-based wind and solar, offshore wind, hydropower, and energy storage. While many programs are already in place to support and encourage these types of resources and significant progress has been made toward the 70 by 30 requirement, aggressive deployment of clean resources must continue, and the effectiveness of programs and policies should be continually evaluated.

E1. Retirement of Fossil Fuel Fired Facilities

Currently, to meet daily energy demand, a combination of generation assets is reserved and then dispatched to meet demand at the lowest achievable cost. This combination of resources is called the "supply stack". Typically, renewable generators run whenever they have supply available. "Baseload"

generators are those generators with low per-unit running cost and also serve as the bottom of the supply stack (chosen to run first and most often) – typically these are large nuclear, hydroelectric, and some of the more economic fossil fuel power plants. Other generation is used to meet energy demand beyond that served by baseload plants, which fluctuates throughout the day. When load increases beyond minimum and average daily load, other "peaking" generators have typically been relied upon to provide the final megawatts in the supply stack. These peak generators are typically the most expensive and polluting units on the system (on an emission rate basis). Peaking generators may also be needed in certain load pockets where energy delivery into the pocket may become congested, requiring energy to be produced and delivered within the load pocket itself, including areas within sub-transmission and distribution networks. Transitioning to a zero-carbon future requires addressing emissions in all areas of the supply stack, from baseload to peaking facilities.

Only after alternative solutions (or combination thereof) such as storage (of any duration), zero-emissions resources, transmission upgrades or construction, energy efficiency, or demand response, are fully analyzed and determined to not be able to reasonably solve the identified grid reliability need, shall new or repowered fossil fuel-fired generation facilities be considered in order to meet DEC emissions reduction regulations. Fossil fuel-fired generation facilities should only be considered if:

- The NYISO and local transmission operators confirm that the fossil fuel-fired facility is required to maintain system reliability and that need cannot be met with any zero-emissions alternatives or combination of zero-emissions alternatives (above).
- A fossil fuel-fired generation facility results in:
    - A greater integration of zero-emissions resources
    - A reduction of fossil fuel-fired generation while decreasing GHG emissions and co-pollutants
        - A significant reduction of GHGs and co-pollutants (reduction requirements to be defined by DEC regulations and analysis)
        - A fossil fuel-fired generation facility addresses a specific environmental justice concern (as required by the Climate Act)
        - A fossil fuel-fired generation or low carbon facility provides needed electric system qualities necessary for the reliable operation of the electric system that the alternatives cannot provide.

Additionally, public and stakeholder input must be incorporated into the decision-making process, as required by Article 10 of the Public Service Law. For all situations, a thorough analysis of equity

considerations, as mandated by the Climate Act, should be completed by DEC and any other relevant State agency.

The CJWG is supportive of strategies to facilitate retirement of fossil fuel fired generation facilities, and recommends the CAC take the additional step of placing a moratorium on the permitting of new fossil fuel plants while until the Final Scoping Plan is in place, or until there is a demonstrated system reliability need that can only be addressed with fossil fuel generation.

Components of the Strategy

- **Assessment and Determination of Emissions Reduction Targets:** The PSC, DEC, NYSERDA, and the New York State Energy Planning Board should work in coordination to determine the potential for GHG emission and co-pollutant reductions from fossil fuel generation by 2030 and set a corresponding timeline for emissions reduction targets. The timeline from present to 2030 for possible emission reductions should be determined in conjunction with the renewable energy procurement and interconnection schedule and should represent a continual decline in emissions from present to 2040 while ensuring reliability. The process should include effective mechanisms for input and comments by stakeholders (including but not limited to generators, utilities, and environmental, environmental justice, public health, labor, and electricity consumer advocates and organizations, as well as local communities) and the public. When setting emission reduction targets, consideration should be given to the location and emissions profile from fossil generating units across the state, as well as relevant planning studies from involved organizations (e.g., the Power Grid Study, NYISO reliability analyses, etc.) to inform decisions to address these emissions in the most efficient and effective manner possible. Disadvantaged communities shall be considered when determining the emissions reduction targets, as required by the Climate Act. The effectiveness of the emissions reduction targets and progress towards achieving the 2030 goals shall be evaluated every two years and adjusted accordingly to ensure the subsequent 2040 zero-emissions target is achieved. Reviews should coincide with the requirements in the Climate Act, State Administrative Procedures Act (SAPA) 3-year review requirement and resource planning review (see below).

- **Promulgation of Emissions Regulations:** DEC should assess regulatory options to reduce emissions from fossil fuel-fired generating units to the maximum extent practicable to achieve the mandates and requirements and goals of the Climate Act while maintaining system reliability. Following the above analysis, and in coordination with PSC, NYSERDA and other interested stakeholders, DEC should

examine all potential regulatory options, including new regulations and/or permit requirements or amendment of current regulations and/or permitting requirements, to determine the most efficient, effective and enforceable format to achieve the determined emissions reduction targets and the Climate Act goals. The process should include effective mechanisms for input and comments from stakeholders prior to formal proposal under SAPA, similar to the process used in promulgating the DEC "Peaker Rule," 6 NYCRR Subpart 227-3. Once completed, DEC should follow SAPA in promulgating the identified regulation(s).

  - Consistent with SAPA, the effectiveness of the regulations should be evaluated every two years. This evaluation should coincide with the resource planning review (see below on planning).
  - Coordination of closures and the necessary reliability assessments should take place between State Agencies (e.g., DEC, PSC, NYSERDA) and other key stakeholders (e.g., the NYISO, utilities and fossil fuel facility owners and operators; see below on planning).
  - Evaluation of GHG emissions and co-pollutants, benefits, reliability needs, cost, and available replacements (and their subsequent impacts) must be executed (see below on planning).
  - Specific focus should also be given to emissions of co-pollutants in disadvantaged and environmental justice communities, as required by the Climate Act.

- **Regular and Transparent Resource Planning:** The New York State Energy Planning Board should commence an iterative planning process in order to support and ensure the achievement of the emissions reduction targets and compliance with the promulgated regulations by DEC. The process should:

  - Be performed every two years and timed to serve as a critical input into future Clean Energy Standard, State Energy Plan and/or Council updates and to coincide with the review of any related regulations or Climate Act requirements.
  - Undertaken in cooperation with the NYISO, DEC, PSC, NYSERDA, and utilities and in consideration of relevant studies by these organizations and requirements of the Climate Act
  - Examine options to reduce or eliminate emissions from fossil fuel-fired generation facilities, including behind-the-meter fossil resources as expeditiously as practicable but not later than 2040, identifying the nature, feasibility, cost and avoided costs, risks and risk mitigants, and impacts on emissions and health as well as reliability. These options may include efficiency, storage, load flexibility, DERs, and transmission and distribution upgrades, among others.

- As part of the resource planning process, undertake planning to address the impacts on communities and workers. Specifically:
  - Assess the revenue impacts on school districts and municipalities of fossil fuel plant closures and ensure adequate funding of the Electric Generation Facility Cessation Mitigation Program as plants are retired[121];
  - Ensure that plant owners are responsible for costs of site remediation;
  - Focus on repurposing these facilities as necessary to take advantage of their location and infrastructure to ensure reliability while meeting the Climate Act requirements;
  - Support a process involving local stakeholders to determine redevelopment of sites as plants are retired.
- Examine options to reduce emissions impacts in environmental justice and disadvantaged communities (see Appendix X for details).
- Investigate and implement options to develop market mechanisms to assist in the removal of fossil fuel-fired generating facilities from the system. These options include, but are not limited to, the opportunity for carbon pricing and valuing of environmental attributes either within or external to NYISO markets. Specifically, for a clean dispatch program that creates Clean Dispatch Credits (CDC). Emission-free, fully dispatchable assets that dispatch during peak load times would generate CDCs. Consideration should be given to both capacity and per-MWh payment structures. LSEs would be required to procure increasing amounts of CDCs annually to ensure progress is being made. In developing any such market mechanisms, New York must ensure Disadvantaged Communities benefit and not be negatively impacted.

E2. Accelerate Growth of Large-Scale Renewable Energy Generation

As the transportation and buildings sectors transition to electric, the increased demand will impact the amount of renewable electric generating capacity needed to meet the 70 by 30 and 100 by 40 requirements. The state anticipates electricity demand growth of 65% to 80% by 2050, dependent on the scale and timing of electrification and whether there are other clean alternatives for the transportation and building sectors. The level of electrification needed to achieve the GHG emissions reduction requirements will increase overall electric load and shift the system peak demand from the summer to the winter. Given the large amounts of renewables that must be procured and developed to reach the goals, the state needs to incorporate load flexibility and controllability into the electric grid as sectors electrify in order to create

[121] As of April 2021, New York State has appropriated a cumulative total of $140 million for the program.

a more manageable system. New and upgraded transmission and distribution systems will also be necessary to deliver energy from where the generation is located (both upstate and offshore), to where the load demand exists, downstate.

This points to the need for efficient processes to deploy large-scale renewable generation and improved transmission and distribution systems. To achieve this, the state has administered successful Clean Energy Standard procurement programs that have been adapted over time like Tier 4 which looks to increase renewables penetration in Zone J and Build Ready that prioritizes the pre-construction development of existing but less desirable, abandoned, or underutilized sites for auction, to provide a de-risked project for developers to construct and operate at these locations.

As previously discussed, the October 2020 Clean Energy Standard increased the number of renewables to be procured in order to meet the Climate Act goals. NYSERDA's current procurement programs including Tier 1, Offshore Wind, and Tier 4, will expand and continue to procure the renewable energy needed to reach these requirements, and a zero-emissions grid. The State also recently created a dedicated ORES to streamline and expedite the siting of major renewable energy projects. The state also participates in existing planning processes related to transmission projects and recently identified the need for several competitive project solicitations through the NYISO Public Policy Transmission Planning Process. Two of those projects are now under construction.

The CJWG is generally supportive of accelerating the deployment of large-scale renewable energy systems, however they also stress the need to balance this approach to large-scale renewables with significant investment and technical support for Disadvantaged Communities to develop behind-the-meter microgrids to reduce grid strain, increase resiliency and affordability, and diversify the state's energy portfolio. The strategies included in this draft Scoping Plan are aimed at doing just that and the need for support for underserved, LMI, and environmental justice communities has been emphasized in the strategies related to DG and CCA.

Components of the Strategy

- **Evaluate and adjust:** The State should continue to evaluate and adjust policies and procurement targets as necessary in order to achieve the Climate Act requirements and goals and deploy renewable energy systems including solar, land-based wind, and offshore wind.
- **Support successful programs:** The State should continue to support successful programs and regulatory changes, such as Build Ready and the Accelerated Renewable Energy Growth and

Community Benefit Act through funding and hiring adequate staff in the ORES and other relevant state agencies (such as NYSERDA, DPS, DOS, and DEC) to ensure a rigorous but efficient and timely procurement and permitting process.

- **Identify facilitating transmission and distribution needs:** The State should identify key transmission and distribution upgrades, improvements, and new line construction needed to deliver renewable energy from where it is built, to where it is needed in compliment with other transmission and distribution activities described later.
- **Establish permitting goals:** ORES should establish a non-binding metric or goal with respect to megawatts of renewable energy that should be permitted each year in such an amount that compliments the Tier 1 request for proposals procurements.
- **Explore:** The State should explore additional areas of openness and engagement with the NYISO and other stakeholders to improve the interconnection/Class Year process.[122]

E3. Facilitate Distributed Generation / Distributed Energy Resources

Clean DG and DERs will continue to be pursued alongside the expansion of large-scale renewables. These resources generate electricity closer to end-users, thereby increasing the efficiency and reducing carbon pollution compared to other generation facilities, as well improving grid resiliency and potentially curtailing the need for costly transmission investments.

DG/DER is also a primary way (alongside energy efficiency) to meet the social equity requirements of the Climate Act. In some areas, clean energy from DG/DERs sources can help to provide some of the reliability attributes that would otherwise be met by running existing fossil fuel generation, thereby improving local air quality. When properly developed, clean DG/DER projects can also allow communities to participate in the process, providing economic development and workforce development opportunities, and bolstering resiliency. Increases in distribution system hosting capacity and the pace of interconnection will be important factors in facilitating deployment of DG/DER.

The CJWG is supportive of this strategy. It suggests that there needs to be a process in place to assure that LMI community solar savings do not conflict, interfere, or in any way prevent access to the other LMI

[122] The NYISO interconnection/Class Year Process is part of the NYISO's Comprehensive System Planning Process that focuses on the NYISO's responsibility to prepare for the impact of expected changes in supply and demand of power on the reliable operation of the New York transmission system over a ten-year period. The NYISO's Interconnection processes enable parties to pursue construction and interconnection of generation, transmission, and load facilities to the New York State Transmission System and Distribution System.

energy savings programs such as the Home Energy Assistance Program. It also flagged the point that when designing incentives, use of grants over tax credits is preferred as tax credits may not be beneficial for LMI consumers. These concepts have been included in the Components of the Strategy section below.

Components of the Strategy

Physical Needs

- **Hosting Capacity:** The State should make proactive and timely investments in local transmission and distribution infrastructure, and associated cost-sharing/allocation associated with the utilities in these upgrades. The State should also accelerate adoption of innovative technologies and programs that increase hosting capacity such as flexible interconnection, hybrid systems and coupling with energy storage or controlled load, smart inverters, and solutions that enable maximum back feeding at the substation level from distribution to transmission as part of the local transmission and distribution planning process.
- **Interconnection:** The State should address the pace of processing interconnection applications and need for right-sizing human resources at utilities to mitigate delays in application processing.

Financial support

- **Rate Design:** The State should consider improvements to dynamic underlying electric rate structures and programs (such as dynamic load management) that provide appropriate price signals to customers to incentivize DER deployment and usage.
- **Compensation:** The State should address improvements to the value of DER stack to more accurately reflect value provided by DERs incorporating the social cost of carbon calculation and avoided transmission costs.
- **Incentives:** The State should target incentives to stimulate high-benefit DER projects (dual-use solar/ag, multifamily housing, heat pumps/geothermal, collective solar projects) and paired with electrification serving LMI and environmental justice communities. NYSERDA should expand the Solar Energy Equity Framework programs, Low Income Community Solar Concept, and Adder for Inclusive Community Solar Projects. The State should ensure that participation in incentive programs is effective for the target audiences (e.g., tax credits may not be as effective for LMI consumers) and does not preclude participation in other programs.
- **Ground-Mounted Siting:** Address resistance and concerns to siting of ground-mounted projects, particularly in upstate and western New York.

- **Rooftop and Parking Lot Solar Permitting:** Need for a streamlined permitting process across authorities having jurisdiction that reduces processing times and soft costs.
- **Zoning:** Provide model zoning laws to municipalities for residential/commercial properties to require new construction be designed as "solar-ready".
- **Resources & Education:** Create or expand on regional discussion forums, between New York, local communities, and projects to connect communities with resources, information, and address local concerns.
- **Aggregations:** Encouraging aggregations of distributed resources will provide additional value for grid management.

E4. Support Clean Energy Siting and Community Acceptance

There is a need to complement the regulatory and procurement processes with multi-pronged approach with communities to support the development and use of information and resources for local communities to make beneficial decisions about renewable energy projects in their community. Strong community communication, engagement, and public outreach will be important for these projects to be possible.

There's also a need for assistance with proactive planning and understanding of how new projects could integrate into existing communities to maximize potential benefits, and for general awareness around renewable energy. Local renewable energy projects can also provide energy cost savings for residents and businesses in the community, local infrastructure development, and job opportunities for area workers.

The CJWG supports finding compromise around local control while achieving state targets and emphasizes the need for community education and engagement to inform New Yorkers about the climate crisis and the benefits of shifting to a clean energy economy.

Components of the Strategy

Clean Energy Development

- **Agrivoltaics:** The State should research and incentivize the viability of agrivoltaics[123] to integrate into the agricultural communities and provide habitat improvement for threated and endangered species.

[123] The co-location of solar powered projects and agriculture.

- **Development Mapping:** The State should develop a Clean Energy Development Mapping tool to help municipal representatives and local communities make informed land use decisions and communicate local wants to developers.
- **Fund Planning:** The State should offer state support and funding for Regional Planning Associations to assist municipalities in planning for renewable energy development.
- **Refine NYSERDA Processes:** NYSERDA should continually refine processes, evaluation, and incentives for determining buildable projects and selecting projects for procurement request for proposals.
- **Decommissioning:** The State should study and advise communities on how to best implement options for decommissioning of community-owned projects at the end of their production life.

Public Education and Outreach

- **Public Education:** The State should launch a statewide public education campaign to inform New Yorkers about the climate crisis and the benefits of shifting to a clean energy economy. The campaign should focus on community-based outreach and education on climate science and solutions and could include a K – 12 climate change curricula in schools, supporting non-profits, increasing public awareness about the benefits of renewable energy, connecting people with clean energy programs job training and educational opportunities, and encouraging local and regional land-use and decarbonization planning.
- **Non-profit Outreach:** Based on available funding, the State should provide funding for non-profits and community-based organizations to do education and outreach about clean energy benefits.

Equity & Local Benefits

- **Measure and Publish Benefits:** The State should ensure community benefits and avoided costs are tracked in dollars as outlined under the Climate Act and that this information is accessible through a platform such as Open NY.
- **Cooperative Structures:** The State should determine who needs benefits and then create municipal/cooperative structures in Disadvantaged Communities, as well as examine laws regarding cooperatively owned enterprises and establish consumer protections in this new market.
- **Host Benefits:** NYSERDA should make host community benefits more robust and targeted (such as NYSERDA's Host Community Billing Program).

- **Local Government:** NYSERDA should empower local governments to take a leadership role in educating the community in clean energy.
- **Streamline Incentives:** Based on available funding, NYSERDA should expand and streamline incentives for energy efficiency, including funding for customers based on utility payment history instead of credit scores.
- **Weatherization:** Based on available funding, NYSERDA should invest in local weatherization assistance and energy efficiency programs.
- **Broadband:** Enable host towns to speed up rural broadband expansion.
- **Climate Resilience Hubs:** The State should incentivize local "climate resilience hubs," a central location that has solar and storage and becomes a location the community can gather during power outages.
- **DCAS:** Improve New York City Department of Citywide Administrative Services for more renewable energy projects.
- **Loan Loss program:** The State should create a loan loss reserve program.
- **Subscriber Benefits:** The State should create a benefits program for LMI community subscribers.

Commercial Rooftop & Parking Lot Solar

- **Rooftop / Parking Lot Solar:** The State should conduct further analysis to identify and implement effective ways to build economic or incentive structures to increase development of commercial rooftop and parking lot solar installations paired with storage to take advantage of the available space, especially in urban areas.

E5. Promote Community Choice Aggregation

CCA programs allow local governments to make bulk power purchases on behalf of participating homes and businesses in their jurisdiction, making it easier for residents and employers to benefit from local clean energy projects, while also improving project economics and advancing the Climate Act goals. Connecting homes, businesses, and community institutions with clean energy products and services through CCA programs, microgrids, district systems, and community-scale campaigns encourages adoption of new, innovative technologies to generate value and savings for consumers in an equitable manner.

Most communities that have implemented CCA procure 100% renewable energy as their default supply. When CCAs integrate opt-out community solar, participating homes and small businesses are enrolled in one or more community solar projects from which they receive credits on their electric bill. These credits directly reduce the charges on the bill. Customers who are enrolled in community solar typically receive guaranteed savings of 5% to 10%. Opt-out community solar allows CCAs to enroll hundred, or even thousands of people at once. This significantly reduces soft costs associated with solar and makes the economics of solar all the more attractive. This arrangement has potential to continue the downward trend in solar prices and incentives, while the total amount of solar dramatically increases. Many CCA programs are working to capture the economic benefits of clean energy more broadly. For example, some CCAs have developed opportunities around opt-out community solar, energy efficiency, heat pumps, EVs, demand response, and energy storage.

The CJWG is generally supportive of encouraging local climate action, and more specifically sees CCAs as tools for transformative change in the way consumers connect to and purchase their energy. The group adds that for CCAs to be successful, there needs to be removal of barriers to entry, particularly for lower income households, and safeguards for energy burdened households that may have been the target of previous predatory practices related to their energy bills and services.

Components of the Strategy

- **Support CCA and Community Distributed Initiatives:** NYSERDA should continue to encourage development of CCA programs where communities choose 100% renewable energy as the default supply, and where participants are automatically enrolled in Community Solar. Prioritization of these efforts should be focused on Disadvantaged Communities.
- **Expand CCA Eligibility:** Within a year, DPS should enable county governments to authorize and form CCA programs with local opt-out.
- **Enable Microgrids and District Systems:** Over next 10 years, NYSERDA should work with utilities and campuses to enable the development of microgrids (municipal, schools and private) and district clean energy systems.

Enhancing the Grid

While transformation of the power sector is critical to achieving the state's goals, it also presents the opportunity to make enhancements to the electric grid. Enhancements can improve the efficiency and delivery of electricity, facilitate the integration of renewable energy, and prioritize clean resources consistent with the Climate Act.

E6. Deploy Existing Storage Technologies

A portfolio of energy storage technologies will be needed as intermittent renewable energy generation penetration increases. Existing and newer, long-duration, storage will be needed to maintain reliability as the state approaches 2040; however, these technologies will need to be deployed well before 2040 to reach the state's goals.[124]

In 2018, the PSC issued a landmark energy storage order based on the Energy Storage Roadmap. The Order established a 3,000 MW energy storage goal by 2030 and included deployment mechanisms to achieve the target. However, the goal was established based on a 50% renewable target for 2030. The new Climate Act targets will require significantly higher levels of energy storage as exemplified in the recent Power Grid Study which identified a need for more than 15 GW of energy storage. The Order also included $350 million in bridge incentives to accelerate the energy storage market, including solar-plus-storage projects with NY-Sun and another $53 million in RGGI funds. These funds have been almost fully allocated. Though the Order was a significant step forward for the energy storage market in New York, deployment needs are most certainly greater than initially envisioned and these existing programs will be insufficient to meet the expanding need. Improved energy delivery and transmission planning processes and modeling and modification to wholesale market rules to better incorporate energy storage technologies could also help to facilitate the transition to a decarbonized electric grid and help to minimize costs to consumers.

The CJWG was generally supportive of this strategy and suggested prioritization of energy storage to protect Disadvantaged Communities where the resilience need is greatest, which is contained in the components below.

Components of the Strategy

- **Update the Energy Storage Roadmap:** NYSERDA and DPS should update the State's Energy Storage Roadmap, as soon as practicable, to update and revise storage deployment goals recognizing the substantially higher requirements identified in the Power Grid Study.
- **Provide increased funding for energy storage deployment:** As an alternative procurement method to Clean Dispatch Credits, the PSC should consider expanding the CES to better integrate storage or initiate a new docket that establishes new binding targets and creates a dedicated

[124] NYSERDA. Pathways to Deep Decarbonization in New York State. 2020.

funding mechanism similar to the CES for storage as soon as practicable and no later than the end of 2022. Funding should be prioritized to projects that are located in frontline communities where the resilience needs are often the greatest.

- **Incorporate energy storage into energy delivery and transmission planning:** Further refined modeling of the future electrical grid is needed to evaluate the potential system reliability needs anticipated for that future grid. The modeling should identify the need for storage resources with longer durations that may develop with technology innovation, to show the true breakdown of potential storage vs. fully dispatchable generation needs.
- **Work with the NYISO:** The State should continue to work with NYISO on market enhancements that facilitate the resource transition, support investment, minimize costs to consumers, eliminate buyer-side mitigation (BSM) for Climate Act resources, and meet reliability.[125]

E7. Invest in Transmission and Distribution Infrastructure

As New York State moves forward in meeting the Climate Act goals there will be a need for investments in New York's transmission and distribution electricity system to allow for the utilization of new resources and to meet growing electric load due to electrification. The scope and nature of these investments are expected to vary depending upon the location and type of energy storage and carbon free generation resources that are added to the system.

The most potent of the GHGs identified in the Climate Act is sulphur hexafluoride (SF6), which is 22,800 times more potent than CO_2 and persists in the atmosphere for thousands of years. SF6 is most commonly used as an insulator in electricity transmission and distribution equipment and its use continues to grow. New York utilities were historically one of the largest emitters of SF6 but are now among the leaders nationwide in reducing leakage rates through voluntary reduction programs. These significant future investments in new transmission infrastructure should include a plan for fully phasing-out SF6 and for transitioning to environmentally friendly and cost-effective alternatives.

The most common current path for transmission to be built in New York is through reliability needs, and Public Policy Transmission Planning process. Curtailed energy or not having enough headroom for renewables is not considered a reliability need so this eliminates this process for building out transmission

[125] BSM is a mechanism used in the capacity market that is intended to prevent bidders from artificially suppressing capacity prices. However, in practice, this can unintentionally favor fossil generators over clean resources.

for the purpose of integrating more renewables. Therefore, continued emphasis on the Public Policy Transmission Planning Process is key to ensuring an electricity system prepared to accept increasing amounts of renewable generation and energy storage resources.

The CJWG is supportive of this strategy, seeing it as key to building out renewables. It suggests the inclusion of additional actions, including to pro-actively identify key transmission and distribution upgrades, improvements, and new line construction needed to deliver renewable energy across the state and maximize the retirement of fossil fired resources. Furthermore, it suggests interconnection be approached through a justice-oriented lens where community-led and community-supported clean energy projects are facilitated and exempt from the sometimes costly interconnection fees that have proved some such projects uneconomic.

Components of Strategy

- **Transmission and Distribution Expansion:** The State should expand electricity transmission and distribution systems to support energy delivery, and, building on the Power Grid Study, continue RD&D and rapid deployment of advanced grid technology to:
    - Alleviate transmission system bottlenecks to allow for better deliverability of renewable energy throughout the state
    - Unbottle constrained resources to allow more hydro and/or wind imports and the ability to reduce system congestion
    - Optimize the utilization of existing transmission capacity and right of ways
    - Increase circuit load factor through dynamic ratings
    - Encourage utilities to accelerate investments in their local systems that will facilitate renewables development and enhancing the electrification of transportation, but also grow safety and resiliency.
- **Strategic Investment**: NYPA, LIPA and utility companies should continue with strategic long-term transmission and distribution investments for expedited projects needed in the short-term (within ~5 years). Utilities should continue investments for local transmission and distribution investments within a utility's footprint, and declare public policy needs in the current NYISO public policy transmission planning process through Federal Energy Regulatory Commission (FERC) Order 1000.
- **SF6 Emissions:** DEC should adopt regulations to reduce SF6 emissions and establish a timeline for phasing out new SF6 equipment. New York should also collaborate with other USCA states to align policies across the country to drive a market shift towards SF6 alternative technologies

nationwide. This will help New York's power grid remain one of the cleanest, lowest emission grids in the country.

- **Hosting Capacity:** The State should focus on increasing hosting capacity with a holistic/top-down approach and to accelerate adoption, while being mindful of the tradeoffs between siting resources in high-cost areas and investments in transmission and distribution infrastructure to reach the most equitable cost option.
- **Renewable Energy Zones:** The State should create a database to track penetration and identify where there may be headroom for Renewable Energy Zones. The database should recommend a process to 1) establish Renewable Energy Zones, 2) determine quantity of renewable energy targeted within each zone, and 3) develop a plan for each renewable energy zone to build sufficient transmission to ensure energy delivery within and out of the zone.
- **Upgrades for Offshore Wind:** The State should conduct further planning and pursue system upgrades on Long Island and in New York City to facilitate 9,000 MW of offshore wind.
- **Multiport Infrastructure:** The State should promote multiport infrastructure investment to support and facilitate the growth of the offshore wind industry in New York. Future offshore wind solicitations should continue to include a multi-port strategy and requirement for offshore wind generators to partner with any of the 11 prequalified New York ports to stage, construct, manufacture key components, or coordinate operations and maintenance activities.
- **Education:** The State should continue engagement, outreach, education, and support for local municipalities, communities, and residents to improve acceptance of energy delivery projects.

E8. Improve Reliability Planning and Markets

Generation resources combined with the transmission and distribution systems, control centers, and wholesale markets provide a continuously operating, reliable system to service New York's electric needs. All of these elements will need to transition and come together effectively to manage the transitioning grid to provide continuity of a reliable power system, while implementing the goals of the Climate Act. A flexible grid also necessitates an interconnected digital system passing data back and forth which increases cybersecurity vulnerabilities and risks. These must be identified and mitigated against.

During the grid transition, several reliability challenges must be successfully managed including resource and resource attribute variety and the anticipation of changing load needs and patterns. Continual study of needs through the NYISO's Comprehensive System Planning Process and expansion of the transmission system to relieve constrained generation pockets will be needed to help increase electric grid reliability during the transition.

With an increasing supply mix comprised of intermittent generation resources the grid will face unprecedented challenges to remain resilient to weather events regardless of the supply resources location. The current system is heavily dependent on existing fossil fueled resources to maintain reliability. To ensure reliability and that generation is available when needed, dual fuel capability currently provides oil back up during periods of high gas and electric demand. To replace these units, dispatchable and emissions-free resources will be needed to balance the system and must be significant in capacity, be able to come on-line quickly, and be flexible enough to meet rapid, steep ramping needs. In addition, markets that incentivize resources with the desired attributes, provide optimal reliable grid management, and are sufficiently flexible to allow for technology innovation will help achieve the Climate Act goals, while ensuring benefits for, and reduced impacts on, disadvantaged communities. This requires several forward-looking market designs that sends the correct price signal at the appropriate time. Effective markets can help to actively facilitate the clean energy transition while supporting reliability and removing barriers to clean energy deployment.

The CJWG generally supports the call for continued efforts to improve reliability and resiliency to extreme weather events and climate change, but suggests that the NYISO and its processes should be more transparent and information better disseminated with local energy advocates. It also suggests that there is a need to address extreme heat vulnerabilities beyond overcapacity to the grid, such as the increased water demand for cooling of power plant systems and the expansion of metal in power lines as a result of extreme heat resulting in sagging power lines leading to an increased risk of tree strike related fires. Furthermore, the group posits that storm hardening infrastructure investments must be first implemented in historically burdened, Black and brown communities, since these communities have less access to cooling for summer storms, heating for winter storms, transportation, or savings.

Components of the Strategy

Planning and Analysis of Needs

- **Continual Evaluation:** The State should conduct established biennial evaluations to assess the state of bulk power system reliability in consultation with the federally designated electric bulk system operator (NYISO) and the state and federally jurisdictional entity the New York State Reliability Council. These evaluations should ascertain if any program adjustments are needed to ensure continued safe and adequate electric service. They should be informed by the review of the State's power system performance in conformance with established operations requirements and by relevant studies including the NYISO's Reliability Needs Assessment.

- **Assessing Climate Change Impacts:** Power system studies and planning should consider analyses to integrate climate change impacts as needed for reliability and resiliency. Studies should reflect that risks and reliability challenges will change over time due to the impacts of climate change and the changes to the power system.

Resiliency

- **Infrastructure Investment:** The State should continue efforts to improve reliability and resiliency to extreme weather events, which will be exacerbated by climate change. This work should include continued infrastructure investment such as: storm hardening, elevating equipment and substations, and moving lines underground. Additionally, design criteria must change over time and must reflect the impacts of climate change as needed. Given the impacts of storms on communities, investment in community outreach to provide effective communication and support from the time of storm preparation through restoration must be made.

Improving Grid Reliability through Markets

- **Market Flexibility:** The State should update the market products, requirements and technology standards needed to maintain reliability over time so that all resources can participate in the market, based on their attributes, to provide the products and services needed for reliability. Undue costs should not be imposed that would impair meeting the Climate Act goals, including creating barriers to renewables. Reliability needs and risks will change overtime and the markets should reflect these changes as well.
- **Market Participation:** The State should work with the NYISO to expand wholesale market eligibility participation rules for new policy resources. The NYISO is in the process of implementing the first part of a Hybrid Storage Model, where hybrid resources will be allowed to participate as two separate resources located at the same site. The current expectation is for a second potentially more versatile "Aggregated" model market design in 2021. The NYISO should also make changes consistent with FERC Order 2222 requirements.
- **Wholesale Market Improvements:** The State should continue assessing opportunities to improve accuracy and granularity of wholesale market energy price signals, including shortage pricing, congestion relief, and peak/off-peak pricing. This should include the evaluation of the inclusion and valuation of ancillary market services in the context of integrating increasing quantities of renewable resources and other products.

- **Support Flexible Resources:** The State should adapt current ancillary service market designs and look to add products that are needed to incent flexibility as needed to efficiently integrate renewables. The NYISO supports markets for energy, ancillary services, and capacity. The fundamental relationship among these markets will likely need to evolve. For example, more revenue will likely shift to ancillary service markets over time as system needs are reevaluated in the context of integrating increasing quantities of renewable resources. This should include proactive development of new products needed, however they should be structured properly to only reflect current system needs to not cause unnecessary costs. A balancing act is needed between developing the products and services of the future while not implementing changes before they are needed.
- **Resource Adequacy:** The State should examine all Resource Adequacy options and continue to improve resource adequacy contribution compensation. Consider alternative market structures of procuring Resource Adequacy. The State should ensure that BSM will not be applied to Climate Act resources and should advocate at FERC for alternatives to BSM that maximize access to the capacity market for public policy resources. The State and the NYISO should investigate how best to include all resources in the capacity markets, with the goal of reflecting energy efficiency and dynamic smart loads in resource adequacy. The State should continue to evaluate the capacity market value of all resource types so that resources are paid for capacity consistent with the value they provide to the grid, and allow fair access to the capacity market for energy limited resources and accurately reflect the value of such resources especially as the need for grid flexibility grows over time.
- **Value Environmental Attributes:** Determine most effective approach to incorporate environmental values in market pricing and/or in policy and investment benefit-cost analysis. Consider improvements to current State programs to incentivize Climate Act resources through mechanisms such as Renewable Energy Certificates, Offshore Wind Renewable Energy Certificates, and storage solicitations. Consider changes and/or augmentation to RGGI program to more fully reflect the cost and impact of emissions as represented in New York policy. Consider if (electric only) carbon pricing in the wholesale markets will help achieve the Climate Act mandates, including a more rapid increase in renewable and storage build out and a transition of the fossil fleet. If carbon pricing is not adopted, consider alternate mechanisms to fully enable Wholesale Markets to support the grid transition. Consider if an economy-wide carbon charge will help achieve the Climate Act mandates. Consider a Clean Dispatch Credit for emission-free, fully dispatchable assets that dispatch during peak load times.

- **Earnings Adjustment Mechanisms (EAMs):** The PSC should initiate a generic proceeding for EAMs to review and evaluate how existing EAMs are working, lay the groundwork and create consistency across the utilities where it makes sense to do so, and consider additional EAMs related to the decarbonization and social equity goals of the Climate Act and the process to do so. This review should be done on a periodic basis, and EAMs should be adjusted as necessary to encourage the needed outcomes.

Support of Distributed Resources and Demand-Side Opportunities

- **Demand-Side Opportunities:** The State should expand demand-side opportunities and opportunities for flexible resources. It is anticipated that demand response resources will play a more critical reliability role in the future as the grid becomes more electrified and the load shape shifts. Demand response can also supply some amount of needed system flexibility without emitting carbon which is consistent with the 2040 Climate Act policy objective. There should be a holistic evaluation of both wholesale and retail demand response programs to identify gaps and opportunities for new programs or program changes to meet the needs of a changing grid. As the grid evolves with state policy, it will become more important that incentives are adequate for the participation of flexible resources in the real-time energy market. An efficient real-time market can create opportunities for resources to compete and meet rapidly changing system needs. The NYISO is evaluating prospective changes to the energy market in the context of its Grid in Transition project.
- **Market Access for Distributed Resources:** Improve access for Distributed Resources and continue improvements to cost causation retail rate price signals through:
    - Continued promotion and improvement of the value of DER Rate Design
    - Continued innovation in DSM and DER programs, with a focus on expanding utility customer enrollment and performance
    - Continued promotion and improvement of Standby rates
    - Increased deployment and efficient use of DER - Continued design and implementation of Distributed System Platforms (DSP) and markets for DER products and services.
- **Availability of Information:** The State should enhance and augment the availability of public information to assist developers in making informed project development decisions.
- **Proactive Advocacy:** Based on available resources, the State should fund expansion of the existing office and team within DPS that systematically focuses on proactive advocacy at NYISO and FERC to provide the necessary resources to DPS to ensure that wholesale markets and planning processes align with Climate Act goals and support environmental justice concerns,

while maintaining reliability. The expanded office should focus on improved coordination with other essential state agencies including NYSERDA and DEC. The office should also monitor the developments of FERC's soon to be created Office of Public Participation and work with both that office and its Environmental Justice senior advisor to assist and support increased participation by low-income New Yorkers at FERC.

E9. Advance Demand Side Solutions

Responsive demand presents an opportunity to optimize for the lowest system cost and most expeditious deployment of both clean supply and demand solutions by reducing the need for electricity, especially during peak hours. As such, responsive demand should be analyzed and appropriately modeled as part of future generation and energy supply to allow for consideration of those modeled impacts on costs and timelines of power generation by decade and incorporated into system planning.

Reducing demand and creating demand flexibility, especially downstate, will yield GHG reductions, criteria pollutant reductions, and health benefits in the near term by reducing reliance on high-polluting peaker facilities. Load management can also help businesses reduce costs and help avoid dual-fueled peaking units from switching to oil during gas demand peaks.

Components of the Strategy

Planning and Analysis

- **Cost study:** DPS and NYSERDA, in consultation with utilities, should complete a study on avoiding or reducing grid upgrade costs through the use of demand response and geothermal, including district thermal systems, especially downstate, with a focus on LMI individuals and disadvantaged communities.
- **Data availability:** DPS, NYSERDA, and the NYISO should identify and make available key pieces of data needed for markets to facilitate the clean energy transition in real-time marginal, average emissions, and/or zonal resource/fuel mix data, as needed from the NYISO and as defined by New York City and pertinent state agencies (a number of assumptions including for imports and exports from other regional transmission organizations and independent system operators must be determined) to facilitate cost-effective implementation of the Climate Act, Local Law 97, and to improve value of DER and demand response programs.

Development of Standards and Tests

- **Appliance standards:** NYSERDA should prioritize state and federal appliance standards and adopt state equipment standards (or advocate for the federal government to adopt standards) that require a universal, standardized communication protocol in electric and heat pump water heaters, as well as in space heating heat pumps, EVs, and in-home batteries.
- **Program participation:** The PSC/DPS should develop standards to enable "opt out" programs rather than "opt in." They should make demand flexibility programs opt-out, not opt-in, as long as standards are developed to ensure that customers will see savings on their bills and so that service delivery is not reduced.
- **Benefit cost analyses:** The PSC should reopen the generic benefit-cost analysis proceeding to update costs and benefits, including Climate Act compliance costs (carbon and other environmental impacts), important non-energy benefits (such as localized health impacts and equity), and inclusion (or lack thereof) of customer cost contributions in order to accurately assess the true value of energy efficiency and demand response while complying with the Climate Act.
- **Equity of rules:** The PSC/DPS should ensure that energy storage does not face double rules and unfair charges. The State should consolidate its permitting rules for energy storage so they can be evaluated in one process. Utility commissions should reexamine their tariffs on energy storage resources and ensure they are applied fairly.

Prioritize under-resourced communities

- **Engagement:** Utilities should engage the community and partner with community-based organizations to learn about communities and identify needs and shared objectives.
- **Funding:** New funding should be directed toward low-income and Disadvantaged Communities and existing funds should be made more accessible.
- **Metrics:** In planning for a sustainable future, New York should work with communities to ensure appropriate metrics to track program success and partner with local governments to establish appropriate consumer protections.

Investing in New Technology

To achieve the 70 by 30 requirement, the focus should be on energy delivery, energy efficiency, and aggressive deployment of existing renewable energy and energy storage technologies. However, the 100 by 40 goal presents significant challenges that cannot currently be met by the deployment of these

existing technologies. Current studies identify that even after full deployment of available clean energy technologies, there is a remaining need for 15 – 25 GW of electricity generation in 2040 to meet demand and maintain reliability, although that gap may change over time.[126] This calls for a focus on identifying and developing solutions for dispatchable technologies that can be called on as needed to balance supply and demand.

E10. Explore Technology Solutions

Whether the answer is new long duration battery technology, RNG, advanced green hydrogen, nuclear, overbuilding of renewable technologies or other new technologies that may emerge due to RD&D efforts over the next two decades, the costs are likely to be high and aggressive action and smart planning will be necessary to make these fundamental shifts in our energy systems in the next two decades. While these actions will be costly, the health, societal, and economic benefits of the transition to clean zero-emitting technologies will be significant. and the cost of inaction or insufficient action will far outweigh the costs of action.

One technology focus moving forward is long duration energy storage. Achieving the Climate Act's high renewable energy, zero-emission electricity system will require substantial amounts of energy storage operating over various time scales – spanning from minutes to hours, days, weeks and even longer – to maintain grid flexibility, reliability, and resiliency.

When it comes to advanced fuels, the prospects are not quite so clear. While they are often touted as flexible and dispatchable resources, many are also unproven at commercial scale. Of particular interest is to ensure historically disadvantaged communities do not see an increase in co-pollutants or reduction in air quality as a result of use of advanced fuel. Therefore, further analysis, technical development, and research is needed in order to determine the feasibility and climate and health impacts of advanced fuels to ensure they provide net benefit.

Nuclear power generation is a complex technology with potential impacts on host communities as well as questions relating to the impacts of nuclear waste on health and the environment. Yet at the same time, nuclear generation provides a significant amount of baseload resources and is carbon-free, providing a complement to the increasing amount of variable generation renewables being added to the grid. Analysis

[126] NYSERDA. New York Power Grid Study. 2021. https://www.nyserda.ny.gov/About/Publications/New-York-Power-Grid-Study

should occur prior to the end of the Zero Emissions Credit program in 2029 to determine whether subsidizing any of the state's remaining nuclear reactors will be necessary for meeting the 2040 emissions mandate and/or whether more cost effective and environmentally friendly alternatives are available. The analysis should consider the ability of nuclear to contribute to baseload and meet reliability requirements, as well as cost, health, safety, community impact and environmental concerns of nuclear power generation.

The CJWG supports the near-term focus on achievement of 70 by 30 via deployment of currently available solutions. However, it expresses strong concern about the promotion of some emerging technologies, including green hydrogen, RNG, biofuels, biomass, and waste-to-energy, which it claims can add more GHGs to the environment rather than less, and also leads to more localized pollution which is concentrated in environmental justice communities. The CJWG highlights the need for further research and consideration of lifecycle GHG accounting and potential air quality and health impacts of these technologies prior to supporting demonstration projects. The CJWG also recommends a lifecycle analysis of the environmental, health, safety, emissions, and environmental justice impacts of nuclear fuel be conducted and the state proactively plan for the scheduled shutdown of the four reactors upstate.

Components of the Strategy

Solutions for Dispatchable Technologies

- **Determine technologies:** NYSERDA should identify, explore, evaluate, and develop dispatchable technologies and solutions as they emerge. This should focus on solutions known to be desirable.
- **Modeling:** NYSERDA should conduct detailed, holistic, modeling within a zero-emissions world. Modeling should include holistic integration of load, generation, and energy delivery, and be flexible in the solutions chosen. While modeling is being completed, the State should move forward with known needs.
- **Support innovation and demonstration projects:** NYSERDA should act as a hub for technological innovation and convene stakeholders and conduct strategic research on new renewable and storage project technologies. NYSERDA should work with a consortium including but not limited to the NYISO, utilities, developers, and solution providers to bring technologies to large-scale deployment faster and more cost-effectively. This includes support for utility-scale demonstration projects for new technologies, including storage and transmission and distribution.

- **Federal resources:** The State should advocate for, and leverage, Federal and National Laboratory resources focused on identifying and commercializing advancements in transmission and zero carbon dispatchable long duration solutions.
- **Market enhancements:** The State should continue market enhancements that better align the markets with the Climate Act to encourage the innovation that will support achievement of the 2040 requirements. Market solutions are important to support investment, minimize the cost to consumers and support reliability.
- **Long-duration energy storage:** NYSERDA should focus programs and funding on research and demonstration projects for the development of large scale and longer duration storage. The State should develop and expand a Storage Center of Excellence so that new technologies can be matured and deployed on the grid for large scale testing, as well as attract and engage relevant parties in collaborative efforts to address the challenges unique to long-duration storage.

Advanced Fuels:

- **Prioritization:** During planning, prioritize emissions-free resources (such as storage, energy efficiency, and renewable energy) where feasible when considering end-uses, technology limitations, impacts, and costs. However, should a substitute for natural gas still be needed, advanced green hydrogen and possibly RNG could fill this gap in order to maintain reliability, if scalability, feasibility, and environmental impact and air quality issues can be addressed.
- **Define emissions free:** DPS and DEC should begin a stakeholder process to define "emissions free" compliant with the Climate Act for advanced fuels.
- **Analysis of impact:** Further analysis, technical development, and research is needed in order to determine the feasibility, climate impact, and health impacts of advanced fuels prior to infrastructure investment. Technological innovation, development, and scaled-deployment is needed in order to prove the effectiveness and economics of the technologies.
    - Determine the lifecycle GHG accounting framework of RNG and advanced green hydrogen. Priority utilization should be provided for feedstocks with the lowest GHG emissions, with strong preference given to zero- or negative-emissions sources.
    - The potential air quality and health impacts of producing and using these fuels and best practices/end-uses to minimize these impacts.
    - The safety of advanced green hydrogen, storage, and pipeline operation.

Nuclear Generation:

- **Evaluate the need:** The State should evaluate the contribution of nuclear power to the 2040 resource mix and any additional policy actions needed prior to the cessation of the Zero Emissions Credit program in 2029.
- **Public input:** If public policy mechanisms are proposed for the continuation of nuclear power generation, effective mechanisms for input and comments by stakeholders and the public should be implemented to include but not be limited to representation from customers, environmental interests, environmental justice communities, labor, local communities and indigenous communities).

Chapter 14. Industry

14.1 State of the Sector

Overview

The Industry chapter of the Scoping Plan contains New York's strategies for mitigating the direct GHG emissions attributable to certain industrial activities within the state. In general, the sectoral strategies in this chapter target the direct, on-site emissions that originate from stationary sources in sectors including manufacturing, mining and quarrying, where such emissions are not already addressed separately in the draft Scoping Plan.[127] Strategies for addressing emissions from the oil and gas sector are discussed in Chapter 18, Gas System Transition.

With a combined total of about 442,000 jobs, these sectors comprise about 5.5% of all non-agricultural private sector employment in the state.[128] Each sector is described in additional detail below.

Emissions Overview

Industrial emissions made up 9% of statewide emissions in 2019, including emissions from methane leaks and combustion from the oil and gas system in New York (45%), the direct combustion of on-site fuel (27%), emissions from imported fuels (20%), and non-combustion industrial processes (6%).

[127] As an example, the sectoral strategies in the Industry chapter do not address the indirect emissions associated by industry's use of electricity or transportation vehicles.

[128] Economic Modeling and Statistics Int'l – NYS DOL Quarterly Current Employment and Wages (QCEW) 2019.

Manufacturing

Manufacturing-based GHG emissions addressed by the strategies in this chapter are those associated with the combustion of fossil fuels and non-combustion industrial processes in the production of goods. In total, there are approximately 437,000 manufacturing jobs in the state[129], with the largest share of GHG emissions created by the production of food, paper, bulk chemicals, glass, cement, metals, semiconductors, wood products and plastics.

As described in Section 2 of the draft Plan, most emissions in the manufacturing sector come from a small subset of what are known as energy- or emission-intensive and trade-exposed industries, causing emission mitigation strategies in this chapter to emphasize approaches that are less likely to result in emissions and economic leakage.

Mining and Quarrying

Mining and quarrying activities produce stationary source GHG emissions primarily from grinding equipment and diesel-powered material handling and moving equipment. There are approximately 4,000 mining and quarrying jobs in the state, most of which are concentrated in construction sand and gravel mining, and stone mining and quarrying.[130] Only a small share of the state's GHG emissions are produced by mining and quarrying activities, some of which also occur within energy- or emission-intensive and trade-exposed industries and are thus addressed in these strategies similarly to manufacturing activities.

Industrial Sector Considerations

In formulating sectoral strategies for Industry, the draft Plan reflects several considerations specific to industrial emissions. The heterogenous nature of industry, and the resulting need for customized solutions on an industry-specific and even factory-specific basis, may result in higher cost per ton of emissions reduced than larger-scale measures in other economic sectors such as power generation or transportation. Additionally, energy- or emission-intensive and trade-exposed industries are likely to represent a high share of industry sector emissions. These industries are both highly sensitive to increases in the cost of energy or emissions, as well as limited in their ability to pass along higher costs to consumers due to trade competition. As a result, non-incentive-oriented approaches are likely to cause leakage, whereby

[129] Economic Modeling and Statistics Int'l – NYS DOL Quarterly Current Employment and Wages (QCEW) 2019.

[130] Economic Modeling and Statistics Int'l – NYS DOL Quarterly Current Employment and Wages (QCEW) 2019.

businesses leave or avoid the state and locate in other jurisdictions where they can emit higher levels of GHGs than they would have had they remained in the state. This results in less economic activity in the state but may achieve no progress on reducing global emissions; in fact, it may increase emissions overall. The Climate Act requires that the Scoping Plan include mechanism to limit emissions leakage, some of which were developed by the JTWG and are described in Chapter 7, Just Transition.

Near-term emission reduction opportunities in industry are likely to come primarily from energy efficiencies and some limited electrification for lower temperature processes. Greater emissions reductions (via the use of carbon capture, low-carbon fuels, or other) will likely occur in the longer term as innovation takes place and technologies scale, mature and become more viable. However, significant opportunities for emission reductions currently do exist in industry and can be achieved primarily through increased organizational focus on energy management and efficiencies.

Vision for 2030

The pathway to reducing emissions in the industrial sector between the present and 2030 will involve the following four pillars: energy efficiency, switching to low carbon fuels, decarbonizing the electricity supply, and negative emissions. Achieving the state's Climate Act requirements and goals are expected to require the industrial sector to embrace solutions within each pillar over time as new technologies and innovative solutions are developed.

The Climate Act established an economy-wide 40% GHG emissions reduction requirement relative to 1990 levels and a goal of statewide energy efficiency of 185 trillion British thermal units energy reduction from the forecasted 2025 energy demand. Industry's contribution to meeting these targets would be primarily with continued investment in energy efficiency and some limited electrification within the sector. Energy efficiency has been embraced by the manufacturing sector because it is one of the most cost-effective methods for reducing its GHG emissions. Due to the potential to reduce the amount of energy that must be purchased, and thereby saving money, efficiency measures may at times be able to pay for themselves without government subsidy. Specific efficiency measures can include upgrading motors and drives, making operational changes to improve compressed air efficiency, and adopting smart manufacturing methods and strategic energy management principles. Due to the heterogeneity of the industrial sector, energy efficiency solutions will need to be customized to address specific needs.

Vision for 2050

To meet the Climate Act requirement of an economy wide 85% reduction in GHG emissions by 2050 relative to 1990 and the goal of net zero emission across the economy the pillars of a decarbonized electricity supply and negative emissions will play a more significant role in the industrial sector. Most industrial facilities need high temperature heat in their manufacturing process, and solutions to reduce emissions from industrial heat could include green hydrogen and/or other low-carbon fuels, as well as carbon capture, use and storage. A few of these solutions are at the early stage of development and will require investment in RD&D to prove at scale and advance to market. To reduce emissions in the industrial sector by 2050, three mitigation strategies have been identified.

Existing Sectoral Mitigation Strategies

Mitigation strategies are those that directly reduce emissions or sequester carbon. The state has already adopted several mitigation strategies that address industrial GHG emissions. NYSERDA, NYPA, and ESD each offer programs in this area, while DEC employs a regulatory approach.

NYSERDA offers support to industry through a variety of programs, with a goal to promote energy efficiency, GHG emissions reduction, and the deployment of renewable energy. Programmatic support can be broadly categorized into four areas: Technical Assistance and Training; Equipment Incentives; Competitive Grants; and RD&D Support. An example of one of NYSERDA's programs is its Strategic Energy Management Program, through which it offers training to industrial facilities to help optimize energy use through a continuous improvement approach.

NYPA's mission is to lead the transition to a carbon-free, economically vibrant New York through customer partnerships, innovative energy solutions, and the responsible supply of affordable, clean, and reliable electricity. NYPA Energy Services programs develop projects in the areas of energy efficiency, EVs, DERs, such as solar and storage, smart street lighting, data driven energy reduction, as well as support other clean energy initiatives.

ESD offers financial assistance (loans, grants, tax credits, venture investments) to incentivize industry in exchange for investment or job commitments, as well as technical assistance to conceive and scale disruptive technologies. For example, ESD's Division of Science, Technology, and Innovation encourages greater collaboration between private industry and universities in the development and application of new technologies, including alternative energy systems. Another ESD program is New

York Ventures, the state's innovation venture capital fund that provides seed and early-stage venture capital funding to support and attract new high-growth businesses.

DEC, as a regulatory agency, reviews air pollutant permit applications for new industrial facilities and significant modifications to existing facilities to ensure that the proposed actions are not inconsistent with and will not interfere with the attainment of the statewide GHG emission limits established under the ECL.

Key Stakeholders

Engaging stakeholder input is critical in the implementation of the various strategies to ensure the solutions will have the intended impact and meet the needs of the market. Included in the dialogue should be entities such as but not limited to state agencies and authorities, individual manufacturers and other affected businesses, environmental justice and other advocacy organizations, environmental professionals, and business groups and trade associations.

14.2 Key Sector Strategies

There are eight key strategies highlighted in this sector, as shown in Table 7.

Table 12. Industry Sector Key Strategies

Strategies
I1. Financial and Technical Assistance I2. Low Carbon Procurement I3. Workforce Development I4. Research, Development, and Demonstration I5. GHG Reporting I6. Economic Incentives

I1. Financial and Technical Assistance

The industrial sector is confronted with many barriers and other challenges to implement emission reduction strategies, the most significant of which include risk aversion that solutions will interrupt manufacturing processes, lack of in-house expertise in new technologies, lack of time to commit to energy savings solutions, lack of trust that the solution will deliver the intended benefits, and intense competition for internal company capital. The state should help overcome these barriers by providing technical and financial assistance in implementing various solutions for decarbonization. Specific solutions could include NYSERDA's engineering study support, financial incentives to buy-down project costs, and leveraging NYPA's low-cost clean hydropower.

Implementation of this mitigation strategy would continue from the present until 2050. Most emissions reductions prior to 2030 will be achieved through energy efficiency and low-temperature electrification. As technology advances, support through this mitigation strategy will further enhance emission reductions by 2050 through other means.

The transition for Industry to decarbonize and embrace new technological solutions will take time and require state support. Providing clear market signals of long-term commitments would bolster industry confidence in decarbonizing the sector.

Directing state assistance towards reducing industrial emissions in disadvantaged communities would be supported by the CJWG. Additionally, the CJWG noted that emissions reductions strategies for Industry do not mention regulation to drive down industrial emissions as close to zero as is technically possible. Additional regulation on industrial sources must be carefully considered within the Climate Act requirements to limit emissions leakage.

Components of the Strategy

- **Efficiency and decarbonization programs:** The PSC should continue to support and approve of funding for development of programs that embrace energy efficiency, electrification and decarbonization. State programs administered by NYSERDA and investor-owned utilities should be complimentary and coordinated to maximize market impacts.
- **Low-cost power programs:** The State should continue to provide qualified industries and businesses with lower electric energy cost through allocations of NYPA power.

I2. Low Carbon Procurement

Another strategy that has been identified to reduce emissions in the industrial sector is to create state procurement incentives so that manufacturers will produce less emission-intensive goods to capitalize on the increased demand for such goods.

The initial focus for this effort should be to incentivize the manufacturing of lower carbon building materials, such as cement, steel, and aluminum. The public sector purchases a large proportion of building materials produced in the market. This enables the state to exert significant influence on the producers of building materials to develop low-carbon options across its entire range of products. At the same time, the standards for verifying what constitute a low-carbon product are relatively well established for these types of materials.

At present, about 28% of annual emissions associated with buildings can be allocated to the use of construction materials, primarily emissions associated with the production of concrete and steel, as well as aluminum, glass, and insulation material.[131] Demand for greener building materials from the private sector will spur manufacturers to reduce the embodied carbon in their products. However, there is an opportunity to accelerate the growth of this demand via public procurement directives, given that nearly 50% of all cement and 20% of all steel that is purchased in the U.S. is paid for with tax dollars.[132]

There are many available pathways to offer advantages to providers of these low-carbon materials in the public procurement process. The state of California's Buy Clean program, for example, created a system in which selected building materials—structural steel, concrete reinforcing steel, flat glass, and mineral wood board insulation—used in public projects would need to meet minimum GWP standards.[133] Another option to enable low-carbon material procurement is to discount bid prices submitted for public work projects if the bidders are utilizing building materials with low GWP. Both houses of New York's Legislature recently passed a bill that instructs the Office of General Services (OGS) to examine available incentives, including bid discounts, to encourage the use of low embodied carbon concrete in state agency projects.[134] The exact method of supporting procurement of low-carbon products should be established through coordinated efforts of expert government stakeholders, with the interagency GreenNY initiative, including NYSERDA, DEC, and other state agencies, leading the effort.

Increasing demand for low-carbon building materials with public procurement directives will have a positive impact on the emissions associated with the state's manufacturing sector. Just as the manufacturing sector is generally heterogenous in nature, specific methods of reducing the GWP of a given building material vary by subsector (such as cement, glass, and steel). In general, interventions to reduce the GWP of a building material are identical to reducing overall emissions, and principally include, but are not limited to, more energy efficient production, process changes, greener production inputs, and/or the sequestration or utilization of captured CO_2.

[131] Global Alliance for Building and Construction, Toward a Zero-Emission, Efficient and Resilient Buildings and Construction Sector (2018).

[132] Rebecca Dell, Build Clean: Industrial Policy for Climate and Justice (December 2020).

[133] Buy Clean California Act, accessed Sept. 27, 2021: https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act.

[134] S. 542A, Sess. 2021-2022 (NY 2021). The bill has not yet been signed into law.

The cost implications of providing preferential procurement standards for low carbon building materials are likely to be marginal given the relatively small share of overall project costs that these materials represent. Today, many lower-carbon alternative products already have comparable cost characteristics to legacy materials, and even more advanced methods of drastically reducing the GWP of building materials are unlikely to have a significant impact on costs. As an example, because cement represents only an estimated 1.5% of public construction costs, an emissions reduction intervention that increases the cost of cement as much as twofold would result in only a 1.5% increase in associated public construction costs.

The CJWG supports this strategy, as well as other demand-side approaches, since State procurement preferences for low-carbon building materials can encourage less energy-intensive manufacturing in some sectors. The CJWG also recommended using a "best value" procurement framework to score bids that commit to climate mitigation efforts and related workforce, training, local hire, and apprenticeship programs targeted to residents in Disadvantaged Communities.

Components of the Strategy

Given the public sector's significant share of market demand for building materials and the critical need for increased supply of low-embodied carbon building materials, the state should increase purchases of low-carbon materials to provide manufacturers with an economic incentive to increase supply.

- **Identify carbon intense materials:** First, the interagency GreenNY initiative should develop a list of the most carbon intense building materials and products eligible for incentives or preferential treatment in procurement.
- **Develop standards:** After identification of eligible products, the interagency group should work with manufacturers, trade associations, researchers, and other like-minded states or federal agencies to set standards for determining the GWP of each building material.
- **Provide policy support:** The State should implement policy mechanisms that provide advantages to projects or procurement bids utilizing products that meet or exceed GWP targets.

I3. Workforce Development

The workforce development enabling initiative is intended to expand the state's existing green workforce and focus on training workers on existing decarbonization technologies and on newer solutions as they become available. As of 2019, there were nearly 164,000 clean energy jobs in New York, a 16% increase since 2015. Jobs in this area are expected to continue to grow as skills will be needed for industry to plan, operate, and maintain various clean energy technology solutions.

Industrial companies face several barriers in this area, including the need to invest the time and other resources necessary to provide the training and to maintaining the dedicated in-house expertise to deliver it. However, these barriers can be mitigated by state programs designed to share in the risk of such investment by providing financial support for the training and by developing training programs geared to industry's specific needs. NYSERDA and the State's DOL have a long history of collaborating and delivering successful clean energy workforce development and training programs and can build upon that success to meet the Climate Act requirements and goals between now and 2050.

The CJWG recommends these strategies ensure consideration of individuals in disadvantaged communities in business and workforce development efforts.

Components of the Strategy

The industrial sector will have both short- and long-term needs to train workers to assist in decarbonization. The State should help industry to do this training by taking the following steps:

- **Expand training capacity:** NYSERDA should partner with training organizations and businesses to increase the number of individuals being provided with training, with particular attention to increasing the number of individuals from disadvantaged communities being served by these programs.
- **Update training content:** NYSERDA should work with training organization and businesses, to update training content to prepare workers for jobs with both established and newly emerging clean energy technologies and strategies. This could be accomplished by issuing competitive solicitations, developing strategic partnerships with industry organizations, and supporting training activities that meet industry's specific needs.

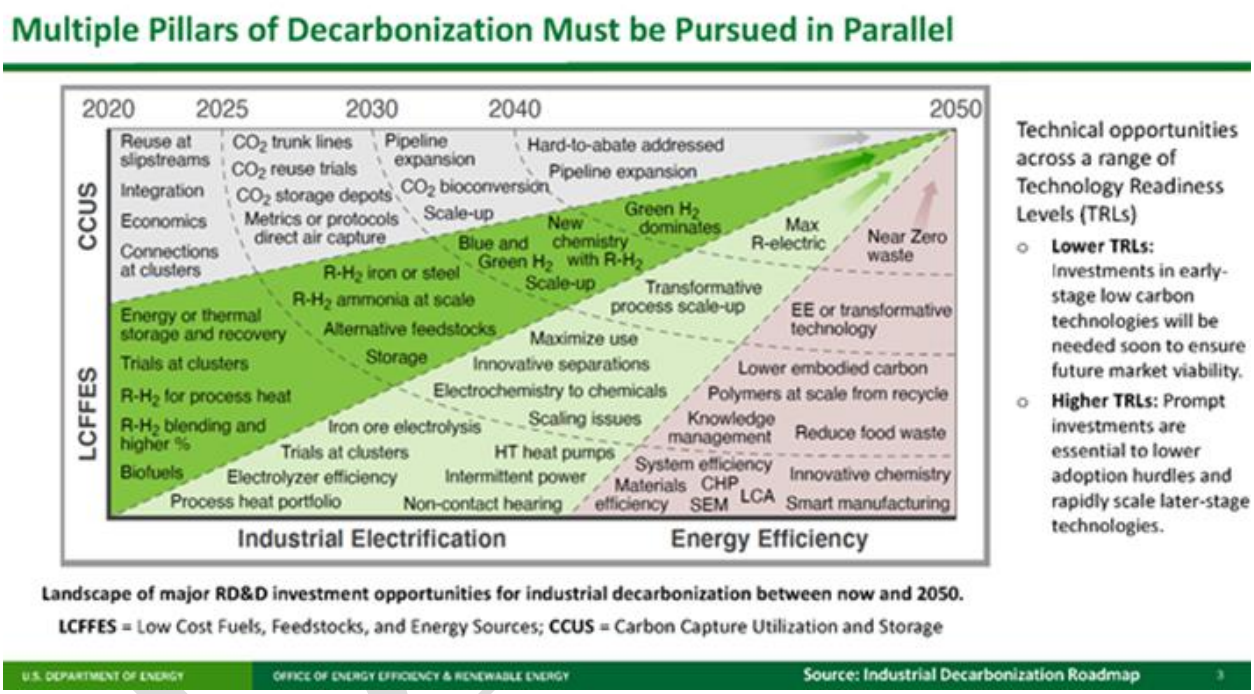
I4. Research, Development, and Demonstration

While currently available market solutions for reducing industrial GHG emissions can help the state's manufacturers make substantial progress in achieving the state's 2030 and 2050 goals, they will not be sufficient. Given the heterogeneity of the industrial sector, the specific solutions for sub-sectors will vary, but they broadly include four main categories:

- Energy efficiency
- Industrial electrification
- Low-carbon fuels, feedstocks, and energy sources
- Carbon capture, utilization, and sequestration

As shown in Figure 52, given current trends, many of the required technologies for deep decarbonization of the industrial sector will not be available in the timeframe necessary for the state to meet its targets. However, the state could speed the deployment of some of these solutions with a robust RD&D agenda. This agenda should be informed by an analysis of which solutions are will have the greatest impact on the state's emissions. This includes impacts on not only the industrial sector, but the buildings, transportation, and power sectors, which are all likely to benefit from advancement of many of these solutions. After this analysis, public capital should be directed at supporting solutions via research funding as well as pilot and demonstration projects.

Figure 52. Pillars of Decarbonization



Source: Industrial Decarbonization: Opportunities and Challenges. CEC Workshop to Accelerate Industrial Decarbonization. August 3, 2021

The CJWG has raised concerns around technology solutions such as carbon capture and storage and hydrogen. The CJWG supports reducing fossil fuel combustion for industrial heat, replacing it with electric heat whenever feasible. The CJWG inquired specifically as to the future use of green hydrogen and made the point that combusting hydrogen has the potential to produce potentially harmful levels of nitrous oxide emissions. The CJWG recognized, however, that some industrial high-heat processes may not be electrifiable, and that in these cases green hydrogen is a potential alternative fuel. Identifying, quantifying, and mitigating these types of harmful effects associated with new technologies and approaches to eliminate hard-to-abate industrial emissions will be a necessary, critical concern of future research efforts.

Components of the Strategy

The state can speed the deployment of industrial decarbonization solutions with a robust RD&D agenda. This agenda should be informed by an analysis of which solutions are will have the greatest impact on the state's emissions.

- **Develop a scope of work for research:** NYSERDA should develop a research agenda for industrial decarbonization solutions. This research should account for impacts on not only the industrial sector, but the buildings, transportation, and power sectors, which are all likely to benefit from advancement of many of these solutions
- **Issue a solicitation:** NYSERDA should issue a solicitation for third party services to conduct research and provide recommendations on the most appropriate areas for investment in emerging industrial decarbonization solutions.
- **Provide funding for research and pilot/demonstration projects:** Based on the results of the analysis, NYSERDA should work to provide funding to optimally scale identified solutions.

I5. Greenhouse Gas Reporting

The ECL requires DEC to consider establishing a mandatory registry and reporting system for individual sources to obtain data on GHG emissions that exceed an established threshold.[135] DEC should promulgate regulations to establish a GHG registry and reporting system. The system should include sources that currently report emissions to DEC on an annual basis and would expand the universe of facilities that are required to report their annual emissions data to DEC by establishing a reporting threshold that is lower than what currently exists.

Having a more complete picture of the amount of GHGs emitted from a larger percentage of facilities would allow for a more focused effort to reduce GHG emissions from existing industrial sources, which can often be accomplished by reducing fuel combustion. Since fuel combustion also releases other contaminants, including hazardous air pollutants, the communities in which these facilities are located can be expected to experience improved air quality and health outcomes.

The registry and reporting system would allow DEC to collect, review, and make publicly available the submitted GHG emissions data. Facilities required to report GHG emissions to the new system would be responsible for the costs involved in generating the data and reporting it. Reporting of GHG emissions by

[135] ECL 75-0105(4).

industry and verification of reported GHG emissions would not be expected to vary significantly from methods used by the agency for other pollutants and DEC should attempt to align, to the extent possible, the new reporting requirements with existing DEC and EPA programs.

Components of the Strategy

- **Develop internal draft of GHG reporting regulation:** DEC should promulgate regulations to establish a GHG reporting program. When developing the regulatory program, DEC should evaluate existing online reporting systems such as those established by EPA and the California Air Resources Board. DEC should work with the state's Office of Information Technology Services to develop an on-line electronic reporting platform for this regulatory program.
- **Provide training to regulated entities:** DEC should work with impacted facilities to ensure information exchange and to ensure that applicable reporting requirements are clearly understood.

I6. Economic Incentives

The state should continue to develop an in-state supply chain of green economy businesses by offering economic incentives like loans, grants, tax credits, technical assistance programs, or even venture capital investments.

One of the most prominent economic incentives that the state can use in attracting these businesses is the enhanced Excelsior Jobs Program for green economy companies that make products or develop technologies that are primarily aimed at reducing GHG emissions or supporting the use of clean energy. This program awards refundable tax credits to green businesses that commit to hiring workers, undertaking research and development, or making capital investments in the state, with credits provided only after-the-fact under a pay-for-performance model.

NYPA has several economic development programs that support industry, other businesses, and not-for-profits in the state. These programs provide either project funding or low-cost power, including hydroelectric power, primarily in exchange for commitments to retain or create jobs and invest capital in the state. An example of a NYPA financial assistance program is ReCharge New York, a program through which NYPA provides low-cost hydroelectric power to businesses and not-for-profit organizations throughout the state in exchange for investment or job commitments. In late 2020, NYPA adjusted the criteria for evaluating economic development awardees to include the applicants' support of green jobs and manufacturing in the New York.

Directing state assistance towards developing green economy businesses in disadvantaged communities would be supported by the CJWG.

Components of the Strategy

Green economy industries are poised for significant growth. Anchoring an in-state supply chain of growing green businesses will help the state meet its climate goals while also attracting new investments and jobs.

- **Offer economic incentives:** These incentives should operate to secure green economy attraction and expansion projects. Implementation should include engagement with green economy businesses to identify potential in-state economic opportunities, engagement with awardees and suppliers of state green procurements to discuss potential in-state economic opportunities, and coordination with state partners to identify all relevant incentives.
- **Implement complementary initiatives:** These initiatives should focus on growing the workforce, supplier base, and market demand that will increase the state's attractiveness as a location for these new green businesses.

Chapter 15. Agriculture and Forestry

15.1 State of the Sector

Overview

Agriculture and forestry encompass multiple economic sectors including livestock, crops, dairy, timber, wood products, and bioeconomy products. GHG emission sources include forestry equipment, livestock, cropland, forest fires, decomposition of dead trees, and development of agricultural and forest areas. The Agriculture and Forestry sectors are also significant carbon sinks, having the ability to pull CO_2 out of the atmosphere and store it in trees, plants, and soils. Additionally, these sectors have the potential to drive emission reductions outside of the state by reducing the demand for imported goods and providing substitutions for more fossil fuel-intensive products. The strategies described in this chapter address GHG emissions mitigation for these sources as well as carbon capture (or sequestration) primarily through the growth of trees and other plants, but also through well managed and healthy soils. Maximizing the carbon sequestration potential in the agriculture and forestry sectors is a key strategy for achieving the Climate Act goal of net zero emissions across all sectors of the economy by 2050.

Vision for 2030

In contributing to the statewide 2030 GHG emissions reduction requirement, the agricultural sector will execute actions to reduce methane and nitrous oxide emissions. To reduce methane and nitrous oxide emissions, the agricultural sector will implement recommendations for livestock operations and cropland management. Both the agriculture and forestry sectors will undertake measures to facilitate broad carbon sequestration. Actions to maintain and increase carbon storage and sequestration on the land base in New York and in agricultural and forestry products through the avoided conversion of farm and forest lands, afforestation and reforestation, improved forest management practices, cropland management practices (such as soil health management practices), and the long-term storage of carbon in harvested wood products (such as mass timber) will achieve approximately 30 MMT CO_2e net sequestered. This chapter will focus on specific management practices, and Chapter 16, Land Use, will discuss strategies related to avoided conversion and afforestation and reforestation.

Vision for 2050

The 2050 goal of the Climate Act is to achieve net zero GHG emissions statewide and a required 85% reduction in GHG emissions. Emissions reductions beyond 85% of 1990 statewide levels can be achieved through approximately 60 MMT CO_2e net sequestration in the Agriculture and Forestry sectors. Additionally, in 2050, agricultural GHG emissions will need to be further reduced from 2030 levels,[136] which will require further development of research, technology, and market solutions where the technical potential has yet to be reached. Support for New York's bioeconomy is recommended to meet the Climate Act requirements and goals and will serve to grow the agriculture and forestry industries in New York by substituting New York-grown and produced products for imported fossil fuel-intensive

Emissions Overview:

Agricultural emissions represented approximately 6% of statewide emissions in 2019 from livestock (92%) and soil management practices (8%). However, agriculture and forestry also provide carbon sequestration benefits and can provide significant contribution towards achieving net zero total emissions from all sectors in the state. For example, the long-term storage of carbon in Harvested Wood Products alone provided 5% of the State's GHG emissions removals in 2019 . These benefits are also described in the Land Use chapter.

[136] Wightman, Jenifer and Woodbury, Peter. 2020. "New York Agriculture and Climate Change; Key Opportunities for Mitigation, Resilience, and Adaptation." Cornell University. https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/2/7553/files/2020/07/CarbonFarming_NYSAGM_FINAL_May2020.pdf

products avoiding , which will contribute to reducing global GHG emissions and increasing sequestration in New York.

Existing Sectoral Mitigation Strategies

New York has 18.6 million acres of forests and 6.9 million acres of agricultural lands in production.[137, 138] Over the last decade, farmers and foresters in New York have continued their efforts and investments to advance environmental sustainability and efficiency, both of which increase carbon benefits and climate resilience. Some of these efforts include:

- New York dairy farmers made significant strides in reducing the carbon footprint per hundredweight of milk through greater efficiencies in precision feed management, reducing enteric emissions from cow digestion.
- The New York State Methane Reduction Plan (May 2017)[59] identified and set targets for reducing methane emissions from the agricultural sector.
- A suite of technical assistance and planning resources were developed through the Agricultural Environmental Management (AEM) framework on farm and forest GHG emission mitigation opportunities.
- New York's Climate Resilient Farming (CRF) grant program, which demonstrates how climate-responsive efforts can be integrated alongside existing environmental and water quality agricultural programming, has awarded $12 million in project funding, resulting in an estimated 300,000 MT CO_2e reduced/sequestered.
- Assisting thousands of landowners with forest management on more than 2 million acres of private lands through programs like the Forest Stewardship program, Environmental Quality Incentives program (EQIP), the 480a Forest Tax Law program, Partnerships for Regional Invasive Species Management, Forest Health rapid response programs, and the Forest Health Diagnostic Lab.

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[137] Albright, Thomas A.; Butler, Brett J.; Crocker, Susan J.; Drobnack, Jason M.; Kurtz, Cassandra M.; McWilliams, William H.; Morin, Randall S.; Nelson, Mark D.; Riemann, Rachel; Vickers, Lance A.; Walters, Brian F.; Westfall, James A.; Woodall, Christopher W. 2020. New York Forests 2017. Resource Bulletin NRS-121. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. https://doi.org/10.2737/NRS-RB-121.

[138] USDA National Agriculture Statistic Service. 2019. 2017 Census of Agriculture, Volume 1, Chapter 1: Part 32 State Level Data: New York. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/New_York/nyv1.pdf

- The Forest Stewardship Council and Sustainable Forestry Initiative has provided Green certification on 800,000 acres of state forests.

To continue to enable farmers to reduce GHG emissions and increase sequestration in soils through site-specific practices on lands under their management, New York will utilize the AEM framework, overseen by the New York State Department of Agriculture and Markets (AGM) and the New York Soil and Water Conservation Committee (SWCC) and locally led and implemented by county Soil and Water Conservation Districts (SWCD). This existing framework will be coupled with new and expanded initiatives, RD&D of novel approaches to reducing emissions and increasing sequestration capacity and increasing workforce capacity to scale up programs and initiatives.

Management of New York's forests, to promote tree health, recreation, wildlife habitat, and wood products, among other reasons, also has many implications for long-term carbon storage and sequestration. DEC will continue to promote programs and work closely with landowners to increase carbon benefits and resilience.

Key Stakeholders

Key stakeholders include landowners, organizations involved in outreach, education, and landowner assistance, forest products, workforce development, research, legislation, and incentive programs. Stakeholders involved in each of these roles are discussed in the following paragraph, however these lists should not be considered all-inclusive. Stakeholders involved in more than one role are only listed once.

Stakeholders that hold forest land in New York include the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), DOT, NYPA, the New York Forest Owners Association, land trusts, utility companies, municipalities, municipal associations, local communities, and private landowners. Stakeholders involved in outreach, education, and other forms of landowner assistance include U.S. Department of Agriculture (USDA), DOS, New York City Department of Environmental Protection, SWCDs, Cornell Cooperative Extension (CCE), the Society of American Foresters, International Society of Arboriculture, New York Society of Arboriculture, New York State Urban Forestry Council, ReLeaf, Master Forest Owners, Arbor Day Foundation, Forest Connect, the Nature Conservancy, hunting stakeholders, arborists, and foresters. Stakeholders involved in the creation, promotion, and use of forest products include NYSERDA, regional economic development councils (REDCs), DASNY, ESD, Empire State Forest Products Association, the WPDC, U.S. Green Building Council, American Society of Civil Engineers, American Institute of Architects, U.S. Department of Energy, PANYNJ, Commercial Aviation

Alternative Fuels Initiative, the Business Council of New York State, New York City Department of Buildings, and waste materials stakeholders. Stakeholders involved in workforce development include Paul Smith's College, Boards of Cooperative Education Services, and the Workforce Development Institute. Stakeholders involved in research efforts include SUNY ESF and Cornell University College of Agriculture and Life Sciences (CALS). Stakeholders involved in incentive programs and legislation include the New York State Department of Taxation and Finance and the state Legislature.

Farmers, state and federal agencies, state Legislature, colleges and universities, county SWCDs, CCE, outreach and education agencies/facilitators, non-profits, land trusts, farm organizations, private sector, professional engineers and planners, financial lenders, watershed coalitions, municipalities, NGOs, food processors and co-ops, agricultural associations, and others may be integral as key stakeholders for implementing strategies of the agricultural sector. Specific implementation leads and stakeholders are listed below for each strategy.

15.2 Key Sector Strategies

New York's forests serve as a major carbon sink that hold 1,911 MMT carbon,[139] nearly ten times the amount of carbon produced by all sectors each year. In addition, forests sequester approximately 26.6 MMT CO_2e annually.[140] Recommended strategies to mitigate GHG emissions and sequester and store additional carbon from the agriculture and forestry sectors are discussed in the sections below. Although also connected to the agriculture and forestry sectors, additional strategies related to land use including avoided conversion of agricultural and forest lands, afforestation, and reforestation are included in Chapter 19, Land Use. The recommendations listed in this chapter provide long-term, integrated approaches to achieving GHG emissions reductions while also ensuring food security, creation of wood products, and promoting agricultural and forest adaptation in the face of a changing climate, while minimizing the potential for emissions leakage by farmers and foresters moving operations out of state. Additionally, the policies that will be presented affect many other non-emission goals of the Climate Act

[139] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

[140] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

and of the state of New York. The key strategies within this sector are organized into four themes, as shown in Table 13.

Table 13. Agriculture and Forestry Sector Key Strategies by Theme

Theme	Strategies
Sustainable Forest Management	AF1. Identify where Forest Management would Provide the Greatest Benefits AF2. Prevent Forest Pests, Diseases, and Invasive Species and Restore Degraded Forests AF3. Maintain and Improve Sustainable Forest Management Practices and Mitigation Strategies AF4. Assist Landowners in Implementation of Sustainable Forest Management and Mitigation Strategies AF5. Support Local Communities in Forest Protection and Management AF6. Create a New York Forest Carbon Bank AF7. Monitor Progress and Advance Forestry Science and Technology AF8. Conduct Education and Outreach on Forest Management
Livestock Management	AF9. Advance Alternative Manure Management AF10. Advance Precision Feed, Forage, and Heard Management
Soil Health, Nutrient Management, and Agroforestry	AF11. Advance Agricultural Nutrient Management AF12. Adopt Soil Health Practice Systems AF13. Increase Adoption of Agroforestry AF14. Develop AEM Planning for Climate Mitigation and Adaptation AF15. Monitor and Benchmark Agricultural GHG Emissions AF16. Establish a Payment for Ecosystem Services (PES) Program AF17. Bolster Local Agricultural Economies
Climate-Focused Bioeconomy	AF18. Develop Forestry Training Programs to Support Expanding Workforce and Climate Knowledge AF19. Expand Markets for Sustainably Harvested Durable Wood Products AF20. Develop a Sustainable Biomass Feedstock Action Plan and Expand the Use of Bioenergy Products AF21. Increase Market Access for New York Low-Carbon Products AF22. Provide Financial and Technical Assistance for Low-Carbon Product Development AF23. Advance Bio-Based Products Research Development and Demonstration AF24. Advance Deployment of Net Negative CO_2 Removal

Sustainable Forest Management

New York has 18.6 million acres of forests, which cover approximately 62% of New York's total land area.[141] Through photosynthesis, forests absorb and store CO_2, which can offset GHG emissions and

[141] Albright, Thomas A.; Butler, Brett J.; Crocker, Susan J.; Drobnack, Jason M.; Kurtz, Cassandra M.; McWilliams, William H.; Morin, Randall S.; Nelson, Mark D.; Riemann, Rachel; Vickers, Lance A.; Walters, Brian F.; Westfall, James A.; Woodall, Christopher W. 2020. New York Forests 2017. Resource Bulletin NRS-121. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. https://doi.org/10.2737/NRS-RB-121.

reduce the impacts of climate change. New York's forests hold an estimated 1,911 MMT of carbon,[142] which is equivalent to the CO_2 that would be produced to power all the houses in New York for the next 100 years.[143] However, there has been a trend in the loss of forested area in the past 10 years that has contributed to a decline in the net amount of CO_2 absorbed by forests each year, from 30.3 MMT CO_2e in 1990 to 26.6 MMT CO_2e in 2019.[144] In addition to forest area loss as New York's forests have aged, their carbon sequestration rate has slowed. To maximize New York forests carbon sequestration potential, it is critical that forest management activities increase statewide.

New York's forests are managed for a wide variety of reasons including promotion of tree health, recreation, wildlife habitat, and wood products. Management of forested areas has many implications for long-term carbon storage and sequestration depending on factors like forest age, health, and tree species as well as how the forest is managed and how the wood is utilized following harvest. Additional forest management considerations include promoting a forest's potential adaptation and resilience to climate change. Some potential ways to help increase a forest's adaptation and resilience include maintaining high tree species diversity, genetic diversity of trees within the forest, multiple age classes (uneven-age management), and removing existing barriers for regeneration (ex: competing plants, invasive species, deer).

To increase New York's forests carbon sequestration and storage and the resiliency of New York's forests, guidance is needed to promote forest management regarding carbon storage, climate resilience, and other climate-related issues using the following tactics. The CJWG supports the strategies for Sustainable Forest Management, however suggested there is an over-reliance on voluntary incentive-based programs.

[142] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

[143] U.S. Environmental Protection Agency. 2021. Greenhouse Gas Equivalencies Calculator. Division of Energy and Environment. Accessed June 4, 2021: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

[144] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

AF1. Identify where Forest Management would Provide the Greatest Benefits

Well-managed forests provide a wide array of benefits to humans and to the natural environment including wildlife habitat, flood mitigation, recreational opportunities, health benefits, reduced heating and cooling costs, protection of air and water quality, and carbon sequestration and storage. Forest management actions will be site specific and targeted to promote the greatest level of benefits to New Yorkers.

Identifying and prioritizing locations for forest management is an enabling strategy that will allow the state to target areas for forest management to maximize carbon sequestration and storage as well as climate resilience. DEC is currently working with SUNY ESF to develop site-specific models of aboveground forest carbon across the landscape, which is expected to be complete in 2022, however updates and improvements will be ongoing. Barriers will include the ability to obtain and update light detection and ranging technology data, quantification of forest benefits such as forest resilience, and mapping of forest benefits.

Components of the Strategy

- **Prioritization models:** DEC should work with SUNY ESF to select, implement, and develop prioritization models for forests in need of management, including those in urban areas.

AF2. Prevent Forest Pests, Diseases, And Invasive Species and Restore Degraded Forests

Invasive species means a species that is nonnative to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.[145] Invasive species may include plants, animals, insects, and diseases. In forests, invasive plants can rapidly change an area's hydrology, displace native species, and prevent forest regeneration. Invasive plants were found in 55% of the most recent forest inventory analysis survey plots[146] and 56% of private landowners were concerned about invasive plants in the most recent National Woodland Owner survey.[147] Invasive

[145] 6 NYCRR 575.2(s) & 576.2(e).

[146] U.S. Department of Agriculture Forest Service. 2020. Forests of New York, 2019. Resource Update FS-250. Madison, WI: U.S. Department of Agriculture, Forest Service. 2p. https://doi.org/10.2737/FS-RU-250.

[147] Butler, Brett J.; Hewes, Jaketon H.; Dickinson, Brenton J.; Andrejczyk, Kyle; Butler, Sarah M.; Markowski-Lindsay, Marla. 2016. U.S. Department of Agriculture Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. https://doi.org/10.2737/NRS-RB-99.

insects and diseases such as emerald ash borer and hemlock woolly adelgid, can cause rapid mortality to trees or contribute to a loss in tree health due to increased stress, contributing to mortality in the long-term. In the most recent National Woodland Owner survey, 74% of private landowners were concerned about invasive insects and disease.[148] By altering the forest ecosystem, preventing regeneration, reducing the growth and vigor of trees, and causing direct mortality, invasive species negatively impact the ability of New York's forests to store and sequester carbon.

DEC enforces 6 NYCRR Parts 575 & 576 regulatory programs regarding invasive species and AGM enforces NYCRR Title 1 Chapter III for insect and disease control. These programs seek to accomplish prevention, outreach, rapid response, and research on invasive forest species and diseases through its Invasive Species and Ecosystem Health program, Partnerships for Regional Invasive Species Management, the New York Invasive Species Research Institute, and the Forest Health Diagnostic Lab, as well as partners statewide. Climate change is expected to increase the competitiveness of invasive plants and increase the range and survival of invasive insects and diseases. Prevention, response, and restoration will be ongoing as new invasive species are introduced and the ranges and competitiveness of existing species in New York expand.

Components of the Strategy

- **Increase prevention of invasive species:** DEC should increase prevention of invasive forest pests and diseases entering New York and the U.S. (such as SMART trade) through strengthened regulations, inspection, and enforcement of wood packaging material and live plant imports.
- **Expand statutory authority:** The State should enact legislation to expand the scope of Section 9-1709 of the ECL to provide DEC with more statutory authority to strengthen and amend Parts 575 & 576.
- **Combat invasive species:** DEC should reduce the loss of forest carbon due to acute forest health issues on private and public forest. Facilitate an increase in capacity for rapid response teams for forest pest and disease outbreaks (such as Asian longhorned beetle, hemlock woolly adelgid, and emerald ash borer) or invasive vegetation issues that negatively impact forest carbon (such as

[148] Butler, Brett J.; Hewes, Jaketon H.; Dickinson, Brenton J.; Andrejczyk, Kyle; Butler, Sarah M.; Markowski-Lindsay, Marla. 2016. USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. https://doi.org/10.2737/NRS-RB-99.

forest regeneration). Priority would be on intervening where rapid, extensive loss of forest carbon sequestration capacity could occur.

AF3. Maintain and Improve Sustainable Forest Management Practices and Mitigation Strategies

Forests in New York are managed for many reasons such as promoting tree health, recreation, wildlife habitat, and wood products. This management has implications for long-term carbon storage and sequestration. Improving and expanding the use of sustainable forest management practices and mitigation strategies are ongoing and have direct benefits for carbon storage and sequestration. Current efforts by DEC include sustainability certification on state lands, the Forest Stewardship program, EQIP run by USDA Natural Resources Conservation Service (NRCS), 480a Forest Tax Law program, and Regenerate NY cost share grant program.

Components of the Strategy

- **Invest in forest carbon research:** DEC should work with SUNY ESF and Cornell CALS to support research, develop best management practices (BMP), guidance documents, and decision trees to inform forest management regarding carbon storage, carbon sequestration, climate resilience, and other climate-related issues including on improving forest resilience and vigor, regeneration, forest soils, and prevention of high-intensity wildfire.
- **Invest in forest carbon research:** DEC should work with Cornell CALS and SUNY ESF to expand funding for and conduct peer reviewed climate, forest carbon, and applied forest management research in New York such as improving forest resilience, vigor, regeneration, and forest soil carbon storage.
- **Develop best practices:** DEC and AGM should develop enhanced forestry management practices to maintain or increase forest carbon stocks while producing an annual sustained yield of bio-based feedstocks from the forest.
- **Implement forest carbon certification program:** DEC should develop and implement a Forest Carbon Certification Program, where qualified participants with a certification credential would be able to work under state funded forest programs and forest carbon programs.
- **Restore degraded forest assets:** DEC should implement restoration measures in degraded forests that have the potential for improved carbon storage, carbon sequestration, and climate resilience such as extending harvest intervals, uneven aged harvests, rehabilitating high graded and under stocked stands, and invasive species management and prevention.

- **Invest in financing options for upgrades and best practices:** DEC should work with the WPDC, and NGOs to provide funding for low interest loans or grants for upgrading to new logging or manufacturing equipment to facilitate, increased utilization, improved forest management or BMPs to lower site impacts (such as machine tracks for wheeled harvesters to lower soil impacts).

AF4. Assist Landowners in Implementation of Sustainable Forest Management and Mitigation Strategies

Of New York's forests 73%, or 13.7 million acres, are owned by private landowners.[149] The majority of all the carbon sequestration and storage occurs on these lands. Of privately-owned forests, only about 27% received professional advice within the past five years, only 18% had a written management plan[150], and only 9% (1.2 million acres) were under professional forest management through the 480a Forest Tax Law Program, which provides tax incentives to landowners for forest management.[151] In addition, the costs of maintaining a healthy forest, forest dieback due to pests and diseases, annual taxes, and shifts to smaller parcel sizes, these landowners have been facing increasing pressures to subdivide and develop their forested lands.[152] In addition to the 480a program, other ongoing DEC programs that assist forest landowners include the Forest Stewardship program, Regenerate NY cost share grant program and USDA NRCS run EQIP. The huge number of private landowners that need to be reached could present a possible barrier to this strategy, however improving sustainable forest management and mitigation strategies will help improve carbon storage and sequestration in New York – as well as climate resilience.

Components of the Strategy

- **Expand education and outreach:** DEC, CCEs, SWCDs, NGOs, SUNY ESF, Cornell CALS, and other organizations and universities across the state should continue to provide, expand, and improve outreach and technical assistance on forest carbon and forest management to landowners including information about estate planning, intergenerational transfer, and the importance and

[149] USDA Forest Service 2020.

[150] Butler, Brett J.; Hewes, Jaketon H.; Dickinson, Brenton J.; Andrejczyk, Kyle; Butler, Sarah M.; Markowski-Lindsay, Marla. 2016. USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. https://doi.org/10.2737/NRS-RB-99.

[151] New York State Forest Action Plan.

[152] Malmsheimer et al. 2008.

contribution of working forestlands through programs such as the Forest Stewardship Program, AEM, Partnerships for Regional Invasive Species Management, and Master Forest Owners.

- **Amend Real Property Tax Law 480a:** The State should enact legislation to amend Real Property Tax Law section 480a to create tracks for forest carbon management, induce greater landowner participation and integrate stronger sustainability provisions (such as forest regeneration) with the primary goal to remain unchanged and encourage sustainable timber management. Tax abatement benefit for landowners should remain unchanged with up to 100% reimbursement to municipalities.
- **Enact new legislation:** The state should enact legislation to create a new real property tax incentive (Real Property Tax Law 480b) to allow private forest landowners to manage for multiple benefits (such as wildlife habitat, wood products, and carbon sequestration) and, if desired, conserve their forests in natural conditions to participate in tax programs. Tax benefit to landowners should increase as the year of commitment increase, recognizing the accumulated sequestration benefits over time. This program should require a forest management plan written by a certified forester if harvesting is required and has a 25-acre eligibility requirement. Initial benefits should start at a lower level than 480a and 480c with up to 100% reimbursement to municipalities.
- **Enact new legislation:** The state should enact legislation to create a real property tax incentive (Real Property Tax Law 480c) to provide forest landowners a tax incentive to undertake practices that increase carbon storage, carbon sequestration, and climate resilience while addressing the need for additionality. This program should be practice and carbon inventory based and require a forest management plan written by a carbon certified forester if harvesting and have a 25-acre eligibility requirement. Tax benefit to landowners should increase as the years of commitment increase to recognize accumulated sequestration benefits over time. Up to 100% reimbursement to local municipalities.
- **Expand funding:** The State should expand the funding for cost share programs, such as Regenerate NY and AEM to assist forest landowners in increasing carbon storage, carbon sequestration, and climate resilience on private forestland, including restoration of degraded forests and implementing BMPs for forest carbon.
- **Establish equipment caches:** DEC, SWCDs, NGOs, and the WPDC should establish equipment caches across the state to allow landowners and operators to borrow forestry and logging equipment to implement approved forest management.

AF5. Support Local Communities in Forest Protection and Management

Local governments including counties and municipalities own approximately 1% of forested areas large and productive enough for wood production and have jurisdiction over land use planning and restrictions for forests within their boundaries.[153] In addition, tree canopy covers 1.3 million acres of urban and community areas, storing about 32.1 MMT of carbon (equivalent to the CO_2 that is produced to power all the houses in New York for 1½ years) and contribute to 1 million tons gross carbon sequestration each year (equivalent to the CO_2 that is produced to power 400,000 homes for 1 year.[154] Increasing forest protection and management in local and urban communities will increase carbon sequestration and storage as well as climate resilience. In addition, trees in urban areas reduce the need for, energy use, and emissions from air conditioning. Current efforts by DEC include the urban and community program, which provides education, outreach, guidance, and a grant program to local and urban communities. An additional community forest conservation grant program is expected to be released in 2022. However, urban and community tree cover is declining by about 6,720 acres annually.[155] In addition, many municipalities lack a comprehensive plan and/or zoning ordinance or laws for forests, and often these documents do not clearly address forest retention and/or uses. In some cases, restrictions within municipal jurisdictions on forest management drive local landowners to develop their land.[156] In addition, due to the costs of maintaining a healthy forest, forest dieback due to pests and diseases, annual taxes, and shifts to smaller parcel sizes, landowners and municipalities have been facing increasing pressures to subdivide, develop or allow development on their forested lands.[157]

Components of the Strategy

- **Provide guidance and support:** DEC should work with SUNY ESF and Cornell CALS to provide guidance, support, and funding to local communities to plan and implement forest maintenance projects that help communities adapt to climate change.

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[153] Daniels, Katherine H. 2005. A Municipal Official's Guide to Forestry in New York State. New York Planning Federation, Department of Environmental Conservation and Empire State Forest Products Association. 31p. Accessed June 9, 2021: http://cceonondaga.org/resources/municipal-officials-guide-to-forestry-in-new-york-state.

[154] Nowack, David J., Eric J. Greenfield, Robert E. Hoehn, and Elizabeth Lapoint. 2013. Carbon storage and sequestration by trees in urban and community areas of the U.S. Environmental Pollution, 178, 229-236.

[155] Nowack, David J., & Greenfield, Eric J., 2018a. Declining urban and community tree cover in the United States. Urban Forestry & Urban Greening, 32, 32-55.

[156] Malmsheimer, Robert W. and Donald W. Floyd. 1998. The Right to Practice Forestry: Laws Restricting Nuisance Suits and Municipal Ordinances, Journal of Forestry 96(8): 27-32. https://doi.org/10.1093/jof/96.8.27

[157] Malmsheimer, Robert W., Patrick Heffernan, Steve Brink, Douglas Crandall, Fred Deneke, Christopher Galik, Edmund Gee, John A. Helms, Nathan McClure, Michael Mortimer, Steve Ruddell, Matthew Smith, John Stewart. 2008. Forest Management Solutions for Mitigating Climate Change in the United States. Journal of Forestry, Volume 106, Issue 3, April 2008, Pages 115–117, https://doi.org/10.1093/jof/106.3.115.

- **Provide BMPs:** DEC should work with Cornell CALS, and SUNY ESF to provide BMP's for urban forests including what trees to plant for carbon sequestration and climate resilience and ways to increase the lifespan of urban trees through improved maintenance.
- **Increase funding:** The State should increase funding levels and scope of Urban and Community Forestry Grants to assist local municipalities and private landowners in the management of the urban forests, including planning, planting, and maintenance of trees.
- **Develop guidance and support:** DEC and SWCDs should develop guidance for and provide support to local communities to establish or expand youth and young adult conservation corps to employ, and train youth for maintaining and improving urban forest management.
- **Support research:** DEC should work with Cornell CALS and SUNY ESF to increase urban forestry and forest carbon research on ways to maximize the carbon and other benefits of establishing and maintaining urban forests.

AF6. Create a New York Forest Carbon Bank

Due to their ability to sequester and store carbon, forests and forest management can be leveraged to offset CO_2 produced by other sectors through CO_2 emissions reduction credits. In carbon market programs, CO_2 emitters are incentivized to reduce their emissions. If their emissions are not reduced, emitters must offset their emissions by purchasing emission reduction credits from a project that enhances carbon sequestration and storage such as afforestation, reforestation, purchase of forested lands, or enhancing forest management. Purchase of these emissions reduction credits in turn allow forest owners to receive additional income which will allow them to conduct necessary forest management to increase forest resilience and carbon sequestration. Creation of a New York Carbon Bank would allow the state to finance GHG emissions reduction and carbon sequestration activities in New York's farms and forests and would take several years to set up and implement. Currently, New York emitters may participate in voluntary carbon markets like the RGGI or participate in compliance markets like the cap-and-trade program run through California's Air Resources Board.

Components of the Strategy

- **Enact forest carbon bank legislation:** The State should enact legislation for the creation of a New York forest carbon bank that would allow New York to finance GHG emissions reduction and carbon sequestration activities by New York farm and forest landowners.

AF7. Monitor Progress and Advance Forestry Science and Technology

Tracking the carbon sequestered and stored by New York's forests is critical to enabling and evaluating the success of carbon sequestration and storage. Monitoring forest carbon progress will help the state identify successful forest management strategies and provide further insight into what land use patterns can lead to the greatest carbon sequestration and storage. Monitoring will also help identify areas of the state that have low regeneration or stocking and areas that have been impacted by invasive species, wildfire, and other disturbances that need restoration efforts. DEC is currently working with SUNY ESF to develop a satellite image-based monitoring platform for statewide forest carbon that is expected to be completed in 2022, however improvements, evaluation, and maintenance of this platform will be ongoing.

Components of the Strategy

- **Monitor forest carbon:** DEC should continue to work with SUNY ESF and Cornell CALS to monitor forest carbon and evaluate tactics to determine efficacy and maximize efficiency.
- **Create science-based decision tools:** DEC should work with SUNY ESF and Cornell CALS to create science-based decision tools to help make the most efficient and cost-effective decisions on forest-based climate change initiatives.
- **Research seedling technologies:** DEC should research seeding technologies, such as use of drones for planting in small forest gaps.
- **Conduct research:** DEC should work with Cornell CALS, SUNY ESF, and WPDC to conduct research on emerging forest products and markets related to bioeconomy and harvested wood product initiatives.

AF8. Conduct Education and Outreach on Forest Management

To ensure and enable the success of the strategies listed within this chapter, education and outreach is needed to reach New York's private and public landowners who can implement forest management practices and mitigation strategies, which will increase carbon sequestration and storage and climate resilience. In addition, the benefits forests and wood products provide should be promoted to the public to increase their use and for a better understanding of why protecting and managing forests is beneficial for carbon sequestration, wildlife, and the people of New York. DEC currently conducts education and outreach through individual programs such as the Forest Stewardship program, EQIP run by USDA NRCS, Regenerate NY cost share grant program, the Urban and Community Forest program, and partners like SWCC, and through efforts like #ForestryFridays on social media, however additional proactive education efforts could be beneficial for reaching new audiences.

Components of the Strategy

- **Promote forest management:** DEC should work with Cornell CALS and SUNY ESF to build public acceptance for forest management and increase the adoption of climate focused forest management on all landownership types.
- **Expand outreach:** DEC should continue to provide stewardship, cooperating foresters, urban foresters, city planners, and local officials with outreach training, technical assistance, resources, and toolkits to better engage landowners and other stakeholders on climate change.
- **Support urban forestry:** DEC should continue to increase the promotion of urban forestry and tree care through TreeLine USA for utilities, TreeCity USA for communities, Tree Campus for college campuses, and ReLeaf efforts in communities across the state.
- **Support education and outreach:** DEC should bolster urban forestry and natural resource education and outreach, especially in underserved communities by identifying and working with local partners.
- **Promote New York wood products:** WPDC and SUNY ESF should engage social media influencers and wood product manufacturers to promote New York wood products as trendy, local, and sustainable, including traditional and emerging wood products and utilization.
- **Provide education and outreach:** Cornell CALS and SUNY ESF should provide education and outreach to the construction industry and public on mass timber construction and harvested wood product applications and carbon mitigation benefits of substituting wood products instead of those that are fossil fuel based.

Livestock Management

The highest level of agricultural emissions is attributed to livestock - primarily methane and secondarily nitrous oxide. Therefore, the following strategies contribute to the deepest reductions in agricultural emissions, addressing methane reduction from manure management practices and from animal feeding. Alternative manure management strategies rely heavily on the advancement of current programs led by the AGM, SWCC, NYSERDA, and county SWCDs. Precision feed, forage and herd management strategies rely mainly on increased training and support to the farm community by Cornell CALS, CCE, nutritionists and feed industry professionals, expanded use of monitoring and decision tools, as well as continued and enhanced research and development of feed supplements and additives for further methane reductions.

AF9. Advance Alternative Manure Management

The storage of manure is an important practice to facilitate nutrient management, reducing the need for synthetic fertilizers, and preventing runoff for the improvement of water quality. However, the treatment and storage of livestock manure can produce methane through the anerobic decomposition of the manure. Manure storages have caused the single highest increase in agricultural emissions from the 1990 baseline year to today.[158] Mitigation of this source of emissions range from technically feasible to challenging depending on the use of available strategies and technologies or through more innovative and advanced manure management system approaches. Manure methane reductions require an evaluation of new processes, technologies, and costs; overcoming storage retrofit and livestock bedding challenges; operating and maintaining systems for methane prevention or optimal capture and destruction to minimize methane loss and leakage; filling gaps in applied research as well as in-field leak monitoring processes; balancing nutrients and methane inputs with increases in imported organic waste processing; and improving quantification and verification of outcomes.

This strategy will reduce methane emissions by implementing practice systems specifically planned and designed for each farm, such as cover and flare systems, anaerobic digester systems, composting, and other innovative systems that collect, capture, and destroy methane from manure storages or prevent methane production through improved manure management. Specific components of this strategy that include utilizing existing state programs and planning tools through AGM and the SWCC, can begin implementation immediately and can scale with additional resources dedicated to these programs. Longer timeframes will be required for other components relating to education, outreach, and market connections with NYSERDA and SWCDs as key partners. These strategies rely on the New York AEM Framework and strong incentives to implement alternative manure management systems. The CJWG favor imposing regulations on dairy and other livestock farmers to reduce emissions. The strategies outlined below rely more heavily on long established technical assistance and cost-share programs to achieve methane reductions from manure management. Feedback from the CJWG indicates a preference for manure management strategies upstream of the manure storage or that reduce animal waste generation at its source.

[158] Wightman, J.L. and P.B. Woodbury. 2016. New York Dairy Manure Management Greenhouse Gas Emissions and Mitigation Costs (1992–2022). Journal of Environmental Quality 45: 266-275.

Components of the Strategy

- **Expand funding for current programs:** AGM and SWCC should expand CRF program funding for alternative manure management practice systems that reduce methane emissions.
- **Expand farmer access:** AGM and SWCC should increase farmer access to technical and financial assistance. Prioritize disadvantaged communities and historically underserved farmers including BIPOC, women, LGBTQIA+ (lesbian, gay, bisexual, transgender, intersex, queer/questioning, asexual, and other), low income, veteran, and beginning farmers.
- **Strengthen program policies:** AGM and SWCC should refine grant program policies to encourage manure management systems funded through state programs to incorporate methane prevention or mitigation strategies including retrofit capacity
- **Expand SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on-farm implementation of GHG emissions reduction and sequestration management practices.
- **Expand technical assistance:** AGM along with stakeholders should increase technical assistance and engineering capacity for feasibility assessment, planning, design, operation, maintenance, and monitoring of alternative manure management systems.
- **Expand training:** AGM and SWCDs should expand training to technical service providers and farm staff to design, build, operate, and maintain alternative manure management systems.
- **Develop new funding opportunities:** AGM should develop a NYS-funded loan guarantee program to stimulate investment in alternative manure management systems.
- **Expand purchasing opportunities:** AGM and SWCC should develop NYS-bulk buying programs to reduce core material and equipment costs (such as covers, flares, separators, standardized controls, and other components), similar to the solar industry and energy-efficient heating programs.
- **Advance energy production:** NYSERDA along with AGM should expand funding for advancement of energy production and methane mitigation, including measurement and abatement of methane leakage, and future innovations based upon the recommendations from the biomass action plan.
- **Minimize fugitive methane emissions from energy production:** AGM and NYSERDA should develop and apply standards for leak detection and repair from energy production systems. These standards will also include monitoring to guide management to minimize losses and optimize GHG emissions reduction benefit.
- **Align market opportunities:** AGM and NYSERDA should align manure management systems designed for energy production, organic waste management, and methane mitigation with

markets (existing or future, Low Carbon Fuel Standard, industry net zero initiatives, and other) and private-sector investment.

- **Make market connections:** AGM and NYSERDA should improve connections and markets between farms with alternative manure management systems and other businesses able to supply organic co-products or use products generated by such on-farm systems (such as electricity, heat, gas, and organic soil amendments).
- **Support research and outreach:** AGM should implement long-term funding support for alternative manure management applied research and outreach, including processes for realizing additional value from manure and analyses for strategic development/siting of methane mitigating manure and organic waste management systems.

AF10. Advance Precision Feed, Forage, and Herd Management

Methane is produced as part of normal digestive process in animals, especially ruminants. During digestion, microbes present in the animal's digestive system ferment feed consumed by the animal. This microbial fermentation process, referred to as enteric fermentation, produces methane as a biproduct, which can be exhaled or eructed by the animal. Although methane from feed digestion represents the highest percentage of agricultural emissions, dairy and other livestock farms have improved feed efficiency, reducing methane emissions per unit of milk and other products since the 1990 baseline.[159] Additionally, over time, New York dairy farmers have made significant strides in reducing the carbon footprint per hundred weight of milk through greater efficiencies in precision feed management, reducing enteric methane emissions from cow digestion.[160]

Deep reductions are required for New York agriculture to meet the Climate Act emission limits. Mitigation of methane emissions from enteric fermentation range from feasible to challenging from the

[159] Capper, J. L. and R. A. Cady. The effects of improved performance in the United States dairy cattle industry on environmental impacts between 2007 and 2017, Journal of Animal Science, Volume 98, Issue 1, January 2020, skz291, https://doi.org/10.1093/jas/skz291;
Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. J. Anim. Sci. 87:2160–2167. doi:10.2527/jas.2009-1781;
Wightman, J.L. and P.B. Woodbury. 2016. New York Dairy Manure Management Greenhouse Gas Emissions and Mitigation Costs (1992–2022). Journal of Environmental Quality 45: 266-275.

[160] Capper, J. L. and R. A. Cady. The effects of improved performance in the United States dairy cattle industry on environmental impacts between 2007 and 2017, Journal of Animal Science, Volume 98, Issue 1, January 2020, skz291, https://doi.org/10.1093/jas/skz291;
Capper, J. L., R. A. Cady, and D. E. Bauman. 2009. The environmental impact of dairy production: 1944 compared with 2007. J. Anim. Sci. 87:2160–2167. doi:10.2527/jas.2009-1781;
Wightman, J.L. and P.B. Woodbury. 2016. New York Dairy Manure Management Greenhouse Gas Emissions and Mitigation Costs (1992–2022). Journal of Environmental Quality 45: 266-275. doi:10.2134/jeq2014.06.0269.

implementation of precision feed, forage, and herd management through continued and enhanced training and support to the farm community to the expanded research, testing, and scalability of feed additives designed to dramatically reduce enteric fermentation.

To reduce methane and nitrous oxide emissions while achieving desired ruminant growth and lactation goals, this strategy requires the evaluation of new processes, technologies, costs, and returns; demands sustained adaptive management by farmers and advisors, flattening the learning curve by farmers, advisors, and the feed industry; filling gaps in applied research; overcoming weather and market disruptions that can lower performance (producing lower quality forage). This strategy acknowledges that additional methane emission reduction may be realized from feed additives developed in the future. Some components of this strategy that include utilizing existing programs and planning tools can begin implementation immediately and be scaled up with additional resources dedicated to them. Longer timeframes will be required for other components relating to applied research and market development of feed additives with Cornell CALS and CCE as key partners for implementation.

Components of the Strategy

- **Expand precision feed and forage education:** Cornell CALS and CCE should expand outreach and education of precision feed and forage management to more ruminant livestock farmers, nutritionists, and feed industry professionals. Other stakeholders essential to this effort include milk cooperatives, and processors.
- **Expand access to monitoring tools:** Cornell CALS should expand access to precision feed and forage management monitoring and decision tools (such as the Cornell Net Carbohydrates and Proteins System) applicable to a range of farm conditions and management. Farm use of the methane module within Cornell system should be increased and statewide benchmarks should be developed to gauge improvement overtime.
- **Expand SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on farm implementation of precision feed and forage management practices.
- **Provide long-term funding:** AGM and SWCC should implement long-term funding support for precision feed, forage and herd management basic and applied research and outreach (including research for methane mitigating feed additives).
- **Establish co-product markets:** DEC should explore establishment of a co-product market for food “wastes” supplied from food processors, retailers, or institutions for best uses, including as livestock feed.

- **Invest in science-based herd management:** AGM and Cornell CALS should develop a science-based strategy focused on improving herd management decision making which positively impacts cow efficiency to reduce GHG emissions while optimizing milk yield and return on investment.
- **Facilitate technical assistance:** AGM and Cornell CALS should facilitate technical assistance to improve access to programs, planning and monitoring tools, and financial assistance for on-farm implementation of precision feed-forage and herd management practices.

Soil Health, Nutrient Management, and Agroforestry

Healthy soils and nutrient management provide for many functions and ecosystem services including sustaining the biological activity and diversity of the soil, water quality protection, nutrient cycling, and carbon sequestration. Practices that improve soil health help to buffer many of the impacts of climate change also increasing a farm's resiliency. The following strategies focus on nitrous oxide reduction and increasing carbon sequestration.

NO_x makes up approximately 9% of all agricultural GHG emissions in New York. Improving nitrogen fertilizer management is an effective GHG emissions reduction strategy that also provide other environmental and economic benefits. Efficient use of nitrogen fertilizer can reduce nitrous oxide emissions from cropland, improve water quality and can save the farmer money.

Improving soil health can increase soil organic matter to sequester carbon as well as maintain and enhance soil structure to increase water infiltration reducing drought stress; decreased runoff after heavy storms leads to better water quality; proper uptake of nutrients by plants reduces access nutrients entering waterbodies; and maintaining or potentially increasing crop yields promotes food security.

Agroforestry practices systems that add trees into areas of agricultural production have the potential to elevate local food production and resiliency, improve water and air quality, provide storm and flood mitigation, increase drought resiliency, provide habitat, scenic vistas and agritourism, increase economic development and jobs. Some emission and sequestration strategies are long-term approaches. It can take decades to develop additional tree cover and years to build soil carbon.

These strategies rely mainly on the continuation and expansion of current state efforts with implementation beginning immediately. Leads for these strategies include AGM, SWCC, DEC, SWCDs, Cornell CALS and CCE. Other key stakeholders include but are not limited to American Farmland Trust, land trusts, the Nature Conservancy, the Farm Bureau, and the fertilizer industry.

AF11. Advance Agricultural Nutrient Management

Farmers in New York have improved nutrient management on lands while increasing crop yields. Comparatively, nitrous oxide emissions from farms in New York are lower than in many other agricultural systems nationally and globally making this mitigation strategy relatively easy to implement. However, continued emission reductions, including improved measurement of existing and future efforts require comprehensive training in the use of nutrient management tools and in some cases new equipment and data collection. Implementation of this strategy also requires sustained, adaptive management by farms and crop advisors.

Farms will continue to reduce nitrous oxide emissions while achieving desired yield and quality through continued and expanded nutrient management planning and implementation on crop fields, hay fields, pastures, orchards, vineyards, and other agricultural lands receiving nutrients. Agricultural productivity and food security are important drivers for climate policy. Nutrient management monitoring and tracking programs, like those led by Cornell's Nutrient Management Spear Program,[161] have aided farms to decrease nitrogen and phosphorus imports resulting in lower losses to the environment. CJWG is supportive of efforts to reduce nitrous oxide emissions through more efficient use of nitrogen fertilizers and have suggested consideration of a fee on such fertilizers as a potential mechanism to reduce their use.

Components of the Strategy

- **Expand funding and technical assistance:** AGM and SWCC should increase support for planning, technical assistance, and soil health or nutrient management practice implementation through the AEM Framework and associated programs, including the CRF and Agricultural Nonpoint Source Abatement and Control (AgNPS) water quality program.
- **Engage with and expand program participants:** AGM, SWCC, and SWCDs should seek feedback from groups, such as but not limited to BIPOC, women, LGBTQIA+, low income, veteran, and beginning farmers, that are not currently engaged in practices and programs to remove obstacles for participation (such as holding focus groups, surveys, and farm-to-farm education).

[161] Cornell University's Nutrient Management Spear Program works to conduct applied, field and laboratory-based research, facilitate technology and knowledge transfer, and aid in the on-farm implementation of beneficial strategies for field crop nutrient management, including timely application of organic and inorganic nutrient sources to improve profitability and competitiveness of New York State farms while protecting the environment. (http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/DairySustainabilityIndicators.html)

- **Expand cost-share eligibility for historically underserved farmers and capital-intensive equipment:** AGM and SWCC should expand cost-share eligibility for equipment needed by farms to implement more advanced soil health and nutrient management practices. Emphasis will be on improved access to technical and financial support for historically underserved and beginning farmers.
- **Expand SWCD capacity:** New York should expand capacity of SWCDs and partners to aid on farm implementation of GHG reduction and sequestration management practices.
- **Enhance workforce training:** AGM and SWCC should continue and enhance training for agricultural planners and farmers.
- **Support implementation services:** AGM and SWCC should support expanding capacity of custom farming service providers to aid on farm implementation of nutrient management practices.
- **Increase use of existing tools:** Cornell CALS and CCE should increase use of improved methods of monitoring performance via crop yield measurement, Nitrogen use efficiency, and Whole Farm Nutrient Mass Balances (for farm-wide Nitrogen management). Document benefits of Nutrient Management to farmers, policymakers, and public.
- **Collaborate with industry led initiatives:** Cornell CALS and AGM should collaborate with industry led nutrient management initiatives and services, such as the 4R Nutrient Stewardship Program.[162] Initiate and expand nitrogen efficiency and yield crop contests for peer-to-peer competition and informational opportunities.
- AGM and SWCC should expand capacity of SWCDs and partners to aid on farm implementation of GHG reduction and sequestration management practices.
- **Increase funding for applied research:** AGM should implement long-term funding support for nutrient management applied research and outreach (such as management approaches and technology).
- **Increase outreach:** Cornell CALS and CCE should increase outreach to all farmers that is consistent with the research and technical standards used in New York. Communicate to consumers the steps taken by farmers for nutrient management.

[162] 4R Nutrient Stewardship provides a framework to achieve cropping system goals to incorporate the Right fertilizer source at the Right rate, at the Right time and in the Right place. (https://www.nysaba.com/4r-ny)

AF12. Adopt Soil Health Practice Systems

This strategy focuses on reducing net GHG emissions as well as increasing carbon sequestration and other environmental benefits through adoption of soil health management practices (such as cover and double crops, reduced tillage, and perennial crop systems), also referred to as regenerative agricultural practices. New York's CRF program launched as a pilot in 2015 to address climate change on farms has awarded $12 million in project funding. Integrated into the AEM framework and modeled after the AgNPS grant program, the CRF program demonstrates how climate-responsive efforts can be integrated alongside existing environmental and water quality agricultural programming.

The State's AEM framework provides cost-share funding and technical assistance for GHG emissions reduction activities including conservation tillage, cover crops, and others soil health management practices. Increasing funding opportunities for existing efforts such as the CRF program and enhancing technical assistance provided through County SWCDs, will result in a higher rate of implementation and provide a familiar process to farmers within an infrastructure that already exists. The CJWG supports soil health and climate resiliency and emphasizes removing barriers for underserved farmers which align with components of this strategy.

Components of Strategy

- **Expand funding for current programs:** AGM and SWCC should increase financial support for currently available and implemented practices. Expand funding for CRF, AEM Base, AgNPS; increase payment rates, increase access, build equity into programs, increase technical assistance, encourage adoption of a system of practices, develop soil health standard, establish annual goal for common practices. Increase awareness and support for urban soils and agriculture.
- **Engage with and expand program participants:** AGM and SWCC should seek feedback from groups/communities not currently engaged in practices and programs (such as holding focus groups, surveys, farm-to-farm educational events, addressing urban soils and urban agricultural operations). Improving access reflects the need to ensure that all farmers can take part in these practices and programs.
- **Increase adoption on rented lands:** AGM should increase practice adoption on rented and leased land. Seek feedback regarding support needed for farmers not currently engaged in practices and programs. Engage, educate, and incentivize landowners to increase adoption of practices on land they rent to farmers.
- **Expand capacity of SWCDs:** The State should expand capacity of SWCDs and partners to aid on farm implementation of GHG reduction and sequestration management practices.

- **Increase perennial plant systems:** AGM and SWCC should support converting annual cropland to perennial hay land/pasture and where appropriate (such as steep slopes and highly erodible lands). This is a current effort supported through the state's AgNPS and CRF programs.
- **Increase planning efforts:** AGM and SWCDs should conduct comprehensive on-farm planning to include carbon sequestration goals, GHG emission, nutrient management, and soil health.
- **Increase use of precision and digital agricultural tools:** AGM should support continued development and implementation of precision/digital agricultural tools and sustainable intensification, which is the sustainable increase in yields on current cropland to reduce stress on marginal cropland to support this mitigation strategy.
- **Develop tools for quantification of benefits:** AGM, SWCC, and Cornell CALS should develop tools for verification of benefits, invest in remote sensing to quantify adoption of practices and environmental benefits.
- **Support research for monitoring and verification:** AGM, SWCC, and Cornell CALS should establish and maintain a comprehensive RD&D strategy for monitoring and verification of soil health that address additionality and permanence to support state climate goals and enable federal and private funding of GHG mitigation practices.
- **Support research for new innovative practices:** AGM and Cornell CALS should establish and maintain a comprehensive research strategy in soil health to bring new practices and approaches (such as enhanced rock weathering and biochar) that increase sequestration rates, productivity, other environmental benefits, and scale for adoption.
- **Develop a business case for practices:** The State should identify practice systems that can generate revenue and/or added value to the farm, identify variety of public and private funding sources.
- **Educate consumers:** AGM and CCE should make efforts visible to the public through outreach campaigns making information more available, expand regenerative agricultural practices in marketing programs (such as New York Grown & Certified), improve information provided to public to help customers understand practices involved in products they purchase.
- **Educate farmers:** AGM, SWCC, and SWCDs should expand education and outreach to include all farmers and to support practice adoption and encourage coupling of practices into systems for maximum benefit. Support farm to farm and peer to peer networking to elevate long-term adoption of soil health practices (local farmer discussion groups).
- **Educate students:** AGM, SWCC, SWCDs, and Cornell CALS should support agricultural and soil health instruction in schools to connect students with farms and farmers and knowledge of ecological benefit of healthy soils.

AF13. Increase Adoption of Agroforestry

Adding trees into areas of agricultural production increases carbon sequestration and other environmental benefits. Some examples of these production and conservation practices exist in New York. Current programs, technical services, and support will be leveraged to increase agroforestry adoption while new programs, increased investment in technical support, and capacity will be necessary. Challenges and barriers to wider adoption exist and must be overcome, including addressing the upfront costs to practice adoption, addressing land access and transfer issues/opportunities, filling gaps in research, field trials, pilot projects, and market analysis in agroforestry systems, addressing long term management and maintenance needs, and availability of appropriate tree species and survivability.

Agroforestry practice adoption can contribute toward the afforestation/reforestation goals, hence having a high mitigation potential. Implementation leads for this strategy include AGM, SWCC, Cornell CALS, SWCDs and CCE. Other key stakeholders include American Farmland Trust, land trusts, The Nature Conservancy, New York Farm Bureau, and other farm led organizations. The CJWG supports aiding BIPOC farmers in opportunities for securing farmland aligning with strategies for long-term farm leases and land transfers necessary for perennial systems.

Components of Strategy

- **Increase adoption of practices:** AGM and SWCC should expand CRF program to incentivize agroforestry and set acreage targets for priority practices.
- **Increase riparian buffers:** AGM and SWCC should continue its emphasis on forested buffers through the state's AgNPS and Source Water Buffer Program and federal, USDA Conservation Reserve Program (CRP)/Conservation Reserve Enhancement Program.
- **Increase silvopasturing:** AGM, SWCC, SWCDs, and CCE should expand programs that plan, design, and implement silvopasture systems which are systems that integrate tress, livestock, and forage in intensively managed rotational grazing systems with a focus on proper site and species selection for adding trees.
- **Expand funding for existing programs:** DEC should expand Trees for Tributaries Program, Non-Ag NPS, DEC Division of Fish and Wildlife Programs.
- **Advance alley cropping practices:** AGM, SWCC, SWCDs, Cornell CALS, and CCE should conduct field trials and pilot projects, expand education and technical assistance for alley cropping.

- **Increase SWCD capacity:** The State should expand capacity of SWCDs and partners to aid on farm implementation of GHG emissions reduction and sequestration management practices.
- **Expand education and technical assistance:** AGM, Cornell CALS, CCE, and SWCDs should expand education and technical assistance for agroforestry practices for beginning farmers and farmers experiencing or planning for generational transfer. Long term planning is required for perennial systems.
- **Support long-term agricultural land transfers:** AGM, AFT, and land trusts should assist farmers in securing long--term leasing and farm transfer to BIPOC, women, LGBTQIA+, low income, veteran, and beginning farmers; long-term leases are required for long term perennial systems.
- **Support business planning and market development:** AGM and SWCC should assist farmers with business planning and modeling for value added practices in agroforestry. Expand supply chain development for new products in agroforestry.
- **Conduct outreach to financial lenders:** AGM, CCE, and Cornell CALS should conduct outreach on the environmental and potential economic benefits of agroforestry systems to financial lenders and insurance providers.
- **Collaborate with federal partners:** The State should collaborate with federal partners to better align federal and state policy priorities.

AF14. Develop Agricultural Environmental Management Planning for Climate Mitigation and Adaptation

New York's AEM framework, overseen by the AGM and the SWCC and locally led and implemented by County SWCDs, will continue to enable farmers to reduce GHG emissions and increase sequestration in soils and forests through site-specific practices on lands under their management.

AEM Planning for Climate Mitigation and Adaptation or the development of "Carbon Farm" Planning has the potential, when plans are implemented, to elevate local food production and resiliency, water quality, air quality, storm and flood mitigation, public infrastructure protection, drought resiliency, habitat, scenic vistas, tourism, economic development, and jobs. A suite of technical assistance and planning resources will be developed through the AEM framework on farm and forest GHG mitigation and carbon sequestration opportunities, allowing for further planning and implementation of regenerative agricultural practices. This strategy is essential to the successful planning and implementation of practice systems that are tailored farm by farm for the reduction of GHG emissions and the increase of carbon

sequestration potential on farmland. AEM planning resources will continue to be designed and made available in ways that are accessible and applicable to all farmers.

Components of the Strategy

- **Develop carbon farm planning protocols:** AGM and SWCC should develop planning protocols for Carbon Farm Planning. Identify gaps for future development. Strive for compatibility among state and federal programs. Design methods for collection and aggregation of outcomes from planned and implemented practice systems (such as estimates for GHG emissions, sequestration, and metrics for adaptation).
- **Pilot carbon farm planning:** AGM, SWCC, and SWCDs should conduct on-farm piloting of Carbon Farm Plans.
- **Conduct outreach and education:** AGM, SWCC and SWCDs should provide communication of AEM Planning for climate mitigation and adaptation with farmers (such as case studies, learning from pilot farmers, training on farmer developed planning protocols/tools, and other).
- **Integrate carbon farming with existing programs:** AGM should include planning protocols in AEM Base Programs and compatibility with federal programs. Priority practice systems from plans lead to implementation via direct investment by farmers, other private investors/lenders, as well as state and federal cost-share programs.

AF15. Monitor and Benchmark Agricultural Greenhouse Gas Emissions

Annual monitoring and benchmarking of GHG emissions mitigation, carbon sequestration, and adaptation performance across applicable areas of management on farms in New York is critical to determining success in meeting targets and provide further insight into what strategies lead to the greatest achievements. Information products provide useful, farm-level data for confidential benchmarking by farmers as well as publicly available data through farm case studies (with farmer agreement) and aggregated datasets (at the state level, rather than the farm level) to support future policy, research, and implementation. Like the farm level AEM planning strategy, this enabling strategy is central to the success of all other agricultural mitigation efforts.

Components of the Strategy

- **Establish funding:** AGM and DEC should establish funding for an agricultural benchmarking and monitoring program. This should be a partnership effort among Cornell CALS, CCE, SWCDs, famer groups, and agricultural industry groups.

- **Monitoring and benchmarking:** AGM should develop methods for monitoring and benchmarking (including program staff and advisory committee). Benchmarking at the farm level for farmer use should be based on comparisons with their historical performance as well as the performance of similar types of farms (each kept anonymous). Benchmarking should also occur at the state level with aggregated, anonymous data based on comparisons with our historical performance.
- **Outreach:** AGM and SWCC should introduce monitoring and benchmarking program with farmers and farm advisors.
- **Make data available:** AGM should deliver data summaries of BMPs implementation and associated estimates of GHG mitigation or sequestration levels for confidential farm-scale use and aggregated summaries for public use. Additional key performance metrics will be developed by the advisory committee/expert panel.

AF16. Establish a Payment for Ecosystem Services Program

Currently, farmers do not capture direct financial benefits from generating ecosystem services through their land management techniques. Agricultural lands implementing conservation BMPs provide countless environmental benefits for surrounding communities including improved water quality, carbon sequestration, and pollinator services. Establishing a PES mechanism to provide a new structure for establishing and maintaining practices systems that reduce GHG emissions and sequester carbon in addition to providing other environmental benefits would provide incentive to farmers. This strategy supports the implementation of other strategies that rely on increased adoption of regenerative agricultural practices.

Components of the Strategy

- **Dedicate funding:** AGM should establish funding for a PES program to be developed for agricultural producers.
- **Develop payment mechanism:** AGM and SWCC should research approach and fair compensation for program participants.
- **Conduct outreach:** AGM and SWCC should conduct education and outreach regarding PES program and benefits to local communities.
- **Pilot PES program:** AGM and SWCC should pilot a PES program for agricultural producers to incentivize continued environmental stewardship.

AF17. Bolster Local Agricultural Economies

This strategy supports emission reductions by enhancing existing programs, and promoting the expansion of those programs, that encourage farm viability and resilient communities through the production and consumption of local food. Climate impacts, as well as COVID-19 impacts, have shown an elevated importance in the need for food security. This strategy is designed to enhance the expansion of markets and support for New York's farming community. This strategy will help to enhance viability of New York's diverse agricultural enterprises. To realize the full goals of our mitigation and sequestration strategies, the economic solvency of the agricultural community must be addressed. Much of this strategy relies on bolstering existing programs and initiatives. Implementation of these strategies are ongoing and will be scaled with increasing resources made available. AGM, OGS, ESD, and CCE are implementation leads and main partners in this strategy. This strategy speaks directly to the support of diverse farm operations including BIPOC, women, LGBTQIA+, low income, veteran, and beginning farmers, the CJWG should be supportive of the goals of this strategy.

Components of the Strategy

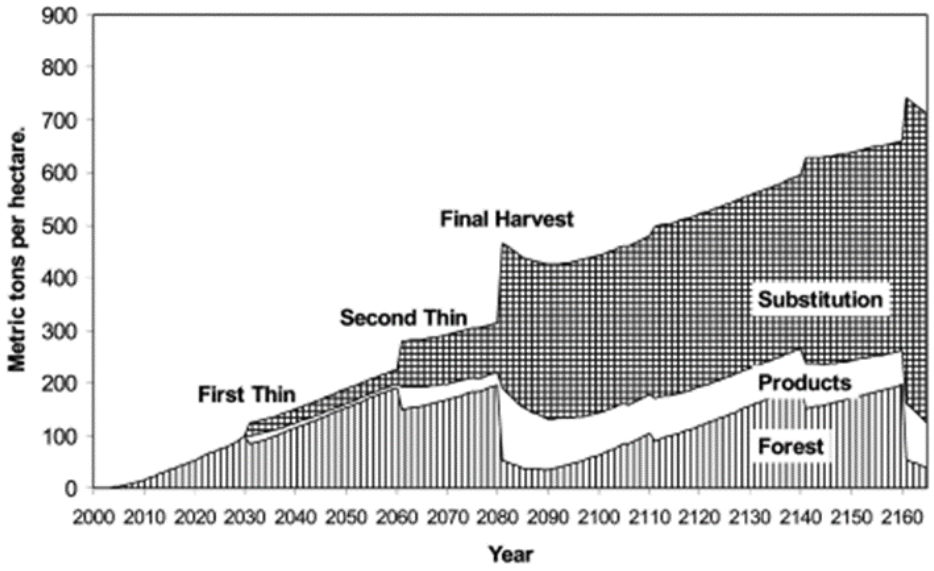
- **Expand procurement programs for New York products:** AGM, OGS, and ESD should expand existing programs in the state that support local procurement of New York agricultural products (such as the Fresh Connect Checks Program, Farmers Market Nutrition Program, Farm-to- School, and Nourish NY).
- **Increase engagement and participation in state programs:** AGM, New York State Council on Hunger and Food Policy, and ESD should engage with communities and producers to advertise these opportunities.
- **Expand education and outreach for new farmers:** AGM and CCE should expand education and technical assistance for beginning farmers and generational transfer. Assist farmers with business planning and modeling.
- **Support new agricultural products:** The State, led by AGM, should help expand supply chain development for new agricultural products in New York such as maple and other agroforestry products.

Climate-Focused Bioeconomy

The bioeconomy is the part of an economy that produces sustainable, renewable bio-based feedstocks, rather than fossil fuel-based feedstocks, to produce products that achieve the climate and social justice requirements of the Climate Act. New York's forest product industry produces a diverse range of products and jobs. New York's forests and wood products industries are directly responsible for nearly

40,000 well-paying jobs and more than $13 billion of economic output and are indirectly responsible for another 53,000 jobs and nearly $10 billion of economic activity.[163] In addition, there is an opportunity for enhanced carbon storage as long-term, durable wood products store carbon. Furthermore, substitution of wood products for fossil fuel based and fossil fuel-intensive products displaces GHG emissions, such as in housing construction[164] (see Figure 53).

Figure 53. Carbon in Forests, Wood Products, and Concrete Substitution Benefits



Source: Perez-Garcia, J., B. Lippke, J. Comnick, and C. Manriquez. 2005. An assessment of carbon pools, storage, and wood products market substitution using life-cycle analysis results. Wood and Fiber Science 37: 140–148.

However, there has been a decline in the number and diversity of primary wood products manufactured directly from logs such as paper, veneer, pallets, boards, and firewood over the last two decades, which has limited management options for forest landowners. To expand the wood products industry to store more carbon and facilitate sustainable forest management, additional wood product markets, further use of wood feedstock and residues, and more training is needed in these industries.

[163] New York State Forest Action Plan. 2020. New York State Department of Environmental Conservation. 144p. https://www.dec.ny.gov/docs/lands_forests_pdf/nysfap.pdf.

[164] Perez-Garcia, J., B. Lippke, J. Comnick, and C. Manriquez. 2005. An assessment of carbon pools, storage, and wood products market substitution using life-cycle analysis results. Wood and Fiber Science 37: 140–148.

AF18. Develop Forestry Training Programs to Support Expanding Workforce and Climate Knowledge

As additional wood product markets and expansion of afforestation, reforestation, and other forest management efforts to enhance the long-term storage of carbon increase, an expansion in New York's forestry workforce will be needed. To help encourage this, information on forest carbon management and climate resilience needs to be incorporated into existing forestry trainings and education programs. Additionally, training programs focused on carbon sequestration, carbon storage, wood product development, and other carbon and climate-related areas need to be developed and promoted within the forestry sector to meet ongoing new demands. Information presented by existing programs will need to be aligned based on BMPs.

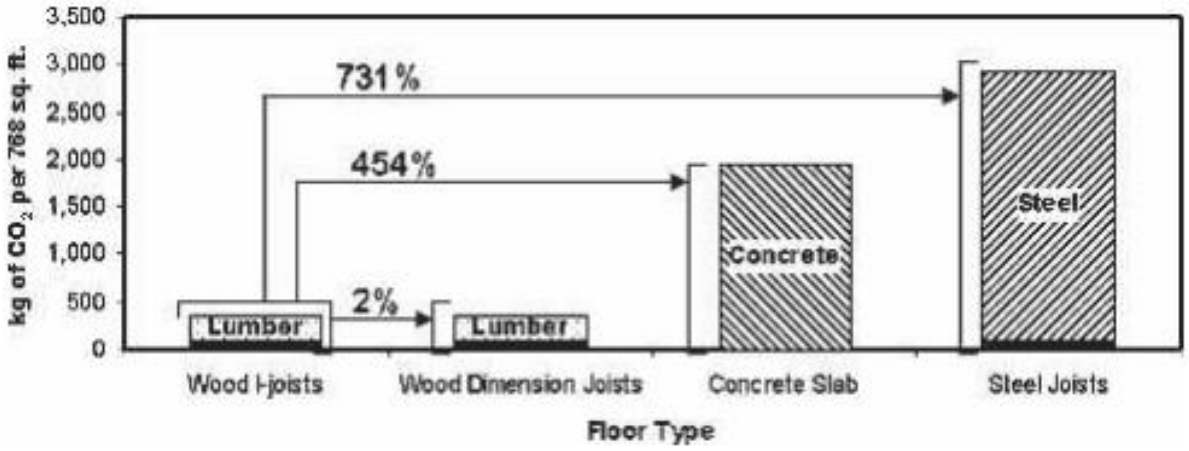
Components of the Strategy

- **Support workforce development and training:** WPDC should develop and support workforce development and training programs for the forest sector, including incorporating forest carbon management into curriculums at the high school (such as the Boards of Cooperative Education Services) and college level and supporting existing training apprenticeship programs for careers in forestry and the forest product supply chain.
- **Integrate forest carbon into education and outreach:** DEC should integrate and support forest carbon, forest carbon management, climate change, and climate resilience into existing forestry training and continuing education programs.
    - DEC should add a requirement for continuing education in forest carbon or forest carbon management to Cooperating Consulting Forest Policy, CP-36, and approve rigor and accountability of the program.
    - DEC should integrate forest carbon and forest carbon management into urban forestry and utility forestry training programs.
    - DEC should bolster support for the Trained Logger Certification Program and implement new training modules including forest carbon BMPs into the Trained Logger Certification program, including increasing carbon sequestration.
- **Lower fee:** The State should enact legislation to lower the initial fee or provide cost share dollars for forestry workers to obtain their New York State Pesticide Applicator's license.
- **Provide outreach and education:** SUNY ESF and Cornell CALS should provide outreach and education to the construction industry and public on mass timber construction and use of harvested wood products (fire safety, high-rise applications).

AF19. Expand Markets for Sustainably Harvested Durable Wood Products

Use of durable, long-lasting wood products especially as a substitution for fossil fuel intensive products like steel, concrete, brick, or vinyl can reduce overall emissions for construction projects. Use of long lasting, durable wood products can reduce GHG emissions when they replace fossil fuel-based products.

Figure 54. Global Warming Potential for Flooring Components



Source: Lippke, B., and L. Edmonds. 2006. Environmental performance improvements in residential construction: The impact of products, biofuels, and processes. Forest Products Journal 56(10):58–63

These products reduce net building and infrastructure GHG emissions and provide long duration carbon storage. In addition to substituting emissions for fossil fuel intensive products, use of wood products benefits forest landowners and provides an economic driver for conservation of forests. The use of high value timber for long lasting products should occur in areas it would be most beneficial to advance forest health and forest carbon sequestration. Execution of and carbon impacts from the components listed below is expected to take five or more years so implementation of these components should begin as soon as possible to help reach long-term carbon sequestration goals.

Components of the Strategy

- **Promote carbon sequestrating materials:** SUNY ESF and WPDC should promote carbon sequestering materials that are substitutes for energy efficiency materials that are fossil fuel based (such as hemp insulation replacing foams and research potential on uses for residues from hemp product creation).
- **Advance building code changes:** DOS and the New York City Department of Buildings should advance building code changes to adopt the International Code Council 2021 International Building Code.

- **Develop standards:** NYSERDA should work with SUNY ESF and Cornell CALS to set standards and specifications for a minimum portion of harvested wood products, such as mass timber or wood flooring, in new construction in certain state-funded/supported buildings and infrastructure projects when New York supply chain can cost effectively meet the demand.
- **Revise state procurement standards:** OGS, DEC, GreenNY, and DASNY should revise state procurement specifications that limit the eligibility of wood products that meet the technical performance standards and set minimum standards for use of wood products in new state-funded construction and infrastructure projects as feasible.
- **Remove barriers:** DOT, DEC, PANYNJ, and EFC should remove barriers and create incentives for using wood for infrastructure applications, including bridges, sound barriers, transportation hubs, utility poles, marine and foundation pilings, retaining walls, docks, and piers.
- **Enhance supply chain:** NYSERDA, SUNY ESF, and Cornell CALS should enhance New York State supply chain for harvested wood products; fund innovation to develop mass timber applications using northern hardwoods.
- **Support research:** NYSERDA, DEC, AGM, SUNY ESF, and Cornell CALS should support research and development demonstration, and technology transfer of wood utilization and wood innovations to scale the use and climate benefits of wood in the built environment.

AF20. Develop a Sustainable Biomass Feedstock Action Plan and Expand the Use of Bioenergy Products

Wood-based bioenergy products such as ethanol, bio-oil, syngas, charcoal, pellets, and briquettes can be used to substitute for fossil fuel products like coal, natural gas, gasoline, diesel oil, fuel oil for heating and cooling, and transportation fuels. Use of these bioenergy products can reduce GHG emissions from long-distance transportation and fossil fuel combustion and improve environmental quality – especially if bioenergy products are developed from wood residues, waste materials, and processing. A Sustainable Biomass Feedstock Action Plan will identify feedstock volumes and production methods that utilize New York State biomass resources in a sustainable, sequestration maximizing manner to create replacements for hard to decarbonize processes while considering other uses for these feedstocks (see recommendation on low-carbon product development). Fuel derived from biomass will likely have a limited but strategic role in New York's 2030 and 2050 needs. The CJWG expressed concerns about the combustion of biomass and biofuels due to their release of emissions. Strategies related to the use of biomass and biofuels are included in this strategy because of the value they provide for displacing carbon emitted from traditional fossil fuels and the potential use for some hard-to-replace carbon emission sources. Biomass

and biofuel emission concerns raised by the CJWG are addressed through sustainability guidelines and standards presented in the components below.

Components of the Strategy

- **Develop sustainability guidelines:** NYSERDA, AGM, and DEC should establish rigorous energy, GHG, and environmental sustainability guidelines and metrics for bioenergy products.
- **Define sustainable feedstocks:** NYSERDA should define sustainable feedstock production for bio-based processing to determine feedstock volume and practices that maximize sequestration, part of biomass action plan.
- **Incentivize residue feedstock use:** NYSERDA, AGM, and DEC should work with SUNY ESF and Cornell CALS to establish preferential pricing to prioritize use of feedstocks that are residues from existing agricultural, forest, and waste systems.
- **Evaluate underused lands for productivity:** DEC and AGM should assess and activate former agricultural and underused lands (including former industrial lands) for more productive uses, one of which could be purpose-grown biomass.
- **Research cost effectiveness:** DEC and AGM should work with SUNY ESF and Cornell CALS to research the most cost-effective methods of using trees and short rotation woody crops (such as shrub willow and miscanthus) to sequester carbon on marginal lands.
- **Develop net-zero energy systems:** NYSERDA and DPS should develop energy systems that can best support a net-zero carbon economy in New York, including programs that leverage private capital to invest in conversion technology for bio-based feedstock into bio-based products
- **Identify efficient bioenergy pathways:** NYSERDA should work with Cornell CALS and SUNY ESF to identify bioenergy pathways with high lifecycle energy efficiency and high emissions reductions (from land-harvest, conversion, and delivery to the end user) that replace fossil fuels and complement next generation energy delivery systems
- **Address hard to decarbonize fuel needs:** NYSERDA and DPS should work with SUNY ESF and Cornell CALS to identify 2050 hard to decarbonize fuel needs (such as high-quality distillate jet fuels) and incentivize appropriate bioenergy development (feedstock supply chain, conversion systems, and end use markets) to meet these needs.

AF21. Increase Market Access for New York Low-Carbon Products

Emerging low-carbon products could be used to substitute for fossil fuel products and fossil fuel-based products to reduce overall GHG emissions – especially for products that are hard to electrify. However,

production capabilities for low-carbon products are lacking in the Northeast and additional defining, monitoring of markets, research, and education are needed for use and promotion of these products. Efforts would take many years before implementation, and monitoring and promotion would need to be ongoing.

Components of the Strategy

- **Track low-carbon product market:** ESD and NYSERDA should begin tracking and reporting on this market to spot emerging trends, innovative applications, external market opportunities, growth opportunities to guide the development.
- **Incentivize innovation:** ESD should spur innovation through lead by example in low carbon procurement requirements for state government (such as bio-based products and low carbon concrete).
- **Identify substitutes that can be used now:** NYSERDA should commence a technology readiness level analysis of low carbon substitutes for fossil fuel-based products and fuels; Identify the high value products from bio-based processing of New York grown feedstocks and invest in production facilities.
- **Incentivize low carbon products:** NYSERDA should provide strategic use of incentives to drive scale-up of high-demand products when the low carbon alternative is not yet cost competitive with the fossil fuel-based option.
- **Define standards for low carbon products:** DFS, NYGB, and ESD should develop standards and guidelines for defining a low carbon product, including ensuring sustainable feedstock production (biomass action plan).
- **Incentivize existing businesses:** NYSERDA, ESD, and DFS should expand access to low interest loans or grants for existing New York State businesses to develop new low carbon products lines by educating local banks on emerging biotechnologies and offering NY Green Bank loan guarantees.
- **Connect suppliers to corporations:** NYSERDA should create a low-carbon products portal to facilitate connecting New York State producers to corporations and other buyers that have made GHG emissions reduction commitments, expand the NY Grown program to cover more products and adding a low-carbon aspect to this program.
- **Expand agroforestry forest products:** AGM should help to expand production of high-value agroforestry products that contribute to maintaining healthy forests (sap/syrup production, nuts, mushroom cultivation, and ginseng production).

- **Provide education and outreach:** DEC, AGM, with ESF should enhance the public's understanding of the bioeconomy and its role in reducing GHG emissions.
- **Develop strategies for hard to electrify applications:** NYSERDA and DEC should develop low carbon fuel strategies for hard to electrify applications.
- **Build buyer confidence:** NYSERDA should provide consumer and business-to-business education on bio-based products and low carbon products, build buyer confidence.

AF22. Provide Financial and Technical Assistance for Low-Carbon Product Development

In addition to State support for increasing market access, financial and technical assistance is needed to grow bioprocessing industries for low-carbon products from low-grade wood and other biomass residuals to create bio-based substitutes for fossil fuel-based products. This assistance must also include an evaluation for any potential emissions of co-pollutants from these processes and measures to reduce or avoid those emissions. Providing this assistance will ensure this strategy mitigates GHG emissions without unintentionally emitting co-pollutants.

Components of the Strategy

- **Quantify bioprocessing investments:** NYSERDA should develop criteria for qualifying near-term bioprocessing capacity investments.
- **Promote high value outputs:** NYSERDA, DTF, and ESD should provide financial and technical initiatives to identify and promote the high value outputs from New York bioprocessing inputs.
- **Attract bioprocessing and bio-based products to the state:** ESD should create an economic development initiative focused on attracting bioprocessing/bio-based product businesses to New York State.
- **Incentivize low grade feedstocks:** DEC and AGM should have preferential pricing for in-state low grade feedstocks that maximize carbon sequestration (organic waste streams, wood residues, marginal land).
- **Invest in conversion technology:** NYSERDA and the Green Bank should develop programs that leverage private capital to invest in conversion technology for bio-based feedstock into bio-based products.

AF23. Advance Bio-Based Products Research Development and Demonstration

Bio-based products have the potential to replace fossil fuel and fossil fuel-based products, including hard-to-decarbonize uses, to lower GHG emissions. Currently, incentives are required to make bio-based and low-carbon products economically competitive for use by industries. In addition, there is a potential for improved efficiency in bio-based and low carbon products and further development of new products. To drive research and development, this strategy recommends developing a demonstration and pilot project portfolio to drive investment in the areas of biobased low-carbon fuels, products, and related sequestration that considers intersection of industrial or manufacturing, agriculture, transportation, and power generation sectors and funding innovation challenges and projects that can scale beyond business as usual to provide GHG emissions reduction benefits. These strategies are not currently underway in New York and it is expected to take several years to develop products and complete research activities. Research must quantify criteria pollutant emissions, ecosystem services, and bioremediation potential of deep decarbonization and net sequestration pathways analyzed under roadmap. This will enable pathways that contribute to improvements in these areas to be considered for pilot funding.

Components of Strategy

- **Determine product gaps:** NYSERDA, with SUNY ESF and Cornell, should develop a research agenda scope for bio-based products by compiling a list of existing products and product efficiencies and evaluating these for gaps and potential improvements
- **Solicit demonstration projects:** NYSERDA should develop solicitation to perform research and identify promising pilot/demonstration projects.
- **Fund demonstration projects:** NYSERDA should fund research and pilot/demonstration projects identified in the research agenda scope as listed in the component above.

AF24. Advance Deployment of Net Negative Carbon Dioxide Removal

CDR pathways create a negative emissions profile for bioeconomy products and other economic sectors (long duration carbon storage beyond net zero), helping to ensure that replacement of fossil fuel and fossil fuel-based products results in lowered GHG emissions. Net negative CDR can provide permanent storage of atmospheric carbon.

Many CDR feedstocks (such as agricultural waste and dedicated energy crops) provide ecosystem and bioremediation services during growth. CDR technology biochar is being used in the western US to remove residual waste products from forest thinning to reduce wildfire risk, and shows promise for urban

organics management, or as a replacement for fly ash in concrete. However, CDR biochar has not been widely used in the northeastern forests and may be the most useful in ecosystems that need to have residual wood removed due to high wildfire risk. Carbon capture directly from the atmosphere is currently extremely expensive and, as such is not widely used. Several years will be needed for DEC and NYSERDA, with assistance from SUNY ESF and Cornell, to begin to set up standards, identify CDR technologies and pathways, and identify research and development priorities.

Components of Strategy

- **Set goals and standards for CO_2 removal:** NYSERDA and DEC should set clear goals and standards regarding the need for net negative removal, evaluate solutions viable today and monitor solutions that could be viable in the future.
- **Identify CDR technologies:** NYSERDA with SUNY ESF should support the identification of verifiable and maintainable CDR technologies and pathways, such as direct chemical carbon capture and CDR options for biomass energy generation (biochar, capture and storage).
- **Prioritize research needs:** NYSERDA and DEC with SUNY ESF and Cornell should develop RD&D agenda and priorities, Initial work to focus on nature-based CDR pathways while examining the role of technology-based pathways in the future.
- **Fund demonstration projects:** NYSERDA should fund demonstration projects of CDR technologies, such as such as direct chemical carbon capture and CDR options for biomass energy generation (biochar, capture and storage) to show the GHG benefits of these techniques over the lifecycle of projects.

Chapter 16. Waste

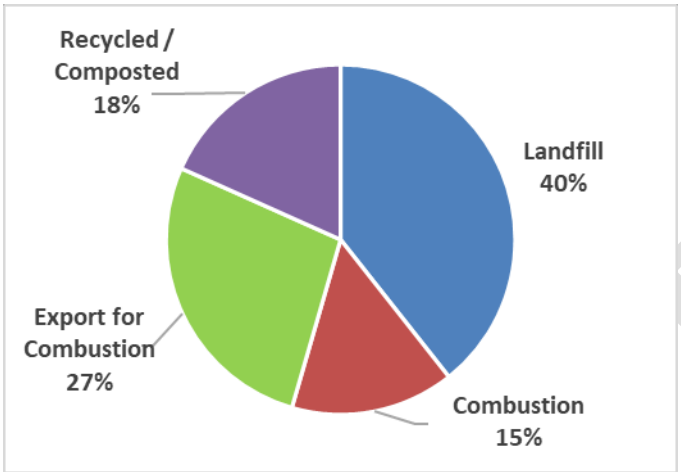
16.1 State of the Sector

Overview

The waste management sector, for the purposes of the climate analysis, includes all aspects of materials management and wastewater treatment. Materials management includes waste reduction, reuse, recycling (including organics recycling), combustion, and landfilling. In New York, more than 18 million tons of municipal solid waste (MSW) is generated each year, or 1,850 pounds for every person that lives in the state.

MSW generated in New York is managed through recycling (including composting and other organics recycling), combustion, landfilling in-state, and export for landfilling or combustion out-of-state. As outlined in the following chart and table, 18% of the MSW generated was recycled, 15% combusted, 40% landfilled in New York, and 27% was exported to other states for landfilling or combustion in 2018.

Figure 55. End Use of MSW Generated in NYS (2018)



MSW Destination	Tons (2018)
Landfill	7,174,868
Combustion	2,764,004
Export	4,954,487
Recycled/Composted	3,341,051
Total MSW Generated	18,234,411

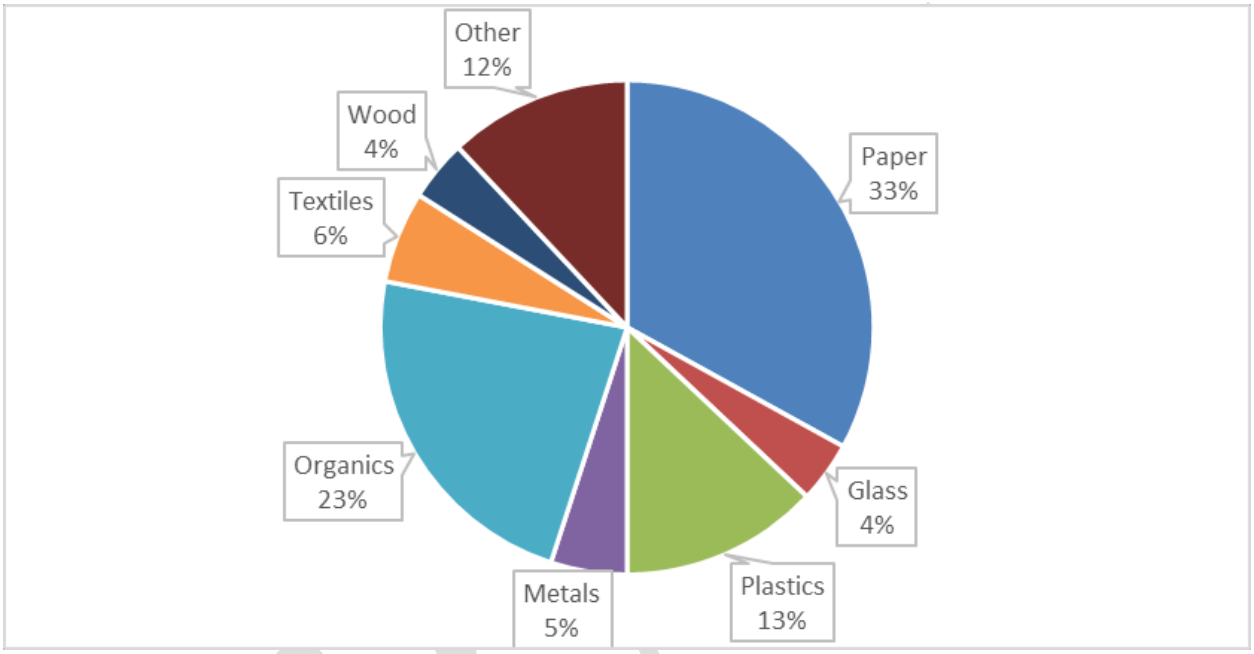
Source: DEC Solid Waste Annual Report

To manage the MSW generated and handled in New York, many facilities are needed. There are a variety of facilities found in the state, including MSW and industrial landfills; combustors; recycling facilities, including organics, recyclables handling, and recovery facilities; construction and demolition debris handling and recovery facilities; and transfer facilities.

The number of MSW landfills has dropped significantly since 1988 and has remained roughly consistent since 2000. In the past, MSW were smaller, local, and less sophisticated. Modern landfills tend to be regional and are sophisticated engineered structures. While many New York State communities dispose of their waste within the state, a significant amount of waste is transported for disposal across state borders, both out of and into the state. The flow of waste is influenced by economic and market forces as well as regulatory and policy directives. However, movement of waste across state borders is considered interstate commerce and is therefore governed by federal authority under the US Constitution. Congress has considered legislation that would allow states to constrain the movement of garbage from other states, but no such laws have passed. In the absence of action on the federal level, the export and import of waste across state borders is expected to continue.

In addition to the quantity of waste generated and how it is managed, the characteristics of the waste stream itself have a major impact on possible climate change impacts. The MSW waste stream in New York is depicted in the following chart.

Figure 56. MSW Generated – Material Composition



Source: Beyond Waste, NYSDEC

Municipally owned wastewater treatment plants perform a critical function in protecting water quality. There are 612 publicly owned treatment works, or wastewater treatment facilities that are owned by public entities, in New York that serve 1,610 municipalities. The total design flow for all facilities is approximately 3,800 mgd (million gallons per day), while the reported actual flow rate is approximately 2,400 mgd. Over 70% of the facilities report actual flow rates that are less than 1 mgd. The facilities range in size from New York City's vast system that processes 1.3 billion gallons of wastewater a day through 14 facilities, to small village systems that process less than 100,000 gallons a day.[165]

Emissions Overview

GHG emissions from the waste sector represent about 12% of statewide emissions, including landfills (78%), waste combustion (7%), and wastewater treatment (15%). Most

[165] https://www.dec.ny.gov/docs/materials_minerals_pdf/bsmgmt2015.pdf

According to EPA, on a life-cycle basis, 42% of the national GHG inventory is influenced by the energy and fuel consumed in the production, use and management of the materials that become waste.[166]

of these emissions represent the long-term decay of organic materials buried in a landfill, which will continue to emit methane at a significant rate for more than 30 years. It also represents both waste landfilling in New York and waste export to landfills in other states.

The most obvious and well-documented contribution to GHG emissions from the management of waste is from the uncaptured emissions of methane from landfills. As organic materials break down in a landfill's anaerobic environment, they generate methane, a GHG 84 times more potent than CO_2 (20-year GWP basis). MSW landfills in New York have gas collection systems in place that greatly reduce emissions, but gases still escape through the landfill cap and leak during the active placement of waste. In addition to landfills, there are other waste handling practices that produce GHG emissions, including combustion and anaerobic digestion. Although anaerobic digestion is recognized as a method for recycling organic waste, if there are leaks from the gas handling system, methane can be lost to the atmosphere. Wastewater treatment plants have GHG emissions through wastewater processing systems and from anaerobic digesters (if present).

Greenhouse implications of waste go beyond waste handling considerations. More than 70% of municipal waste comprises products and packaging, the production, distribution, and disposition of which generate emissions. Every step of the process—mining, harvesting, manufacturing, and distribution—consumes energy and generates pollution. Thus, to the extent that waste can be reduced through extended use of products and materials and through various recovery strategies, they will not have to be replaced with new materials requiring an equivalent demand on resources and the environment.

The lifecycle impacts of waste are described in the EPA's report, Solid Waste Management and Greenhouse Gases: A Life Cycle Assessment of Emissions and Sinks. For many wastes, the materials in the waste represent what is left over after a long series of steps, including extraction and processing of raw materials, product manufacturing, transportation of materials, consumer use, and waste management.

[166] Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices, US-EPA, September 2009.

The most significant GHG emissions impact during the lifecycle of products and packaging result not from disposal, but production of the products and packaging that eventually become waste. According to the U.S. Department of Energy's Energy Information Administration, industry worldwide uses more than 50% of the energy consumed.

Waste prevention and recycling can significantly reduce industrial energy consumption. For example, a lifecycle study on the paper industry found that recycling paper and using that recycled paper in production reduces the greenhouse impacts of paper manufacturing by two to six times (depending on the paper grade) as compared to virgin manufacturing and landfilling or combustion. Using recycled materials in paper production can also reduce demand for virgin timber, conserving trees that absorb CO_2. The potential for positive impacts of material recovery and reuse in the metals industry is even greater. When manufacturing aluminum, 95% of the GHG emissions can be avoided by substituting scrap vehicle aluminum for virgin feedstock.[167] The GHG emissions reductions related to manufacturing with recycled materials in place of virgin are so substantial that the GHG emissions from transportation of materials for recycling are not a significant factor in the overall carbon footprint of recycling.

There are significant opportunities to reduce or avoid GHG emissions by improving both materials themselves and our materials management practices. Strategies to do this are discussed later in this chapter.

Vision for 2030

For solid waste management and water resource recovery facilities (WRRFs), the major contributors to emissions are associated with landfill emissions, with sources found at WRRFs and other facilities. To reduce emissions to achieve the required 2030 GHG emission reductions, significant increased diversion from landfills, as well as emissions monitoring and leak reduction will be needed.

Vision for 2050

The Climate Act requires a more dramatic decrease in GHG emissions by 2050, achieving at least an 85% reduction (compared to 1990 levels). For solid waste and WRRFs, this necessitates a dramatic shift in the way waste is managed, to the point that landfills are only used sparingly for specific waste streams, and

[167] https://recycling.world-aluminium.org/review/sustainability/

reduction and recycling are robust and ubiquitous. Also, methods to monitor leaks and emissions are well developed and implemented, and those emissions are significantly reduced.

Existing Sectoral Mitigation Strategies

In 1988, the Solid Waste Management Act (Section 27-0106 of the ECL) established in law the preferred hierarchy of solid waste management. The hierarchy established the following priorities to guide the programs and decisions of DEC and other state agencies:

- First, to reduce the amount of solid waste generated;
- Second, to reuse material for the purpose for which it was originally intended or to recycle the material that cannot be reused;
- Third, to recover, in an environmentally acceptable manner, energy from solid waste that cannot be economically and technically reused or recycled; and
- Fourth, to dispose of solid waste that is not being reused or recycled, or from which energy is not being recovered, by land burial or other methods approved by the department.

In addition to the hierarchy, the Solid Waste Management Act established:

- Structure and expectations for regional solid waste management planning units to encourage regional cooperation;
- Requirements and funding for local solid waste management plans in accordance with the hierarchy of solid waste management methods;
- A mandate that municipalities adopt and implement source separation laws or ordinances for recyclables from all generating sectors by 9/1/92 (less than five years from enactment); and
- DEC's role in fulfilling these requirements.

The Solid Waste Management Act's requirements were intended to ensure that both state and local governments work actively toward establishing environmentally sound solid waste management systems that integrate the hierarchy of solid waste management methods and emphasize waste reduction and recycling, using landfills only for materials that could not be managed in a more productive way.

To enhance waste reduction, reuse, and recycling programs, DEC has initiated a number of actions, including grants, product stewardship, organics recycling, education initiatives, and others.

Grants

The Municipal Waste Reduction and Recycling (MWRR) Program, funded by the Environmental Protection Fund (EPF), is the financial backbone of municipal recycling infrastructure in New York, with $83.5 million allocated since 2010. The MWRR program provides a recycling grant program for municipalities that covers capital, recycling coordinator salaries, education, outreach, and planning projects, and household hazardous waste collection.

Product Stewardship

The New York State Electronic Equipment Recycling & Reuse Act (E-waste Law) was signed into law on May 28, 2010. The E-waste Law requires manufacturers who sell or offer for sale covered electronic equipment (such as computers, computer peripherals, televisions, small scale servers, and small electronic equipment) in the state to register their brands of covered electronic equipment with DEC, and establish a convenient acceptance program for the collection, handling, and recycling or reuse of electronic waste, free of charge to most consumers.

From April 2011 through December 2018, over 725 million lbs of electronic waste from New York consumers were sent for recycling or reuse, rather than being sent to landfills, waste combustion facilities or other improper disposal methods. In addition to electronic waste, New York has programs that require manufacturers to collect and recycle rechargeable batteries, retailers to incentivize lead battery return, manufacturers to collect and manage mercury thermostats, requirements to collect and recycle post-consumer paint, and to recycle cell phones.

Green Products

The procurement of green products by government entities can drive the market for products made with recycled content and reduce waste. Through the GreenNY initiative, New York leverages tremendous purchasing power to drive markets to produce products that utilize recycled content, generate less waste and are in alignment with circular economy principles. The GreenNY initiative drives state procurement of green products.

With these state programs, purchasing green, post-consumer products is made easier and more accessible. The New York Office of General Services (OGS) Procurement Services manages about 1,500 state purchasing contracts, many of which contain environmentally friendly products and services. The

GreenNY initiative has established a total of 53 green procurement specifications covering approximately 94 different commodity, service, or technology products to be purchased by the state.

New York State Bag Waste Reduction Act

In 2017, it was estimated that New Yorkers used 23 billion bags annually. As of March 1, 2020, all plastic carryout bags (other than an exempt bag) became banned from distribution by anyone required to collect New York sales tax. For sales that are tax exempt, plastic carry out bags are still not allowed to be distributed by anyone required to collect New York state sales tax (unless it is an exempt bag).

Outreach and Education

DEC initiated a number of outreach and education programs to enhance recycling, including the Recycle Right NY campaign, using social media and other means to educate the public on recycling, the DEC Delivers platform to publicize information, education for students, and market development. To research ways to increase recycling, DEC is funding multiple state colleges to look at paper, glass, waste composition, public attitudes, and other aspects of recycling.

Food Donation and Food Scraps Recycling Law

In 2019, New York passed the Food Donation and Food Scraps Recycling law. Effective January 1, 2022, large generators of food scraps (defined as generating an annual average of two tons per week or more) must donate edible food and recycle all remaining food scraps if they are within 25 miles of a viable organics recycler. In addition to the Law, DEC has implemented grants programs and multiple outreach efforts to increase food donation and food donation and food scraps recycling.

Key Stakeholders

Key stakeholders include environmental NGOs, municipalities, state agencies, emergency food relief organizations, businesses, solid waste management facilities, and solid waste transporters.

16.2 Key Sector Strategies

The key strategies within this sector are organized into three themes, as shown in Table 14.

Table 14. Waste Sector Key Strategies by Theme

Theme	Strategies
Waste Reduction, Reuse, and Recycling	W1. Organic Waste Reduction and Recycling W2. Waste Reduction, Reuse, and Recycling W3. Extended Producer Responsibility (EPR)/Product Stewardship W4. WRRF Conversion W5. Refrigerant Diversion
Fugitive Emissions Monitoring, Detection, and Reduction	W6. Reduce Fugitive Emissions from SWMFs W7. Reduce Fugitive Emissions from WRRFs
End Markets and Biogas Utilization	W8. Recycling Markets W9. Biogas Use

Waste Reduction, Reuse, and Recycling

Waste reduction, reuse, and recycling is critical to achieve the targets and goals of the Climate Act. The strategies described below are ambitious, fundamentally shifting the way New York currently produces, uses, and handles products and materials at end-of-life. Significant GHG impacts from this sector include the uncaptured emissions of methane from landfills, specifically from organic materials. There are also significant GHG impacts from the creation and distribution of products and packaging. Therefore, the following strategies are aimed at addressing the full lifecycle of materials and products from product creation to the beneficial use of materials that would have otherwise been wasted. For waste management facilities located in disadvantaged communities, reducing the volume of material handled and capturing methane reduces odors that significantly impact quality of life for those communities and pose potential health impacts. Reducing waste volumes will also reduce the need for transfer facilities and will reduce truck traffic from waste hauling that can impact disadvantaged communities.

W1. Organic Waste Reduction and Recycling

Reducing the disposal of organics, including food scraps, is key to reducing the methane and CO_2 emissions at landfills and combustion facilities. Food scraps make up 18% of the total MSW stream in New York. A portion of this is wholesome, edible food that should first be source-separated and provided to people in need. This can be achieved by introducing and implementing legislation, new regulations, and financial support statewide. Proven technologies exist and successful existing systems for managing these materials can be replicated, but there are challenges related to financial limitations, behavioral change, and logistics. The relatively low cost of landfilling (particularly in Western New York) makes

recycling less attractive to both the private and municipal sectors. The development of infrastructure for additional organics recycling capacity and improving food donation systems is costly. However, when implemented correctly, these costs can be partially shifted from existing waste disposal costs. Economically viable markets must also exist for the soil amendments and other resultant products of organics recycling to make sustainable systems. The CJWG agrees that ending the disposal of food scraps and yard waste at landfills and incinerators is probably the single most important action the state can take to cut emissions from this sector. The CJWG recommends stronger programs to require major food generators, farms, supermarkets, restaurants and institutions like universities, hospitals to all develop sophisticated programs that transfer excess edible foods to local food banks and other programs designed to feed the hungry.

Components of the Strategy

- **Significantly reduce the disposal of organics:** The State should enact legislation to amend and expand the existing Food Donation and Food Scraps Recycling Law (2019) to phase in organics source-separation requirements, eventually ban combustion and landfilling of organics, and require a surcharge (fee per ton) on all waste generated in New York to provide financial support for reduction, reuse, and recycling.
- **Financial assistance:** The State should expand existing financial assistance programs for emergency food relief organizations, organics recycling facility infrastructure, municipalities, non-profits, and food scraps generators. This includes incentivizing public-private partnerships for organics recycling facility development.
- **Use existing organics models:** DEC and appropriate housing authorities should expand and replicate successful models of organics collection programs inclusive of multi-family buildings and public housing. The state should expand education and outreach for residents, schools, and generators of food scraps.
- **Simplify regulations:** DEC should simplify regulatory requirements for co-location of solid waste infrastructure operation as well as siting for small-scale, non-profit facilities.
- **Requirements for local plans:** DEC should require local solid waste management planning units to emphasize food scraps recovery programs.
- **Facilitate research and development:** DEC should facilitate research for and development of recycling markets for organics/soil amendment products and end uses.

W2. Waste Reduction, Reuse, and Recycling

Waste reduction, reuse, and recycling initiatives significantly reduce the methane and CO_2 emissions at landfills and combustion facilities by avoiding disposing of waste in the first place. Outside of direct state agency impact, municipalities and non-profit organizations are already implementing successful and replicable waste reduction, reuse, and recycling programs. However, having consistent and sufficient funding, staff, and technical support to establish and operate will lead to greater success. The CJWG is supportive of policies that reduce waste and encourage recycling. CJWG recommends convenient recycling collection programs throughout the state and that these programs receive adequate funding.

Components of the Strategy

- **Fee per ton on waste:** The State should enact legislation to establish a surcharge (fee per ton) on all waste generated in New York to provide financial support for reduction, reuse, and recycling.
- **Enact legislation:** The State should enact legislation requiring "By Request Only" policies for single-use products and require reusable/refillable options for consumer goods in retail stores.
- **Phase out single use packaging:** The State should enact legislation that supports the reduction and eventual elimination of single use packaged items for use in stores.
- **Container deposits:** The State should enact legislation to implement deposit container programs where feasible.
- **Support for local facilities:** The State should provide financial support for local reuse centers, material exchanges, and repair shops to move beyond volunteer-run operations.
- **Workforce development:** The State should support workforce development, job training and trade skills in repair, refurbishment, remanufacturing, recycling, and innovative materials reuse.
- **Textile recycling:** The State should implement comprehensive textile waste reduction and recycling programs.
- **Buildings solutions:** The State should expand and replicate successful models of recyclables collection and outreach programs inclusive of multi-family buildings and public housing and fund infrastructure development (such as eco-hubs) to increase access to reuse and recycling opportunities for multi-family housing and campuses.
- **Outreach:** The State should implement new and expand existing statewide campaigns for reduction, reuse, and recycling targeting New York residents and businesses and increase research collaborations and expand upon existing partnerships to improve outreach and education efforts. The State should also support peer-to-peer education and outreach campaigns in underperforming and BIPOC communities around reduction, reuse, and recycling.

- **Support municipalities:** The State should support coordination between local and regional municipalities to enhance regional recycling initiatives and provide funding to hire local enforcement officers for municipal recycling programs, encouraging cross-jurisdiction and multi-planning unit collaboration.
- **State procurement standards:** The State should enact legislation to require state procurement standards for recyclable products (such as textiles, paper, and packaged products).
- **Research and evaluation of current standards:** The State should evaluate the feasibility of requiring deposit-driven, universal restaurant reusables, evaluate the feasibility of requiring reusable shipping containers and padding to replace packaging material from online retailers, support innovative zero-waste product development and business projects, and support digital demand software and technologies to monitor and reduce over-production across all sectors.
- **Tool development:** The State should develop lifecycle analysis model and solid waste management decision making tool.

W3. Extended Producer Responsibility/Product Stewardship

Enacting broad EPR or product stewardship requirements to cover end-of-life management of post-consumer products will allow the state to ensure their sustainable management. Successful EPR legislation and programs already exist in New York for beverage containers, electronic waste, mercury thermostats, post-consumer paint, cell phones, pharmaceuticals, and rechargeable and lead-acid batteries. Products that could benefit from new EPR legislation include packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, all batteries, appliances (especially those containing refrigerants), mattresses, and other methane-generating wastes. While it may require the development of additional infrastructure to collect and recycle additional materials, EPR strategies shift responsibility for the end-of-life management onto the producers and manufacturers of consumer goods and away from the general public. This also encourages sustainable product design and waste prevention measures higher up the product chain.

While opposed by some industries, legislation to create a framework for EPR, or individual legislation targeting products with the greatest GHG reduction impact, can significantly reduce these potent gases that are generated when consumer goods and packaging are disposed in landfills and at combustion facilities. Additionally, the end-of-life management of solar panels and large-scale batteries will become more of a concern as renewable energy technologies are implemented and grow. The CJWG is strongly supportive of policies focused on waste reduction and have expressed support for EPR, indicating that passage of an EPR bill should be a priority for addressing emissions from the waste sector.

Components of the Strategy

- **Enact legislation:** The State should enact and implement new legislation that creates an EPR/product stewardship framework. Alternatively, individual legislation should be enacted targeting products with the greatest GHG impact (such as packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, batteries, appliances [especially those containing refrigerants], and mattresses).
- **Research end-of-life:** DEC should research end-of-life management for difficult to manage materials, such as solar panels.

W4. Water Resource Recovery Facility Conversion

Transforming wastewater treatment plants from a waste disposal priority to WRRFs that emphasize the capture of beneficial products is a key component of the circular economy. WRRFs, which represent much of the existing capacity for organics materials management in New York, present tremendous opportunity for reducing GHG emissions. However, the funding for WRRFs is tied to municipal water and sewer rates, is generally constrained, and is largely dedicated to improving water quality, making it difficult to self-fund beneficial reuse projects. Additionally, currently market conditions and regulations favor the landfilling of biosolids and digestate byproducts over beneficial reuse. Rising landfilling prices may push some municipalities to beneficially reuse naturally, but others that have agreements with local landfills and will require additional incentives to transition to recycling systems. Many municipalities are already working toward these goals and would benefit from additional state support.

Capital investments will be necessary to unlock the GHG emissions reduction potential of new resource recovery approaches and fully utilize the infrastructure as well as maintain a state-of-good-repair. Biogas and digestate products resulting from beneficial reuse can be valuable if markets are aligned with GHG emission reducing priorities, and incentivizing biogas production could reduce costly infrastructure upgrades at WRRFs. Existing treatment plants have high thermal demands to operate digesters used to stabilize sludge. Boilers and engines on site are often able to replace natural gas with a WRRF's own digester gas. Some facilities may be well situated to provide local communities and co-located facilities with limited but strategic quantities of biogas. The CJWG favors on-site use of biogas captured from waste management and that no significant new transmission infrastructure should be allowed to support additional biogas.

Components of the Strategy

- **Beneficial use:** The State should support beneficial use of biosolids and renewable biogas, recognizing that water treatment process waste generation is unavoidable.
- **Optimize anerobic digestion:** The State should operate co-digestion programs at anaerobic digesters with existing capacity and include difficult to compost organics such as post-consumer food scraps and fats, oils, and grease.
- **Implement co-digestion:** The State should support increased pre-processing and de-packaging capacity throughout the State to capture more organic waste from products that are packaged, but are no longer suitable for public sale.
- **Research co-pollutants:** The State should evaluate the extent and impact of co-pollutants such as emerging contaminants.

W5. Refrigerant Diversion

HFCs, widely used as refrigerants in appliances, are potent GHGs with very high GWPs. HFCs contained inside well-maintained appliance systems pose minimal threat to the environment, however 90% of fugitive emissions of these gases happen during end-of-life management of the appliance. Policies incentivizing the destruction of refrigerants at end-of-life would encourage the retirement of old, energy-inefficient equipment so that these materials are not released to the atmosphere. These policies should be coupled with continued alternative refrigerant and system efficiency research and production.

An EPR program has the potential to be cost-effective and its impact easily quantified with reporting requirements. There are a wide range of manufacturers, products, and types of refrigerants used in new and existing appliances. Enforcement may be challenging due to the large number of facilities managing these end-of-life appliances, and there is currently a lack of comprehensive disposal data.

Components of the Strategy

- **End of Life:** DEC should promulgate regulations requiring reclamation or destruction of refrigerants from appliances at end-of-life and institute requirements for verification and reporting. The Legislature should enact EPR legislation for refrigerant-containing appliances.
- **Appliance Servicing:** DEC should promulgate regulations banning the sale of virgin high GWP refrigerants for servicing with an exception for reclaimed refrigerants.
- **Reporting:** DEC should create a registry and reporting requirements (to track sales, stockpiles, and leaks) for large refrigeration and HVAC systems and refrigerant wholesalers and distributors.

- **Research:** DEC should research end-of-life management for various refrigerants and their alternatives.

Fugitive Emissions Monitoring, Detection, and Reduction

The quantification of GHG impacts from fugitive emissions at solid waste management and WRRFs are currently under-reported and will vary based on several site-specific factors such as waste composition and facility design. Assessing these systems both during and beyond the active life of operation as well as minimizing/repairing equipment releasing fugitive emissions (leaks) can significantly reduce sector GHG emissions. The CJWG strongly supports controlling fugitive emissions from landfills, sewage plants and other methane sources as a critical step in reducing emissions from the waste sector.

W6. Reduce Fugitive Emissions from Solid Waste Management Facilities

The anaerobic decomposition of organic materials in MSW landfills and digesters generate a combination of gases, predominately methane and CO_2. Existing regulations require landfills to install gas collection systems and provide continued monitoring well beyond the active life of the facility. Fugitive GHG emissions have also been detected at anaerobic digestion facilities from operation, malfunctioning flares, or gas management systems during the downtime or maintenance on the units, or from the storage of various undigested materials on-site. The current GHG emissions levels from these point sources can vary significantly among individual facilities and are likely being under-reported (as shown in a study on California's methane super-emitters).[168] While monitoring technologies continue to improve, there are significant financial limitations on the facilities and municipalities.

Identifying and reducing fugitive emissions of methane from landfills and anaerobic digesters through baseline measurement, increased monitoring, and engineering and regulatory programs can reduce leaks and provide facilities with comprehensive data on their operations.

Components of the Strategy

- **Landfill gas capture:** DEC should enhance existing regulations for landfills to require installation of landfill gas collection systems sooner after waste placement and expand monitoring requirements beyond existing criteria

[168] Duren, R.M., Thorpe, A.K., Foster, K.T. et al. California's methane super-emitters. Nature 575, 180–184 (2019). https://doi.org/10.1038/s41586-019-1720-3

- **Enhanced landfill cover systems:** DEC should develop regulations for enhanced landfill covers to increase oxidation of methane, specialty landfill gas collectors for difficult to access areas, and gas dewatering to increase collection efficiency.
- **Maintenance:** DEC should improve maintenance on methane collection systems at anaerobic digesters.
- **Monitoring:** DEC should incorporate improved emissions monitoring programs, utilizing new technologies (such as drones).
- **Research:** DEC should research comprehensive landfill GHG emissions to evaluate monitoring techniques, quantify fugitive GHG emissions, and evaluate most appropriate uses for the gas during the transition to statewide electrification.

W7. Reduce Fugitive Emissions from Water Resource Recovery Facilities

Similar to solid waste management facilities, comprehensive data on existing fugitive GHG emissions WRRFs is not available, and additional regulations and funding sources will be critical to address wastewater sector impacts. Wastewater infrastructure was not always designed to mitigate GHG emissions. Municipalities will need to measure and reduce GHG emissions from WRRFs, septic, and sewer systems, which can be difficult without the proper equipment and training.

Where density and local conditions allow, septic tanks should be eliminated and converted to municipal sewer collection systems or advanced onsite treatments. Larger municipalities may be able to absorb some of these costs, but medium and smaller municipalities do not have the funding to accomplish this without state support. Total sewering costs will vary based on the availability and proximity of a local WRRF, local soil conditions, and other factors. Fortunately, some larger municipalities are already implementing these techniques and can provide guidance for others to replicate successful programs. Some communities have high septic costs because of soil conditions and may be willing to transition. Emissions from wastewater treatment plants lead to odors and potential health impacts which have a significant impact on neighboring communities. Prioritizing reducing these leaks in disadvantaged communities will improve air quality in these communities.

Components of the Strategy

- **Capture and beneficially reuse fugitive biogas:** DEC, EFC, and NYSERDA should work with local utilities and municipalities to repair and consistently operate WRRF flares, boilers, engines, or other equipment on-site and evaluate captured biogas potential to identify strategic beneficial

uses before flaring excess capacity. DEC should also require additional emissions monitoring regulations and oversight.

- **Monitoring:** DEC should perform emissions monitoring and updates at WRRFs and septic systems.
- **Ensure proper maintenance of septic systems at the municipal level:** The State should enact legislation to establish a municipal funding mechanism (paid for by homeowners) to allow contractual services for routine maintenance on septic systems.
- **Encouraging transition to sewer:** EFC should repurpose existing septic sewer assistance programs to include sewer hookups to defray high up-front costs of sewering.
- **Operator training:** The State should provide financial support and job training to wastewater system operators.
- **Research:** DEC should research nitrous oxide emissions profile of WRRFs.

Markets for Recovered Resources and Biogas Utilization

The recycling industry needs viable and consistent markets to continue to capture the economic value of materials and promote them for their highest and best use. Support for domestic recycling facilities and markets for the resulting recovered resources is critical in keeping the recycling strategies in this Plan financially feasible and easy to replicate.

While solid waste management and WRRFs are recommended to follow all other strategies in this draft Plan to achieve the maximum reduction, reuse, and recycling of waste, it is recognized that some wastes (including biosolids) are unavoidable. Additionally, the organic fraction of waste already disposed of in landfills will produce methane in-place for many years. Capturing these unavoidable gases for strategic and local use while the State transitions to electrification will help meet the goals of the Climate Act while avoiding future reliance on fossil fuels.

W8. Recycling Markets

Some markets may exist currently, but the prices paid for secondary materials are rarely enough to sustain the cost of the collection and processing systems. Additionally, developing more local and regional opportunities for materials management can lessen the impact of global economic market fluctuations (such as the China National Sword policy). In support of this market development work, New York has entered into contracts to fund SUNY research in overall domestic recycling markets development, plastics recycling research, and glass processing innovations. OGS implements existing green procurement rules to obtain recycled content materials at state agencies and ESD has previously assisted with funding

recycling markets for materials such as glass and tires. Implementing additional funding resources for municipalities and implementing sound post-consumer content requirements across different sectors can make secondary material processing cost competitive with virgin materials, conserving resources and reducing the GHG emissions impact from the disposal of otherwise recyclable materials. The CJWG are supportive of recycling programs that cut the need for virgin materials and reduce emissions from the manufacturing of consumer goods.

Components of the Strategy

- **Market development for recovered resources:** The State should support domestic recycling facilities and markets for recovered resources (including compost, digestate, and recycled aggregate/building deconstruction materials) and incentivize public-private partnerships for recycling facility development. The State should also enact legislation to require a minimum level of recycled content in certain products and packaging.
- **Reuse of building materials:** DEC should provide financial assistance to research the increase of capture and reuse of building deconstruction materials and recovered aggregate. DEC should also change requirements (such as procurement standards and bid specifications) to include recycled or reused deconstruction materials.
- **Recyclables in green procurement:** DEC and OGS should enhance and implement new green procurement programs to require the use of recyclables (such as compost and construction aggregate) by state and local entities and those contracting with the government.
- **Organics roadmap:** DEC should conduct a market study of the quantity and characteristics of organics (food waste, biosolids, other high strength waste) produced statewide, including possible end uses of such products (such as agriculture, mine reclamation, roadside soil amendments, and erosion control).

W9. Biogas Use

During the implementation of aggressive waste reuse, reduction, and recycling techniques, it is recognized that some amount of waste generation will be unavoidable. Biogas generation from landfills and from anaerobic digestion will continue and a viable use for the biogas is needed. Determining limited and strategic best uses for energy produced from biogas derived from organic waste is needed. Assessing use in the waste transportation sector, electric co-location, or cogeneration opportunities for energy and heat intensive industries and hard to electrify users is an avenue for biogas use. End use should be focused on applications where no new gas transmission infrastructure will be needed. Alternative revenues at organics recycling facilities, such as biogas revenue, will allow lower tip fees to attract organics at

competitive levels. Stable, enhanced energy revenue will attract investment to aggressively manage methane in existing disposal facilities and existing and new organics recycling facilities. The CJWG expressed that biogas could play a role in environmentally sound waste disposal, but caution should be taken to avoid biogas use intentionally or inadvertently leading to the extended use of fossil fuels.

Components of the Strategy

- **Strategic use of biogas:** NYSERDA and PSC, along with utilities, should evaluate strategic and local uses of generated fuels, electricity, or other energy produced from biogas for essential needs during the transition to electrification and other low-emissions energy sources. This evaluation should stress fuel uses in the waste transportation sector, electric co-location or cogeneration opportunities for energy/heat intensive industries, and hard to electrify users.
- **Funding for organics recycling infrastructure:** NYSERDA and PSC, along with utilities, should identify energy pricing models and conduct a market-based study for waste-generated biogas. The State should also provide a funding mechanism to support an organics recycling infrastructure.
- **Research:** DEC should complete a comprehensive landfill gas and WRRF emissions research study. The study should evaluate emissions monitoring techniques, quantify fugitive emissions, and evaluate the most appropriate uses for the gas during the transition to statewide electrification.

Statewide and Cross-Sector Policies

Chapter 17. Economy-Wide Strategies (PLACEHOLDER)

Chapter 18. Gas System Transition

18.1 Overview

Decarbonizing the natural gas system in New York State will be a complicated undertaking affecting a broad range of stakeholders: the utilities that need to transform their business models; gas utility customers that need to retrofit heating, hot water and cooking appliances in their homes and businesses; local governments that need to consider building code changes; commercial and industrial gas customers that need to consider changes to their business operations; regulators that will need to equitably and legally balance shareholder and customer interests when deciding, for example, how to handle assets tied to fossil fuels that are no longer able to generate an economic return because of changes associated with decarbonizing the economy, commonly referred to as stranded assets.

There are various scenarios to be considered for how to decarbonize the natural gas system, ranging from electrification and gradually discontinuing operations of the gas utility infrastructure to repurposing the infrastructure to deliver RNG Using existing natural gas infrastructure to deliver hydrogen or a natural gas/hydrogen blend would reduce the emissions of GHGs from the natural gas distribution system, but the incorporation of hydrogen brings with it implications for safety and compatibility of the system, as well as potentially increased costs for customers. During the transition to the decarbonized systems, investments in traditional infrastructure may still be necessary to maintain reliability for remaining natural gas customers.

It is important that the transition to a decarbonized natural gas system in New York State not impose undue cost burdens on customers that rely on this fuel for home heating, especially those who can least afford cost increases. Demand reduction measures that reduce customer reliance on natural gas, including energy efficiency and demand response programs, must be increased. Electrification of heating load may not be possible for all customers. Continued availability of some form of methane will likely be necessary to retain some industrial customers in the State, many of whom employ significant numbers of New Yorkers. In addition, continued economic development in the State may rely, in part, on continued availability of methane fuels, including RNG.

The production of natural gas in the state was 11.8 TBtu in that same year, primarily in the electric generation, residential, and commercial sectors, which combined account for 91% of natural gas consumption.[169]

The natural gas system is divided into three sectors:

- **Upstream:** Includes activities such as exploration (well drilling and testing), production (extracting raw gas), and gathering and boosting (transferring resources to pipelines or processing facilities).
- **Midstream:** Processing of raw gas, transmission and compression of gas through main transmission pipelines, and storage of gas.
- **Downstream:** Distribution of gas to end users through truck delivery or pipelines.

Historical emissions from the natural gas sector in New York State have declined since 2005, due to decreases in both emissions from the upstream sector and distribution components. The upstream reduction reflects the supply conditions in the state, as well as the sensitivity to fluctuations in the national and global gas markets and policy considerations, such as the state's ban on high-volume hydraulic fracturing. The reduction on the distribution system was driven by the New York PSC's policy to require utilities to remove leak-prone pipes from service and the aggressive reduction of known leaks on natural gas distribution systems. In 2016, methane emissions from the oil and gas sector accounted for approximately 1% of the statewide emissions. However, CO_2 emissions from the combustion of gas accounted for 43% of fuel combustion emissions across the transportation, electricity generation, residential, commercial, and industrial sectors. Though gas accounts for 35% of fuel used for electricity generation in New York State, it accounted for 82% of electricity sector emissions in 2016. Many states and the federal government account for GHGs using the current IPCC guidelines, which advises using a 100-year GWP from the IPCC AR4. However, in 2021, DEC proposed a new rule (6 NYCRR Part 203 – "Oil and Natural Gas Sector") to address methane leakage from the oil and gas sector. The regulations aim to reduce or prohibit the venting of natural gas at wells, compressor stations, storage sites, and metering and regulating stations. The proposed rule also contains rigorous leak detection and repair requirements for oil and gas infrastructure and requirements for controls and operations.[170] The regulations are predicted to reduce 1.2 million metric tons CO2e of methane emissions, the equivalent of

[169] NYSERDA. 2021. "Patterns and Trends: New York State Energy Profiles, 2003–2017." 2021. https://www.nyserda.ny.gov/about/publications/ea-reports-and-studies/patterns-and-trends

[170] DEC. Proposed Part 203 Oil and Natural Gas Sector. https://www.dec.ny.gov/regulations/122829.html

taking 236,753 cars off the road.[171] This proposed regulation is a major step forward in reducing methane emissions from the gas infrastructure, but there is still much to be done to fully reduce emissions and strategically decommission the gas system.

The need to reduce New York State's use of fossil gas and quickly mitigate methane emissions from this sector are amplified because of the Climate Act's use of a 20-year GWP and the inclusion of upstream emissions in the accounting methods, as discussed in Current Emissions (Chapter 4).

Vision for 2030

Comprehensive analysis and planning have occurred to design a gas transition that is equitable, cost-effective, and maintains system safety and reliability. The gas transition will have to be comprehensive to consider both gas use for power generation and gas use in individual buildings and homes as these sites electrify. Permitting and servicing requirements have been updated to reflect the Climate Act goals and to align with a transition away from gas. To significantly reduce emissions as the system is decommissioned, enhanced regulations for leak detection and repair have been instituted, including increasing the frequency of leakage surveys and deployment of new technologies to detect fugitive methane.

Vision for 2050

By 2040, New York State will operate on a zero-emissions electricity grid. This requires a full transition away from the use of fossil gas by this year within the power generation sector. Gas will be relied upon only in a limited fashion as an energy source. By 2050, the state buildings sector will be energy efficient and electrified to the extent practical while relying on low carbon fuels for hard-to-electrify applications. Due to the reduced demand and emissions reductions targets, the gas system may retain limited service for some industrial or commercial customers for hard-to-electrify applications. Older and leaking gas infrastructure will have been largely replaced, and the gas system will have begun to contract as electrification increases. What need remains will rely on new and leak-resistant equipment. Interstate transmission of natural gas across the state will continue until the geographical regions that border New York State reduce their reliance on natural gas.

[171] DEC. DEC Announces Proposed Regulations to Reduce Methane Emissions from Oil and Natural Gas Sector. 2021. https://www.dec.ny.gov/press/122850.html

Key Stakeholders

Key stakeholders for transitioning the gas system include federal and state regulators (FERC, PHMSA, DEC, DPS, and PSC), gas industry workers, the DOL, gas infrastructure owners, and NYSERDA, municipalities that adopt and enforce building codes, and industrial, commercial, and residential gas customers. The adoption of measures to transition the natural gas system will be heavily dependent on end-use customer adoption of enhanced energy efficiency, demand response, and electrification. That is, utilities have an obligation to continue to provide safe and reliable service, so the speed of end-user adoption of natural gas alternatives will affect the speed with which the utility will be able to transition its own infrastructure.

18.2 Key Strategies

There are two key strategies highlighted in this sector, as shown in Table 10.

Table 15. Gas Sector Key Strategies

Strategies
G1. Transition Away from Gas G2. Maintain the System and Reduce Emissions

G1. Transition Away from Gas

The transition away from natural gas should be carefully managed, phased, and conducted with a focus on just transition principles while maintaining safety and reliability for those who still depend on the energy being delivered. However, the transition should take place as quickly as possible and to the maximum extent possible and include the production, transmission, and distribution components of the system. End-use appliances will become obsolete and need to be replaced.

The state has already taken action toward this transition. The PSC has initiated the Gas Planning Proceeding (Case 20-G-0131) to ensure safe and reliable long-term natural gas planning, which will also require consideration of GHG emission targets in the Climate Act. Furthermore, utility rate case proceedings that appear before the PSC are now required to incorporate a demonstration of how the cases comply with the requirements of the Climate Act, including some of the emerging strategies contained within this draft Scoping Plan, such as no marketing of natural gas and positive marketing of electrification.

The CJWG supports the transition away from gas infrastructure and stresses the need for cost-effectiveness and equity to ensure the transition is just. The CJWG recommends that progress be prioritized in Disadvantaged Communities, where co-pollutants pose a high cumulative burden, and that any progress support the denial of natural gas infrastructure permits. The strategy of prioritizing Disadvantaged Communities may drive costs higher due to the scattered nature of these communities on a distribution system and the need to maintain system integrity, reliability, and the sequence of deconstructing upstream supply assets. The most efficient contraction of the natural gas system would begin at the ends of the system and work inward toward connections with pipelines which will not always begin with Disadvantaged Communities, that may not lie at the ends of the existing natural gas system.

Components of Strategy

- **Analysis and planning:** Develop a detailed analysis to determine the most equitable and cost-effective strategy for transitioning from natural gas while maintaining affordable, safe, and reliable service. Transitioning and decommissioning the gas system will require significant planning due to the complexity of the system, and the need to coordinate with building electrification while maintaining reliable and safe service. To ensure grid reliability, complete the transition in parallel with the NYISO's *Reliability Needs Assessment*. Ensure that the analysis informs a detailed and strategic approach to decommissioning and contracting the distribution system while considering end-use customers who are highly reliant on gas, economic impacts, feasible alternatives, and growth in the power generation sector with electrification (including the Consolidated Edison Steam System).
    - The strategy for transitioning away from natural gas usage must include energy efficiency and demand response programs, which, to date, have mainly been used specifically in gas constrained areas within existing natural gas service territories. Commercial and industrial customers who can shift natural gas usage away from peak periods of consumption without using an alternative fossil fuel present an untapped opportunity. Research must be done on other demand response programs, such as utility control of large commercial water heaters that could shift natural gas usage away from peak periods. The capture of waste heat from water heated for industrial or commercial purposes could reduce natural gas load. Use of the proper incentives could ensure that these programs are pursued in an extremely cost-effective manner.
    - An emphasis and focus needs to be placed on permanent load reduction measures that can significantly reduce natural gas usage and demand in the short term, while also providing

benefits for the end users if and when buildings are electrified in the mid to long term. Building envelope measures provide these benefits and must be implemented efficiently and effectively. This will require coordination on various levels across the state from the agencies and entities that provide support for LMI customers, weatherization programs, building electrification programs, and other energy efficiency programs to develop a comprehensive approach.

- **Inclusion of LMI and the gas industry workforce:** Develop a comprehensive equity strategy to prioritize the needs of LMI households and disadvantaged communities in the transition, ensuring they are not left behind. This will require meaningful engagement of LMI households and residents of disadvantaged communities in the transition process and prioritizing technical and financial assistance to enable these households to make energy efficiency upgrades and electrify affordably. Create an equitable transition plan for the gas industry workforce, including protections, retraining and training that leverages transferrable skills, and job transition opportunities with attention to opportunities at dual-commodity utilities. This requires both a comprehensive system-wide equity strategy and utility-level equity strategies that include adequate accountability and oversight.
  Special consideration will need to occur for the workforce at gas only utilities. Since transitioning away from natural gas will likely result in consolidation and the ultimate close of natural gas utilities, the existing workforce will need a path to transition careers. Electric utilities benefitting from the increased revenue of electrification of heating load should absorb some of the potential burden of the stranded costs. Bankruptcy of gas utilities should be avoided. Amending the Public Service Law to allow gas-only utilities to become thermal energy providers may provide a path to their exit from the natural gas business.
- **Regulation development and emissions reduction targets:** Support the current DEC effort to promulgate regulations to decrease methane emissions from gas infrastructure, including upstream emissions, and, in coordination with the PSC, develop specific emission reduction targets (including interim targets) for transmission, storage, and gas distribution utilities upstream of the meter. These targets are necessary to guide utility gas system planning.
- **Permitting and service requirements:** Enact state legislation to amend the Public Service Law and the Transportation Corporations Law to move away from promoting natural gas system expansion by marketing natural gas to prospective customers or providing natural gas service lines and extensions of natural gas mains at no cost to new customers (such as the "100-foot rule"). Have each utility regularly file a proposal for how it will meet the state's 2030 and 2050

emissions reduction goals within its customer base. Incentives and rebates for gas equipment offered by utilities or NYSERDA should be phased out, particularly for sectors and building typologies in which electrification is a near-term solution. To the extent consistent with reliability and safety, the state should deny additional gas infrastructure permits to avoid creating additional stranded assets and exacerbating GHG emissions. Furthermore, the state should advocate to FERC for denial of gas infrastructure projects that will exacerbate GHG emissions.

- Consider building codes and standards among the first measures undertaken. New building codes must limit the application of gas burning appliances in new construction. Focusing solely on reduction in natural gas–fired appliances may encourage consumers to use propane- or oil-fired appliances, so consider the interplay among the three fuel types. In addition to providing proper incentives to consumers to employ electrification of space and water heating, HVAC contractors must be trained on the merits of heat pumps so they are more comfortable with recommending this equipment to customers, and contractors must be provided with proper incentives to encourage the conversion.
- The PSC has jurisdiction over the rates and operations of a number of electric and natural gas municipal energy systems and can direct the entities to implement decarbonization measures. Additionally, the PSC has jurisdiction over the state's privately-owned water utilities. While many water utilities have fewer than 50 customers, some could be ordered to implement water usage reduction measures that would translate to reductions in both energy usage and emissions.

G2. Maintain the System and Reduce Emissions

The transition from oil and natural gas will take time and, during that time, the state will continue to rely on oil and natural gas infrastructure to deliver safe and reliable energy. To ensure reduced emissions during this period, the state should develop systems to minimize methane leakage from this sector.

To cap abandoned wells, the CJWG suggests that public funds be used as a last resort and that the state consider ways the oil and gas industry could contribute to reducing emissions from these sources.

Components of Strategy

- **Regulatory action:** support future efforts from DEC to further control, reduce, and eliminate methane emissions from gas infrastructure. This may include implementing the use of leak detection and repair–enhanced technology, developing an inventory of all infrastructure and sources of methane emissions potentially subject to state regulation, and operation and

maintenance requirements resulting in reduced methane emissions. DEC should coordinate with the PSC to develop specific targets to guide utility system planning in this regard that would be incremental to existing regulations. The PSC Gas Planning Proceeding, Case 20-G-0131, will address long-term gas utility planning.

- **Research and development:** Continue conducting research and development of leakage detection technologies, including continuous monitoring technologies and survey (aerial or land) for the production, transmission, and storage of natural gas.
- **Reporting and inventory:** Develop a program to accurately characterize gas infrastructure components through information requests to better estimate emissions and improve inventory reporting. Have DEC develop an online registry to collect and organize data and information in a manner that informs and directs infrastructure decommissioning. The Climate Act ([75-0105(4)) states that DEC shall consider a registry but does not direct DEC to create one. The online registry should have a transparent planning and reporting process, include emissions from the gas industry (from wells to end of distribution network pipes/burner tips) and lists of fugitive methane from sources such as landfills and wastewater treatment. The registry should track and collect data needed for interim targets. The registry should account for, report, and track environmental attributes of any advanced fuel project or fugitive methane avoidance project that ensures no double counting of reductions or environmental benefits. The CAC should determine the best and highest environmental attributes. In addition, the PSC should ensure that all rate agreements it reviews comply with the CLCPA, and its proceeding focused on modernizing natural gas planning should require natural gas utilities to monitor and report emissions as well as develop strategies for reducing emissions within their individual service territories.
- **Leakage detection and repair and abandoned wells:** The state should develop an integrated plan and coordinate efforts to with utilities, gas producers, infrastructure owners, and local municipalities to deploy advanced leak detection technology and to repair leaks in remaining gas infrastructure while maintaining affordable, safe, and reliable service. The program should be designed with measures to limit leakage to the extent feasible, particularly with regard to higher-emitting infrastructure and EITE industries, where leakage would be most likely to occur in the absence of such measures, and should identify appropriate funding sources to locate and cap abandoned wells. Alternative approaches, such as output-based rebates and border adjustments, have been used in other jurisdictions. For a more in-depth discussion on the topic of leakage and EITE industries, please see Appendices X, Y, and Z. The PSC Gas Planning Proceeding (Case 20-G-0131) should require utilities to identify leak-prone pipe for replacement, quantify leakage, consider Non-Pipe Alternatives, and maintain safe and reliable service.

Chapter 19. Land Use

19.1 Overview

The way we use land, whether for development, conservation, or a mix of uses, directly affects the state's carbon emissions, sequestration, and storage. Smart growth land use patterns reduce transportation-based GHG emissions by reducing automobile use and thus reducing VMT; sustainable land use planning and zoning can facilitate optimal siting of renewable energy; and protection of forests, cropland, and wetlands is critical for natural carbon sequestration. Deciding where to conserve land, where to develop and how to arrange and design that development constitutes the critical first steps in addressing climate change in land use. These decisions directly impact the ability to achieve carbon mitigation, sequestration and adaptation and resilience goals.

The dense and targeted development patterns that result from implementation of smart growth land use principles can support land conservation strategies that are critical to climate change mitigation. Strategic open space conservation can help contain sprawl and direct development into more appropriate areas, and maintain large, vegetated natural lands that contribute to carbon sequestration and storage, while providing an array of additional benefits including wildlife habitat, agricultural production, flood protection, clean water, wood products, and recreation.

Land use and land management decisions that seek to maximize carbon sequestration in our natural and working lands is a key component to realizing the Climate Act goal of net zero emission across all sectors of the economy. Not only are natural and working lands critical for carbon sequestration, avoiding conversion of such lands eliminates the prospect of additional GHG release.

Smart growth and local government planning are important enabling actions that are needed to balance the protection and restoration of natural and working lands, development, and clean energy siting. New York State envisions a significant shift to infill development and redevelopment of existing buildings in municipal centers with existing infrastructure to proliferate compact, mixed-use, mixed income development, which will attract future population growth, support and revitalize Disadvantaged Communities, and accelerate TOD. This development pattern would create new opportunities for open space conservation and be fully aligned with the state's transportation and other infrastructure investments, resulting in far less automobile use and dependence and a concomitant reduction in GHG emissions from vehicles.

While land use decision-making falls largely within the jurisdictions of municipalities (cities, towns, villages), state policies, programs and incentives can influence and inform those local decisions to achieve more sustainable, climate-friendly land use outcomes. .

To ensure zero-emissions electricity while increasing sequestration to reach net zero by 2050, local governments will be challenged with balancing these different types of land use. Smart growth and local clean energy siting assistance will be necessary immediately and long-term to help communities meet local needs while balancing land use priorities and pressures.

Existing Strategies

There are more than 28 million acres of natural and working lands in New York.[172, 173, 174] Smart growth and local planning and decision making are needed to inventory and maintain existing wetlands, high value conservation areas, and agricultural production for GHG emissions mitigation, resilience, and adaptation benefits while balancing the increased demand for areas devoted to renewable energy production, forest land, and development. As discussed in Chapter 2, New York has worked for decades on climate action. In addition to the aforementioned, there are several existing strategies that protect natural and working lands and promote smart growth. Over 75,000 acres of farmland has been protected from development through the Farmland Protection Implementation Grant Program and tens of thousands more acres of forestland have been protected from conversion through land purchases and easements with funds from the EPF. Programs like Regenerate NY, AgNPS, the Hudson River Estuary Program, and the annual spring seedling sale assist landowners with tree planting efforts and have resulted in the planting of tens of thousands of trees. The Downtown Revitalization Initiative (DRI) promotes compact, mixed-use development that is energy efficient, focuses development in its downtown, and promotes the use of public transit and reduced dependence on the automobile. Since 2016, forty communities have completed the DRI planning process. The Brownfield Cleanup, Environmental Restoration, and Brownfield Opportunity Area (BOA) programs offer incentives, planning and technical assistance, tax credits, and

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[172] Albright, Thomas A.; Butler, Brett J.; Crocker, Susan J.; Drobnack, Jason M.; Kurtz, Cassandra M.; McWilliams, William H.; Morin, Randall S.; Nelson, Mark D.; Riemann, Rachel; Vickers, Lance A.; Walters, Brian F.; Westfall, James A.; Woodall, Christopher W. 2020. New York Forests 2017. Resource Bulletin NRS-121. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. https://doi.org/10.2737/NRS-RB-121.

[173] USDA National Agriculture Statistic Service. 2019. 2017 Census of Agriculture, Volume 1, Chapter 1: Part 32 State Level Data: New York. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/New_York/nyv1.pdf

[174] Huffman & Associates, Inc. (August 1999) Finalized June 2000. Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's. Prepared for New York State Department of Environmental Conservation. June 2000. Larkspur, California. l7pp. plus attachments. https://www.dec.ny.gov/docs/wildlife_pdf/wetstattrend2.pdf

liability relief for brownfield cleanup and redevelopment. DOS promotes smart growth through the Local Waterfront Revitalization Program, the Smart Growth Comprehensive Planning Grant Program, and the Countywide Resiliency/Smart Growth Planning Grants Program. DEC offers the Adirondack and Catskill Smart Growth Grants Program and the Climate Smart Communities Program.

Key Stakeholders

Stakeholders that promulgate and enforce land use regulations include municipalities at every level, including cities, towns, villages, counties, and special districts. Stakeholders that guide land use policy and investment include MPOs, county planning boards, regional planning councils, REDCs, industrial development agencies and authorities, and local and regional authorities, such as the Adirondack Park Agency. Stakeholders that hold forest land in New York include DEC, AGM, OPRHP, DOT, NYPA, New York Forest Owners Association, land trusts, utility companies, municipalities, municipal associations, local communities, and private landowners. Stakeholders involved in outreach, education, and other forms of landowner assistance include USDA, DOS, DEP, SWCDs, CCE, the Society of American Foresters, International Society of Arboriculture, New York Society of Arboriculture, New York State Urban Forestry Council, education and conservation non-profits, hunting stakeholders, arborists, and foresters. Stakeholders involved in research efforts include SUNY ESF and Cornell CALS. Other stakeholders involved in developing and administering incentive programs and legislation include the New York State Department of Taxation and Finance and the Legislature.

19.2 Key Strategies

The key strategies for reducing GHG emissions through land use practices are described below and organized into three themes, as shown in Table 16.

Table 16. Land Use Key Strategies by Theme

Theme	Strategies
Protection, Restoration, and Monitoring of Natural and Working Lands	LU1. Mitigate Carbon Emissions by Protection of Forest Lands LU2. Afforestation and Reforestation LU3. Avoid Agricultural and Forested Land Conversion LU4. Protect and Restore Wetlands LU5. Mapping, Research, Planning, and Assistance
Forests and Farmland in Municipal Land Use Policies	LU6. Provide Guidance and Support for Afforestation and Reforestation to Local Communities LU7. Increase Forest and Farmland Protection in Municipal Comprehensive Plans LU8. Provide Guidance and Support on Clean Energy Siting to Localities
Smart Growth	LU9. Regional and County Planning and Technical Assistance LU10. Direct Planning, Zoning, and Pre-Development Grants LU11. Align State Funding Priorities

Theme	Strategies
	LU12. Accelerate TOD

Protection, Restoration, and Monitoring of Natural and Working Lands

Natural and working lands in many parts of the state are under pressure from development and conversion, which is causing a steady decline in the amount of CO_2 being absorbed each year.[175] Over 13.7 million acres, or 73% of New York's forests are owned by private landowners.[176] When surveyed, private landowners owning 91.7% of these forested acres stated that they want to keep their forests as forests.[177] However, due to the costs of maintaining a healthy forest, forest dieback due to pests and diseases, annual taxes, and shifts to smaller parcel sizes due to inheritance laws, private landowners have been facing increasing pressures to subdivide or develop their forested lands.[178]

Afforestation and reforestation have the potential to greatly increase the carbon sequestration and storage capacity in New York state. In New York, there are 3.9 million acres that have the potential for reforestation and afforestation, including 1.6 million acres of marginal cropland and pastureland and 27,000 acres of natural lands, which would help mitigate 13.1 MT CO2 per year, with the greatest mitigation potential for pasturelands (9.9 MT CO2 per year), urban areas (1.7 MT CO2 per year), and biological corridors (1.49 MT CO2 per year). However, there may be competing uses for these lands, such as agriculture, renewable energy project siting, and development that will likely make much of this land unavailable for afforestation and reforestation efforts. Identification of areas for reforestation and afforestation is a first step to increasing forest area, as well as carbon sequestration and storage.

[175] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

[176] USDA Forest Service. 2020. Forests of New York, 2019. Resource Update FS-250. Madison, WI: U.S. Department of Agriculture, Forest Service. 2p. https://doi.org/10.2737/FS-RU-250.

[177] Butler, Brett J.; Hewes, Jaketon H.; Dickinson, Brenton J.; Andrejczyk, Kyle; Butler, Sarah M.; Markowski-Lindsay, Marla. 2016. USDA Forest Service National Woodland Owner Survey: national, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011-2013. Res. Bull. NRS-99. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 39 p. https://doi.org/10.2737/NRS-RB-99.

[178] Malmsheimer, Robert W., Patrick Heffernan, Steve Brink, Douglas Crandall, Fred Deneke, Christopher Galik, Edmund Gee, John A. Helms, Nathan McClure, Michael Mortimer, Steve Ruddell, Matthew Smith, John Stewart. 2008. Forest Management Solutions for Mitigating Climate Change in the United States. Journal of Forestry, Volume 106, Issue 3, April 2008, Pages 115–117, https://doi.org/10.1093/jof/106.3.115.

LU1. Mitigate Carbon Emissions by Protection of Forest Lands

New York has 18.6 million acres of forests,[179] which hold an estimated 1,911 MMT of carbon.[180] In addition to carbon sequestration and storage, New York's forests provide wildlife habitat, forest products, flood mitigation, recreational opportunities, and mental health benefits, and protect the state's air and water quality. Forestlands in many parts of the state are under pressure from development and forest conversion, which is causing a steady decline in the amount of CO_2 being absorbed each year. Keeping forests as forests is critical to maintaining and increasing levels of carbon sequestration and storage and preventing emissions, as forests sequester and store much more carbon than any other land use in New York. State and municipal land acquisition provide the most reliable long-term protection of forested areas from land conversion. There are currently 4.8 million acres of forestland owned by the state, local municipalities, or land trusts in New York. To maintain the state's carbon storage and sequestration levels, additional protection is needed, which can be accomplished through land acquisition and conservation easements.

The state should implement the following tactics that keep forests as forests to maintain New York's forest carbon sequestration and storage levels and prevent emissions from development. Many of the strategies and components listed below will take several years to implement and receive carbon benefits, so actions to keep forests as forests should begin as soon as possible to prevent emissions. Comments from the CJWG were supportive overall of the strategies listed below for mitigating carbon emissions by the protection of forest lands.

Components of the Strategy

- **Enact "Keep Forests as Forests" law:** The State should enact legislation to "keep forest as forests" requiring developers to purchase and set aside forested land when forest carbon is lost during development.
- **Establish programs to support local land acquisition:** DEC should enhance support for local land acquisition and conservation easements by municipalities and land trusts through

[179] USDA Forest Service. 2020. Forests of New York, 2019. Resource Update FS-250. Madison, WI: U.S. Department of Agriculture, Forest Service. 2p. https://doi.org/10.2737/FS-RU-250.

[180] Domke, Grant M.; Walters, Brian F.; Nowak, David J.; Smith, James, E.; Ogle, Stephen M.; Coulston, J.W.; Wirth, T.C. 2020. Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2018. Resource Update FS-227. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p. https://doi.org/10.2737/FS-RU-227.

mechanisms such as the Community Preservation Act, Conservation Partnership Program (CPP), Forest Conservation Easements for Land Trusts and Community Forest programs.

- **Maintain and increase state land acquisition:** DEC should continue to maintain and increase land acquisition (fee and conservation easement) by state, municipalities, and land trusts.
- **Require participation in carbon markets:** The State should enact legislation to establish and/or require participation in a forest carbon market for GHG emission sources in the State.

LU2. Afforestation and Reforestation

Following European settlement in the 1600s, New York's forest cover began to drop. This trend increased rapidly during the Industrial Revolution, and by the 1880s, less than 20% of New York State was forested. With the recognition that New York must restore its forested resources, the New York State Conservation Department began widespread planting efforts in the early 1900s. Planting efforts continued with the Civilian Conservation Corps in the 1930s and following World War II. New York is now 63% forested, but opportunities remain for additional afforestation and reforestation efforts to improve carbon sequestration, carbon storage, and all the other benefits that forests provide,[181] especially on New York's 1.6 million acres of marginal lands and areas otherwise lacking sufficient natural regeneration. The strategies within this theme propose an increase in tree planting and efforts to encourage natural regeneration of trees, which will increase carbon sequestration and storage. Seedlings take up to 5 years to become established after planting or natural regeneration, at which time they begin to grow more rapidly and have a greater impact on carbon sequestration.

The New York State tree nursery system was founded in 1902 to reforest areas of the state that were subject to erosion, flooding, and sedimentation. Numerous tree nurseries were established across the state to grow seedlings for afforestation and reforestation efforts. By 1973, all state nurseries were consolidated to the Tree Nursery at Saratoga, which produces 1.2 million bareroot and plug seedlings annually, of which only 200,000 are used for planting on state forests.[182] If only marginal lands are considered for afforestation and reforestation, 872 million trees will be needed over the next 30 years (more than 29

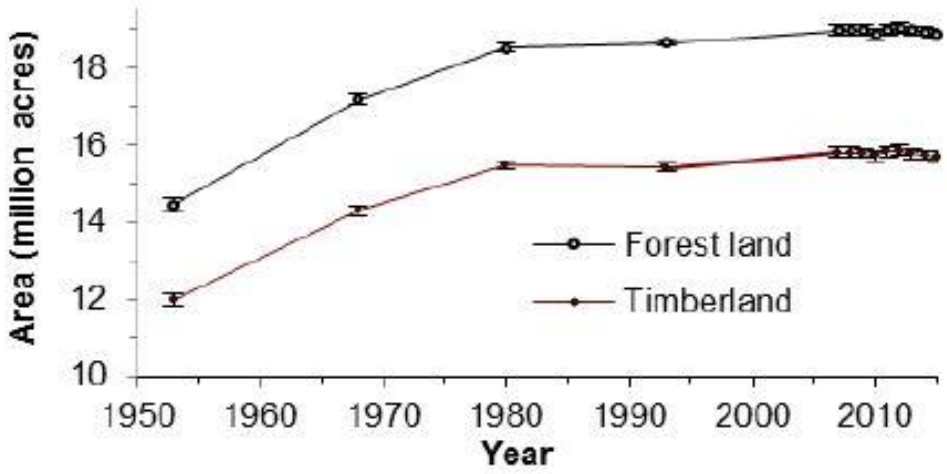
[181] Verschoor, K. and Van Duyne, G. Tree Planters' Notes 55(2):4-13. 2012. https://rngr.net/publications/tpn/55-2/forestry-and-tree-planting-in-new-york-state/at_download/file.

[182] Verschoor, K. and Van Duyne, G. Tree Planters' Notes 55(2):4-13. 2012. https://rngr.net/publications/tpn/55-2/forestry-and-tree-planting-in-new-york-state/at_download/file.

million/year.[183] However, if all potential locations are considered, a total of 2.2 billion seedlings will be needed (73 million/year).[184]

If reforestation and afforestation are going to be a part of GHG emissions mitigation strategies by 2030 and 2050, these efforts need to be started as soon as possible to allow time for seedling establishment. The CJWG feedback was supportive overall of the strategies listed below for the Afforestation and Reforestation strategy.

Figure 57. New York Forest Land Cover over Time



Source: Figure showing forest land (at least 10% tree canopy cover) and timberland (forestland capable of producing wood crop) by year, New York, 1953 to 2016 (Albright et al. 2020)

Components of the Strategy

- **Prioritize locations:** DEC should identify areas where afforestation and reforestation are the most likely to succeed using data provided by the Reforestation Hub,[185] experts, and other authorities. Of the potential land available, factors that may impact afforestation and reforestation success include the soil and site conditions, the level of deer browse, the presence of invasive

[183] Fargione J, Haase DL, Burney OT, Kildisheva OA, Edge G, Cook-Patton SC, Chapman T, Rempel A, Hurteau MD, Davis KT, Dobrowski S, Enebak S, De LaTorre R, Bhuta AAR, Cubbage F, Kittler B, Zhang D and Guldin RW. 2021. Challenges to the Reforestation Pipeline in the United States. Front. For. Glob. Change 4:629198. https://doi.org/10.3389/ffgc.2021.629198

[184] Cook-Patton SC, T Gopalakrishna, A Daigneaul, SM Leavitt, J Platt, SM Scull, O Amarjargal, PW Ellis, BW Griscom, JL McGuire, SM Yeo, and JE Fargione. Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation. One Earth, V 3(6): 739-752. https://doi.org/10.1016/j.oneear.2020.11.013

[185] Cook-Patton SC, T Gopalakrishna, A Daigneaul, SM Leavitt, J Platt, SM Scull, O Amarjargal, PW Ellis, BW Griscom, JL McGuire, SM Yeo, and JE Fargione. Lower cost and more feasible options to restore forest cover in the contiguous United States for climate mitigation. One Earth, V 3(6): 739-752. https://doi.org/10.1016/j.oneear.2020.11.013.

species or other competing vegetation, and limitations on lands with other important uses such as rights-of-way and utility corridors.

- **Reforest rights-of-way:** DOT should work with public and private partners on reforestation efforts in right-of-way areas of the state. These partnerships should determine and focus on tree and shrub species compatible with power transmission and distribution rights of way, roadside areas, pipelines, railroads, and other right-of-way areas and develop programs for afforestation and reforestation in these locations. Public outreach for right tree, right place is needed.
- **Invest in planting technologies:** DEC should invest in seeding technology to fill in smaller forest gaps where needed. These may include the use of drone and robotic technology to distribute seeds in areas regeneration needs to be supplemented.
- **Invest in and update the Colonel William F. Fox Memorial Saratoga Tree Nursery:** The State should provide funding to increase the state tree nursery's capacity to support large scale afforestation and reforestation efforts, including expanding tree species offerings to meet adaptation and resiliency challenges and implementing upgrades to enhance seed collection, seed storage, seedling production, workforce development, and pre-and post-planting practices.
- **Increase grant program funding:** The State should increase of funding for the Urban and Community Forestry Grants to assist local municipalities in the management of the urban forest which can reduce risks associated with extreme heat, drought, and flooding. This would include funding for planning, planting, and maintenance of trees. The State should also provide funding opportunities for private individuals to establish and maintain privately owned trees. This component aligns with adaptation and resilience strategies discussed in further in Chapter 21 and the Appendix.
- **Prioritize locations:** Urban and community forest cover is declining by about 6,720 acres annually.[186] As urban and community forest cover decreases, so do the critical benefits that these trees provide, such as carbon sequestration, reduced heating and cooling costs, air and water quality improvement, and flood mitigation. In addition to the Urban and Community Forestry program, DEC should develop an opportunity assessment to focus tree establishment and maintenance efforts within urban areas and communities where the most climate, societal, and public health benefits are likely to be achieved.
- **Provide guidance and support:** DEC should work with SUNY ESF to develop guidance and provide support and funding to local communities for planning and implementing planting and

[186] Citation missing

maintenance projects that help communities adapt to climate change. This may include sharing resources (like equipment, staff, and bulk ordering). This will help communities maintain critical ecosystem services like flood mitigation, clean air, clean water, reduced sediment and nutrient runoff, reduced energy use, shade, reduce risks associated with extreme heat, and improve human health. This component aligns with adaptation and resilience strategies discussed in further in Chapter 21 and the Appendix.

- **Fund cost-share programs:** The State should continue to expand the funding for cost share programs, such as Regenerate NY, to assist forest landowners in widespread implementation of reforestation and afforestation efforts. These existing programs can help move reforestation/afforestation efforts forward while larger efforts, such as the NY Tree Corps become established.
- **Develop equipment loan program:** The SWCC should develop a tree planting equipment loan program to give landowners and operators access to specialized equipment for small-and large-scale tree planting projects.
- **Provide free tree seedlings:** DEC should expand or create new, free tree seedling programs such as Trees for Tributaries and Buffer in a Bag programs to assist landowners with planting projects. DEC should also explore partnerships with local governments and regional organizations to scale up programs.

LU3. Avoid Agricultural and Forested Land Conversion

Forested Lands

In the past 5-10 years, 65,327 acres of forest land have been converted to other uses each year, such as development, renewable energy production, or agriculture, while only 37,909 acres of non-forest have reverted to forests annually.[146] This strategy proposes additional research and legislation to keep forests as forests. Research activities would include determining and prioritizing the most efficient and effective conservation activities and policies to keep forests as forests and prevent emissions. Legislation changes could take several years and would support forestry activities and require mitigation following development of forests to offset forest conversion emissions and sequestration loss.

Agricultural Lands

The objective of this strategy is to maintain and protect the state's potential for carbon sequestration on agricultural lands through avoided farmland conversion. It will also help to enhance farm viability,

increase food security, and implement smart growth measures to reduce future GHG emissions from VMT.

Agricultural land protection captures carbon in the land base and prevents future emissions from vehicle use by preventing sprawl development. Protecting farmland has the potential to maintain or improve local food production, community resilience, water quality, air quality, storm and flood mitigation, public infrastructure protection, drought resilience, wildlife habitat, economic development, and employment. All of these may have associated health benefits. This strategy requires continued support from public policy and funding for land acquisition, conservation easements and tax incentives; outreach to landowners for interest in selling lands or conservation easement opportunities; coordinating with vast numbers of municipalities with different zoning and planning goals (home rule); improved data connecting land conversion and quantification of GHG emission reduction; understanding the opportunities for land access and intergenerational land transfer.

Components of the Strategy

- **Increase funding and capacity of existing programs:** The State should increase funding for Farmland Protection programs to plan for agriculture and purchase Development Rights (through conservation easements) by state, municipalities, and land trusts.
- **Increase support for historically underserved farmers:** AGM should assist farmers in securing long-term leasing and farm transfer to historically underserved including, BIPOC, beginning farmers, socially disadvantaged, limited resources, and women farmers. This should support youth engagement, internships, and educational opportunities.
- **Strengthen state programs that support agriculture:** AGM should continue and strengthen agricultural assessment and agricultural districts programs.
- **Enhance local capacity to conserve lands:** The State should increase local capacity to conserve agricultural lands through statewide authorization of the Community Preservation Act, elevating the CPP, programs that facilitate the transfer of development rights, and other.
- **Expand legislation:** The State should expand legislation to secure local government ability to designate Minimum Maintenance Roads to reduce subdivision and development pressure on those roads that may result in conversion of farmland to other land uses.
- **Research avoided conversion impacts:** DEC and AGM should continue researching ways to support avoided conversion of forest lands and farmland, respectively, including by quantification of No Net Loss, prioritizing conservation activities, and monitoring to quantify policy impacts.

- **Increase support for succession and farmland access:** AGM should support farmland access and succession with the advancement and development of programs that make farmland more affordable and assist farmers to navigate generational transfer issues. AGM should also expand education and technical assistance for beginning farmers and generational transfer. These efforts should focus on assisting farmers with business planning and modeling and expanding supply chain development for new products.
- **Link farmland protection with environmental management programs:** AGM, DEC, USDA NRCS, and USDA Farm Services Agency should make connections between existing programs (such as AEM, CRF, and AgNPS) to increase co-benefits. This action should target protected farmland for agricultural BMPs that reduce GHG emissions and sequester carbon like soil health management practice systems.
- **Foster new datasets to support decision making:** AGM and DEC should work with Cornell CALS and SUNY ESF should develop new data sets to support avoided conversion and develop monitoring and quantification methodologies to measure the impacts of avoided conversion.
- **Strengthen Right to Practice Forestry law:** The State should enact legislation to strengthen the Right to Practice Forestry law (ECL Section 9-0815) to prevent municipalities from unreasonably restricting or regulating forestry operations on private land.
- **Mitigate impact from renewable energy projects on forests:** DEC should work with NYSERDA to facilitate the siting of renewable energy projects including solar on appropriate sites to avoid adverse impacts New York forests in order to mitigate impacts to carbon storage and sequestration.

LU4. Protect and Restore Wetlands

This strategy focuses on maintaining and enhancing the carbon sequestration potential of freshwater, non-tidal, coastal and estuarine tidal wetlands, submerged aquatic vegetation, and other coastal habitats in New York through protection, restoration, and monitoring. Suggested legislative and regulatory actions and increased funding would address these gaps and provide opportunity for comprehensive protection, restoration, and monitoring of wetlands. While GHG emissions reduction by wetlands may be low compared to forests in New York, it is important to note that many of the state's wetlands are forested, and all wetlands are part of the natural infrastructure necessary for climate adaptation and resilience and collectively contribute to overall carbon storage and sequestration strategies.

Protection of New York's 2.4 million acres of freshwater, non-tidal wetlands[187] (1990s estimate) can contribute to sequestration goals necessary to reach the State's net zero goal. Today, some freshwater wetlands receive protection from Article 24 of the New York ECL and from Section 404 of the federal Clean Water Act. However, many remain vulnerable to alterations that can diminish or destroy their ability to store and sequester carbon, provide habitat, filter water, and mitigate flooding. At the federal level, recent changes to the 2020 promulgated Navigable Waters Protection Rule removed protections for a significant number of wetlands. At the state level, the New York Freshwater Wetland maps are inaccurate and based on outdated technology, leaving approximately 1,000,000 acres of wetlands unprotected, despite meeting the regulatory criteria of Article 24.[188] Restoration and monitoring can further expand the role of wetlands and our understanding of their sequestration potential and opportunities. Estimates suggest that more than half of New York's historic wetlands were lost due to activities like filling, draining, and dredging; preventing similar trends is critical in the face of climate change and continuing pressure from development and incompatible land-use change.

These recommendations are expected to be moderately difficult to implement. Risks to consider include potential opposition to increased regulation or municipal resistance to land protection. Institutionally, there may be insufficient funding and staff, or policy differences in permitting agencies. Additionally, there may be competing interests (such as agriculture and renewable energy) and variable landowner interest in selling or easements. Collectively, these potential barriers could be addressed through new funding (like the Environmental Bond Act), partnerships, and prioritizing and increasing funding for the New York Open Space Plan to support climate strategies. Other possible mitigants include cross-agency and cross-industry communication and coordination, stakeholder engagement, outreach, and education; and reimbursement programs for lost municipal tax revenue.

Components of the Strategy

Efforts in this area can expand and enhance existing programs at relatively low cost, with funding primarily for increased agency staff and land acquisition.

- **Incentivize the use of natural and nature-based features through Army Corps of Engineers regional permits:** DOS, DEC, and DOT should develop regional permits (or specific Nationwide

[187] Huffman & Associates, Inc. (August 1999) Finalized June 2000. Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's. Prepared for New York State Department of Environmental Conservation. June 2000. Larkspur, California. l7pp. plus attachments.

[188] NYS DEC Estimate (2020).

Permit 54 regional conditions) with Army Corps of Engineers to incentivize use of natural and nature-based features to enhance resilience and ecosystem benefits of freshwater and tidal wetlands.

Freshwater Wetlands

- **Improve and expand the regulation of New York Freshwater Wetlands:** The State should enact legislation to improve and expand regulation of all freshwater, non-tidal wetlands, and adjacent areas by fundamentally changing New York's statutory system for regulating these wetlands, including shifting wetland maps from regulatory to informational, and establishing jurisdictional boundaries through field delineation. Implementation of a regulatory program should be further improved by updating state regulations and developing internal and external guidance.
- **Ensure regulatory oversight for wetlands and waterbodies removed from federal protection:** The State should enact legislation to ensure regulatory oversight for wetlands and waterbodies that were removed from federal protection under the Navigable Waters Protection Rule and explore expanded use of Unusual Importance designation to restore oversight to a portion of the wetlands that lost protections under the rule. This should be accomplished within three to five years in collaboration with DOS, ORES, DPS, and the Attorney General. This component aligns with adaptation and resilience strategies discussed in further in Chapter 21 and the Appendix.
- **Increase investment in freshwater wetlands:** The State Legislature, DEC, and DOS should increase investment in the protection, restoration, and monitoring of freshwater, non-tidal wetlands, and adjacent areas, including riparian areas, to maximize carbon sequestration potential (such as an Environmental Bond Act, the EPF, and grants programs like DEC Water Quality Improvement Program and New York State CPP). This should be accomplished within 10 years with assistance from stakeholders that may include OPRHP, conservation NGOs, counties, municipalities, land trusts, and SWCDs.
- **Prioritize protection and restoration of wetlands with the potential to sequester carbon:** The state should fund research that will evaluate the methane emissions and carbon sequestration associated with freshwater impoundments and the impact of their specific water-level and salinity management strategies. DEC should also identify historically drained freshwater wetlands where the oxidation or organic carbon in drained soils in an ongoing source of CO_2 to the atmosphere. These areas should be prioritized for any voluntary buyouts and restoration to wetland status.

Tidal Wetlands

- **Address sea-level rise in state coastal regulations:** DEC should revisit implementation of the tidal wetlands and coastal erosion hazard areas regulatory programs in light of sea-level rise projections, develop internal and external guidance, and determine whether changes in law and regulations are necessary (such as a review of NYCRR Part 661 to consider whether existing elevation, distance, and setback limits on tidal wetlands and adjacent area jurisdiction will remain adequate as sea level rises).
- **Increase planning and investment in existing tidal wetlands and other coastal habitats:** The state Legislature, DEC, and DOS should increase investment in the protection, restoration, and monitoring of existing tidal wetlands, including submerged aquatic vegetation), to protect their ability to sequester carbon from declines due to marsh drowning, sediment starvation, and seagrass die offs caused by pollution in runoff and coastal water quality (such as an Environmental Bond Act or the EPF, and grants programs like New York State CPP). DEC should develop a portfolio of design-build and shovel-ready marsh restoration projects so that New York can compete with neighboring coastal states for high-quality dredge material from Army Corps of Engineers and is ready to take advantage of federal cost-sharing opportunities.

Enable Marsh Migration

- **Plan for sea-level rise and allow marshes to migrate in the future:** DEC should work with municipal partners to create mitigation banks that acquire, restore, and monitor larger tracts of tidal wetland habitat by bundling credits purchased by applicants for state tidal wetlands permits when their projects cause smaller amounts of unavoidable habitat loss, such as the Sawmill Creek wetland mitigation bank.[189] DEC should identify future potential marsh migration routes as sea-level rises and prioritize these parcels for purchase and restoration; fund municipal coastal debris removal efforts, map and remove historical fill and other obstacles to marsh migration on public land, and remove abandoned boats and other large marine debris that smother and damage existing tidal wetlands; and create an insurance program that defrays the financial risk associated with cleaning up legacy pollutants when municipalities acquire coastal properties for marsh restoration and protection.

[189] https://edc.nyc/project/marshes-initiative

LU5. Mapping, Research, Planning, and Assistance

This enabling strategy focuses on maintaining and enhancing the carbon sequestration potential of natural areas in New York, including wetlands, coastal habitats, forests, and grasslands, through improved mapping (both regulatory and non-regulatory), research, conservation planning guidance, stewardship, and assistance for local governments and landowners.

Regulatory programs and land acquisition are two important strategies for maintaining and restoring carbon sequestration potential. These programs must be enhanced with current science, conservation guidance, and increased capacity of partners like local government planners and landowners who routinely make decisions that have lasting impacts on natural areas, including those that have little protection like small wetlands and forests. These strategies are needed to pair priority conservation areas with priority growth areas – a key component of smart planning and smart growth that can sustain large, functioning natural areas that provide health benefits to people and other ecosystem services like flood mitigation, habitat for plants and animals, and opportunities for outdoor recreation for residents and visitors.

Newly available technologies and non-regulatory models from other regions and states can inform these enabling strategies and include relatively low-cost mapping, analysis, research, technical assistance, and funding. Success will require agency staff to provide technical assistance, training, and project management; and funding for small grants, research, mapping, analysis, development of implementation material and tools, and stewardship initiatives. Also important are sufficient funding and partnerships to ensure adequately resourced programs, additional education and outreach to communities, and targeted training and technical assistance for key decision-makers and stakeholders.

Components of the Strategy

- **Update wetland and natural resource mapping:** DEC should apply the best available technology to update maps of wetlands (regulated and unregulated; tidal and non-tidal); shallow water habitats; Significant Coastal Fish and Wildlife Habitats; Coastal Erosion Hazard Areas; and priority forests and natural areas. DEC should also ensure all maps and inventories are accurate and publicly available; schedule recurring updates using the best available technology; and replace Article 24 wetland maps with updated informational Article 24 wetland maps. This effort should engage OPRHP, DOS, conservation NGOs, research partners, SWCDs, and other state agencies in the process.

- **Consider technologies:** Consider emerging and tested mapping technologies, included those applied in light detection and ranging technology Enhanced Wetlands Mapping in the New York City Watershed, Land Cover Mapping and Modeling Initiatives in Chesapeake Bay Watershed and Delaware River Basin, and Object-based Wetland Mapping Approach for Pennsylvania; and National Oceanic and Atmospheric Administration's new high resolution land cover data products.
- **Develop a statewide conservation framework:** DEC should develop a statewide conservation framework[190] that incorporates current, accurate spatial data on critical ecosystems (terrestrial and aquatic), including priority ecosystem complexes and future needs that address climate adaptation needs (such as landscape connectivity, wetland migration pathways, and source water areas); and provides basis for prioritizing state funding, tax relief, land acquisition, and technical assistance programs to conserve priority natural areas and promote smart growth. This should be publicly accessible and DEC should also provide outreach and assistance to ensure appropriate and effective use of framework. This effort and should engage stakeholders such as OPRHP, DOS, conservation NGOs, research partners, SWCDs, regional planning commissions, and land trusts. This component aligns with the adaptation and resilience strategies discussed in further in Chapter 21 and the Appendix.
- **Assist local governments to create land-use policies:**[191] DOS, DEC, and the Legislature should assist county and local governments to create land-use policies, land conservation programs, and smart growth strategies that prioritize and protect wetlands, forests, grasslands, stream buffers, and other natural areas (such as the statewide authorization of Community Preservation Act; training and support on use of CRRA model local laws, comprehensive planning language, zoning, and other conservation planning approaches; and funding for Conservation Advisory Committees and Environmental Management Councils). Key stakeholders should include regional and county planning commissions, counties, municipalities, conservation NGOs, and SWCDs.
- **Provide conservation incentives to landowners:** The State should enhance and create landowner incentives and other techniques to conserve and restore tidal and non-tidal wetlands,

[190] Example of regional conservation frameworks in New York include the Hudson River Estuary Wildlife and Habitat Conservation Framework and the Tompkins County Unique Natural Areas, Conservation Plan and Strategy. A statewide example is the Florida Critical Lands and Waters Identification Project. An increasing number of statewide data sets are available to inform a New York framework; examples include the Open Space Institute's Climate Resilient Landscape Initiative and NY Natural Heritage Program databases and models.

[191] Existing outreach and extension programs and partnerships can serve as models: DOS Local Government Training Program; Hudson River Estuary Program's Conservation and Land Use Team; and county planning federations.

forests, grasslands, and natural areas and utilize living shoreline and nature-based solutions (such as tax abatement programs, tax incentives, land conservation programs, and PES).

- **Research and monitor carbon storage and sequestration potential:** The State should fund research, analysis, and monitoring to determine carbon storage and sequestration potential of tidal and non-tidal wetlands, submerged aquatic vegetation, forests, and other priority natural areas, to increase understanding of mitigation opportunities and to establish siting protocols and priorities for conservation and restoration.
- **Develop new cost-benefit analysis tools:** DEC, in collaboration with DOS and research partners, should develop cost-benefit analysis tools that incorporate the value of carbon for use in planning, environmental assessment, and permitting of conservation and restoration projects.
- **Develop demonstration projects:** DEC and DOS should initiate climate resilient demonstration projects by working with existing wetland protection, restoration, or natural and nature-based features projects to add additional components for maximizing climate resilience and carbon sequestration capacity, developing quantification models and best practices, and monitoring effectiveness.
- **Develop a service corps program:** DEC and OPHRP should create a conservation and restoration service corps program[192] for early and experienced professionals and a youth climate conservation corps for unemployed young people ages 18 to 25. The programs should focus on ecosystem stewardship, management, and restoration activities to maximize carbon sequestration in natural and developed areas (such as tree plantings in lower-income neighborhoods, wetland restoration, and native grassland establishment in municipal parks). These programs would support a just transition and "green job" career training. This component aligns with adaptation and resilience strategies discussed in further in Chapter 21 and the Appendix.

Forests and Farmland in Municipal Land Use Policies

Local governments and organizations provide planning, guidance, and support for land use and to residents. However, many municipalities lack a comprehensive plan and/or zoning that clearly address afforestation or reforestation. Municipal comprehensive plans are used to proactively guide development and other community planning, and while these plans often include information from natural resource inventories, critical barriers, and other local and regional smart growth planning resources to help inform the plan, they often do not include forestland and farmland. The following strategies discuss how to better

[192] GulfCorps is an example of a conservation corps focused on creating resilient coasts and communities in five Gulf Coast states.

equip municipalities with the proper tools to ensure the protection of New York's natural and working lands, while still advancing renewable energy.

LU6. Provide Guidance and Support for Afforestation and Reforestation to Local Communities

Some municipalities may lack the expertise and capacity to support afforestation and reforestation projects, which may result in land being put toward other uses. This strategy involves providing funding and personnel resources to directly support communities in their planning and planting efforts as well as developing trainings and materials to increase outreach and education to local municipalities and organizations. This strategy would take several years to get in place, so it needs to be started as soon as possible to allow time for seedlings to become established in time to be a part of GHG emissions mitigation strategies by 2030 and 2050.

Components of the Strategy

- **Provide guidance for local communities:** DEC should develop guidance and provide support for local communities to plan and implement planting projects that help adapt to climate change.
- **Increase landowner assistance:** DEC should enhance agency and partner capacity to deliver technical assistance and education programs including planting plans and species selection for landowners. This includes assisting with planting plans and site and species selection, promoting tree planting programs, and increasing capacity through partnerships to meet requests, ensure minimal overlap of services, capture accomplishments, and coordinate efforts.
- **Establish NY Tree or Climate Corps:** DEC should establish NY Tree or Climate Corp to provide direct tree establishment and maintenance services to public and private landowners. Staff for a NY Tree or Climate Corps would be regionally based and work with DEC Lands and Forests and local SWCDs, trees for tributaries, and other restoration programs to coordinate location selection, site needs, and implementation. A regionally-based Tree Corps would be provided with several teams of staff (at least 1 team per DEC region) and equipment to establish and maintain seedlings at no or low cost to landowners.

LU7. Increase Forest and Farmland Protection in Municipal Comprehensive Plans

This strategy proposes creation of tools to help municipalities identify and fund inventories of forest and farmland, development of BMPs, and a requirement to include forestland and farmland in planning

efforts, which will help communities target lands for conservation and prevent emissions from land use conversion. Development of tools and BMPs would take several years.

Components of the Strategy

Identify Land Resources

- **Survey land resources:** DEC, in partnership with AGM and DOS, should conduct a quantitative survey of land resources across the state and identification of critical barriers including options of using idle and underutilized lands.
- **Support the development of local natural resource inventories:** State agencies, such as DEC, DOS, and/or AGM, should provide funding to further development of natural resource inventories, critical barriers, and other local and regional smart growth planning and decision-making resources (such as maps to identify suitable reforestation locations) that include forestland and farmland. These resources should support local and regional smart growth planning and decision-making (such as maps to identify suitable reforestation locations, highest value cropland, and idle lands for farming).

Support Best Practices in Planning

- **Develop guidance for BMPs:** DOS and DEC should develop guidance and BMPs for the inclusion of forestland protection in municipal comprehensive plans, including strategies and best practices for land conservation, and identifying priority areas for conservation. DOS should fund technical assistance to implement guidance and BMPs effectively.
- **Require forest inclusion in planning:** State funding agencies should require the inclusion of forestland and farmland protection in state funded municipal comprehensive plans.

LU8. Provide Guidance and Support on Clean Energy Siting to Localities

The Climate Act contains significant requirements for clean energy development, such as the distributed solar and energy storage targets. Local land use decisions are an important part of meeting these requirements. As discussed further in Chapter 20, Local Government, communities often do not have the capacity to plan for renewable energy siting. The following components would better equip local municipalities with the tools they need to effectively consider natural and working lands when planning for clean energy projects in their communities.

Components of the Strategy

- **Develop new planning tools and resources:** NYSERDA should collaborate with community stakeholders, the agriculture and forestry sector, the solar industry, and utilities to develop new planning tools and resources. These tools would include mapping to help municipalities undertake a comprehensive evaluation of the potential for clean energy development in their communities and to plan proactively for deployment that maximizes local benefit and minimizes impact on lands with high-quality soils, forests, and other competing uses.
- **Enhance technical and financial support:** NYSERDA should collaborate with regional planning boards to provide technical and financial support to help local governments plan for and review solar projects.

Smart Growth

Smart growth is compact, mixed-use, mixed-income community development that is walkable, bikeable and transit-accessible and contains a diversity of housing choices, open spaces and public gathering places accessible to people of all ages, incomes, backgrounds and mobility capabilities. Smart growth promotes locational precepts that seek to direct and concentrate development in what are referred to as priority development areas—such as downtowns, main streets, municipal centers, transit-oriented areas, abandoned manufacturing facilities, and disadvantaged communities, among others. Complementarily, smart growth seeks to prohibit or restrict development in what are called priority conservation areas, where development is less desirable for ecological, agricultural, hydrological, or recreational reasons, among others. Smart growth land-use patterns reduce GHG emissions largely in the transportation sector by reducing automobile use, measured as VMT. More specifically, automobile travel is reduced by decreasing the travel distance between daily locations through a denser concentration of different land uses that we regularly access; reducing the number of car trips necessary for daily activities by concentrating that mix of destinations within walking, biking, or transit distance of one another; and providing mobility alternatives to the automobile, such as walking, biking and public transportation (also known as mode-shifting).

The state has taken several steps to promote smart growth and re-investment in downtowns, cities, and other municipal centers. The DRI, for example, provides $100 million annually to redevelop and revitalize ten downtowns, awarding $10 million to one community in each of the state's 10 economic development regions. The State has also funded municipal comprehensive plans that include smart growth, sustainability and climate mitigation and resiliency, including DOS' Smart Growth Comprehensive Planning Grant program, DEC's Climate Smart Communities and Adirondack/Catskill

Smart Growth grant program, NYSERDA's Cleaner, Greener Communities initiative and ESD's Strategic Planning and Feasibility Studies grants. The New York land bank law has yielded the most robust set of land banks in the nation, redeveloping vacant properties, and combating blight disinvested neighborhoods. The state's historic preservation tax credit has generated significant investments in historic buildings in traditional downtowns. The Complete Streets law has helped to create walkable, bikeable, transit-friendly communities for all users. And the state passed the Smart Growth Public Infrastructure Policy Act to curtail state investments in sprawl. Continuing and expanding upon the implementation of municipal, county, and regional smart growth plans, policies, zoning and projects will play a critical role in continuing to achieve the mandates of the Climate Act through reduced VMT.

The following smart growth recommendations seek synergies that result in a proliferation of smart, equitable planning, zoning, and projects, while synchronizing with supportive transportation and housing policies and practices. In particular, the strategies and recommendations align with related transportation goals such as doubling public transportation service outside the MTA service area by 2035 and significantly expanding service within the MTA's service area, equitable TOD, and shifting to low- or no-carbon transportation alternatives to a single occupancy automobile. State agencies and local government officials responsible for implementing these smart growth recommendations should reference California's Senate Bill 375 as a guide for integrated land use, housing, and transportation planning, recognizing Senate Bill 375's shortcomings and the different governance structures of California and New York.

These strategies and recommendations acknowledge and respect the fact that land use zoning falls largely within the authority of municipalities (cities, towns, and villages). The state, however, can influence those local land use decisions through direct planning grants, regional/county planning, technical assistance and capacity-building, and state and local incentives, disincentives and, where appropriate, mandates. Counties and regional planning entities can provide support to municipalities to develop local land use plans and local laws that promote smart growth. It is also critical to recognize the prioritization of disadvantaged communities in the development of these recommendations. Communities of color have been historically disenfranchised by discriminatory land use policies and smart growth strategies and recommendations represent part of a decades-long effort to reverse past discrimination and level the playing field.

LU9. Regional and County Planning and Technical Assistance

Regional and county planning should guide future growth, redevelopment, and conservation at the multi-municipal scale. There should be facilitation and support of collaborative multi-municipal smart growth

comprehensive planning at the county and regional scales to inform and guide land-use decisions, including designation of priority development areas and priority conservation areas. While land use zoning, which determines final land use and development decisions, falls within the jurisdiction of municipalities, this broader regional lens is necessary to inform those local decisions to serve broader land use goals that transcend municipal boundaries--i.e., regional economies, daily travel patterns and transportation systems, housing needs (particularly the availability of permanent affordable housing to meet the entire region's needs and avoid displacement and gentrification, as highlighted by the CJWG) hydrologic functions, open space preservation, and ecosystem health, among others.

Components of the Strategy

- **Achieve alignment with sustainability plans and principles:** State funding agencies and sources should align selection criteria with the priorities and principles contained in the Cleaner, Greener Communities Regional Sustainability Plans, to the extent practicable.
- **Achieve alignment with REDC plans and projects:** ESD, DOS, DEC and NYSERDA should identify opportunities to increase coordination with REDCs and alignment of REDC regional strategic plans with sustainability/smart growth/equity principles.
- **Support county-based resiliency planning:** DOS should expand Countywide Resiliency Planning grants to incentivize county-wide smart growth comprehensive plans that adhere to clear state goals and outcomes. These plans should include health impact assessments where feasible and relevant, particularly in disadvantaged communities that have experienced health disparities.
- **Prioritize areas for development and conservation:** The state, particularly DOS and DEC, should develop criteria and incentives for regional entities and counties to identify priority development areas (including areas appropriate for clean energy siting) and priority conservation areas in consultation with local jurisdictions and communities. The following definitions of priority development areas and priority conservation areas were developed in consultation with the Land Use and Local Government Advisory Panel and the CJWG.
    - Priority development areas are areas appropriate for a concentration of compact, mixed-use, mixed-income development with a variety of housing options at all levels of affordability. Priority development areas should have the proper infrastructure in place to accommodate greater density and should be walkable, bikeable and transit-accessible. Primary examples may include BOAs, downtowns, central businesses districts, municipal centers, hamlets, former industrial districts, infill projects in developed areas, obsolete fossil fuel-based power plants, re-development/adaptive-use of existing buildings, TOD/Equitable TOD,

Disadvantaged Communities (as defined by the CJWG), dead/dying malls and vacant property clusters designated by land banks, among others.

- Priority conservation areas are areas that preserve and restore vital habitats, landscape connectivity, biodiversity, natural water movement, local food security and passive recreation. They may include wetlands, riparian areas, Critical Environmental Areas (as defined by New York's State Environmental Quality Review Act [SEQRA]), forests, agricultural lands and other natural areas and working lands, among others.

- **Expand state funding eligibility for regional and community-based organizations:** The state, particularly DOS, should extend eligibility for funding in program solicitations for select smart growth-related planning and implementation grants to regional planning councils and, where appropriate, qualified community-based organizations.
- **Further empower counties to implement shared regional smart growth priorities:** DOS, in collaboration with counties and local governments, should evaluate opportunities through the use and potential expansion of General Municipal Law Section 239 County Review to further empower counties to implement shared regional smart growth priorities throughout metropolitan and micropolitan statistical areas in municipal planning, zoning, and subdivision proposals.
- **Encourage local tax incentives for infill and downtown redevelopment:** DOS should work with the industrial development agencies and authorities in each region to proliferate tax incentive policies in their Uniform Tax Exemption policies to incentivize infill and downtown redevelopment.

LU10. Direct Planning, Zoning, and Pre-Development Grants

The state should provide direct planning and zoning assistance to local communities and promote municipal implementation of mitigation strategies through enhanced technical assistance, increased support for local adoption of zoning and land use regulations consistent with smart growth principles, and local policies that support sustainable, equitable development and the accelerated expansion of local clean energy while also ensuring and enhancing public outreach, education and engagement, particularly in frontline communities that have historically been disenfranchised and discriminated against in the local land use decision-making process. This strategy aims to empower local governments to achieve smart growth planning and development.

Components of the Strategy

- **Provide state support for comprehensive plans:** DOS and DEC should expand Smart Growth and Climate Smart grant programs to assist municipalities in the efficient development of comprehensive plans, district/corridor plans and zoning, including form-based codes, that adhere to clear state goals and outcomes. Particular attention should be given to disadvantaged and smaller rural communities that have less capacity, funds, or staff for comprehensive planning.
- **Develop model smart growth local laws:** DOS should collaborate with other state agencies as appropriate, including DEC, HCR, OTDA and NYSERDA, to develop model local laws to assist municipalities of various sizes and capacities to implement smart growth plans and zoning laws, including model inclusionary zoning to address gentrification, displacement, and the concentration of poverty. Model local laws to address density and affordability should also be developed, including zoning and site plan review laws that accommodate a variety of densities and uses for localities as a baseline. Such laws should also make available siting for supportive housing, group homes, homeless shelters, multi-family housing, accessory dwelling units, and other affordable housing, and expedited local review of supportive housing or affordable housing where at least 20% is affordable at 80% AMI or below.
- **Provide municipalities with baseline data for planning:** The state should provide centralized necessary baseline data for municipalities to access and use in developing plans, including data on affordability, poverty, and public health.
- **Consolidate all state funding opportunities:** All State funding programs should be included in the annual Consolidated Funding Application, to the extent practicable, and the State should provide a centralized source of information on all state funding opportunities for municipalities and not-for-profits.
- **Expand existing programs to support municipal smart growth planning:** The State should expand the roles and responsibilities of DOS Smart Growth planning, NYSERDA Clean Energy Communities Regional Coordinators, and DEC Climate Leadership Coordinators to provide smart growth planning and zoning technical assistance and capacity-building to municipalities, which would include the integration of land use, transportation, economic development, and housing planning and projects.
- **Expand site/facility re-use planning:** NYSERDA and DOS should support community-based planning to inform redevelopment of obsolete power plant sites and brownfields, particularly through NYSERDA's Power Plant Re-use initiative and DOS's BOAs program, in furtherance of the principles developed by the JTWG.

- **Enhance the awareness of state resources by publishing a Sustainable Development Resource Guidebook:** The State should develop a Sustainable Development/Climate Act Resource Guidebook to serve as a resource to assist regional entities, counties, municipalities, and developers in navigating, accessing, and integrating state programs relevant to sustainable community and clean energy development. This should improve accessibility and ease coordination across programs.
- **Provide a centralized data repository:** The State should build on existing state data portals such as NYSERDA's Climate Science Clearinghouse and DOS's GIS Gateway to provide a centralized, user-friendly digital repository of data resources useful to regional/county/local planners in the development of smart growth land use plans, zoning codes and projects, including data on affordability and other equity matters, disadvantaged communities, climate change projections, and cumulative health impacts. This data resource should be framed as a one-stop shop to consolidate data and planning tools related to climate change mitigation and adaptation, disaster risk reduction, and regional and local land use planning and clean energy siting.
- **Ensure equitable development while avoiding displacement and gentrification:** DOS and other state agencies should explore opportunities to address displacement, gentrification, the concentration of poverty, segregation, and inequitable access to opportunity by providing assistance and resources for community land trusts, land banks, and inclusive zoning that promotes mixed-income, affordable, rental and supportive housing, and shared/community-centered ownership models.
- **Provide outreach and educational materials to support equitable development:** The State should provide model outreach materials and other tools and guidance to support pre-development community outreach, engagement and education for smart growth projects to generate support, awareness and buy-in prior to a developer filing the project with a municipal board. This model should be created in coordination with community-based organizations, local government officials, universities, and others, as needed.
- **Increase the role of community-based organizations in local planning:** DOS should provide grant funding to support community-based organizations to develop local land use plans for disadvantaged communities that can inform and guide development to reduce emissions, adapt to climate change, and achieve a just transition. Examples of such plans include UPROSE's Green Resilient Industrial District, El Puente's Green Light District, THE POINT Community Development Corporation's South Bronx Community Resiliency Agenda, and PUSH Buffalo's PUSH GREEN / PUSH BLUE.

- **Support for generic environmental impact statements (GEISs):** DOS, DEC, and other regional entities and local stakeholders should evaluate options, such as financial and technical incentives, to support development of GEISs for local smart growth overlay zoning (preferably in priority development areas, such as TODs), including early and comprehensive community engagement. The State should consider an established revolving grant fund to support the GEISs, with a pay-back by the developer if it develops projects consistent with the zoning.

LU11. Align State Funding Priorities

State funding should align with smart growth and equity goals and seek to eliminate funding that induces sprawl, particularly with new infrastructure. This is the stated purpose goal of the Smart Growth Public Infrastructure Policy Act. This Act, however, has been utilized primarily in a review and advisory capacity, rather than as a basis for granting funds for smart growth and, just as importantly, denying funds for sprawl. An interagency working should develop amendments to this Act to implement its goal and the requirements of the Climate Act more fully. The amendments should include definitions of priority development areas, priority conservation areas, equitable TOD, and climate justice, along with stronger requirements for state spending beyond the limited existing scope of public infrastructure to comport and align with these definitions.

Components of the Strategy

- **Refine/align state smart growth public infrastructure act criteria:** The State should enact legislation to amend the 11 Smart Growth criteria contained in the State Smart Growth Public Infrastructure Policy Act to define public infrastructure and more accurately identify infrastructure projects that enable both smart growth and sprawl, as well as align those criteria more directly with the Climate Act, with an emphasis on equity and affordability. These amendments should include definitions of priority development areas and priority conservation areas. The amendments should also expand the purview of the law to apply to all state agencies and authorities and all relevant state programs, including planning and design grants (not just infrastructure).
- **Priority funding for smart growth:** State programs should prioritize funding for infrastructure projects that most clearly support smart growth principles and outcomes, as determined through the smart growth review that agencies must conduct through the Smart Growth Public Infrastructure Policy Act, particularly projects in priority development areas.
- **Stable funding for Restore NY and the Environmental Restoration Program:** The State should provide regular funding for Restore NY and DEC's Environmental Restoration Program to

ensure dependable availability of support for the restoration of distressed, vacant, abandoned, contaminated and/or brownfield areas.

- **Expand priority state support for BOA projects:** The State should expand and enforce the "priority and preference" provision in the BOA statute to include other relevant grants beyond those already identified in statute.

LU12. Accelerate Transit-Oriented Development

Smart Growth planning should accelerate mixed-use, mixed-income TOD, with an emphasis on Equitable TOD (E-TOD), around key transit hubs served by rail and bus rapid transit.

TOD creates compact, mixed-use, mixed-income, walkable communities within a half-mile of rail or transit hubs. TOD decreases dependence on cars, expands mobility options such as walking and biking and generates the critical mass of residents and commuters needed to support an expansion of public transit services. TOD also presents an ideal opportunity to meet equity and climate justice goals of the Climate Act by incentivizing green affordable housing near transit, which also reduces transportation costs for lower-income households. E-TOD ensures that affordability, climate justice and environmental justice play a prominent role in the TOD equation in planning, zoning, funding, project implementation and public policies on the state and local levels.

Several state programs have sporadically funded TOD, including HCR's Low-Income Housing Tax Credit program, DRI, Better Buffalo Fund, Local Waterfront Revitalization Program and REDC Strategic Plans and priority projects, among others. The State should, however, provide dedicated and priority funding, in existing and new programs, specifically to support TOD because TOD/E-TOD shows the greatest promise of reaching the Climate Act's GHG emission reduction and equity goals in land use. While land use patterns generally take time to shift and produce measurable climate results, TOD can be expedited with State support given its defined geographic scope and focus; TOD also produces more measurable GHG reduction outcomes. The CJWG recommended a statewide program to plan and develop E-TOD.

Components of the Strategy

- **Support TOD planning and zoning:** The State should support municipal equitable TOD plans and zoning, including form-based codes, through a grant program and guidance and technical assistance (including model local laws).

- **Promote equity tools and resources:** The State should promote and support equity tools and models, such as community land trusts, land banks, inclusionary zoning and shared/community-centered ownership and equity models to address displacement, gentrification and the concentration of poverty.
- **Require TOD plans around commuter rail:** The State should require communities with commuter rail stations to have an adopted TOD plan that meets state criteria to be eligible for supportive state TOD resources, with due consideration for smaller rail stations that may not have a full TOD or TOD plan.
- **Prioritize TOD in the Smart Growth Public Infrastructure Policy Act:** The State should enact legislation to amend the State Smart Growth Public Infrastructure Policy Act to more effectively direct state resources to projects that advance TOD, as well as add a definition of, and criteria for, TOD that includes rail and bus and the particular transit needs of rural areas. Amendments should extend applicability of this law to all state agencies and authorities and all relevant state programs, including planning and design grants (not just infrastructure).
- **Provide subsidies for E-TOD:** The State should explore enhanced subsidies for TOD projects, especially those that include a meaningful threshold level of affordable housing and incorporate tools and measures such as community land trusts, land banks, inclusionary zoning, and shared/community-centered ownership models.
- **Expand TOD as a state housing goal:** The State should include the TOD State Housing Goal in NYS Housing and Community Renewal's 9% Low-Income Housing Tax Credit program in all relevant state solicitations, consider other opportunities for tax credits for projects in TOD areas that are consistent with an adopted TOD plans, and meet state criteria for equity and affordability, such as an additional "bump up" of Brownfield Cleanup Program tax credits in designated BOAs that are also TODs.
- **Support for GEISs:** The State should fund and support GEISs to streamline the review process in TODs. This can be accomplished by creating a revolving fund for municipalities to undertake GEISs for TOD zoning and projects; if a developer agrees to build according to the TOD zoning and accepts certain community benefits components, such as affordable housing, green infrastructure, green building or public spaces, the developer will pay back into the fund a portion of the cost of the GEIS (consider using tax increment financing for this purpose).
- **Support local parking management policies that reduce automobile-dependence:** DOS, in collaboration with municipalities, MPOs, and affected agencies, should explore opportunities to support and incentivize lower municipal parking minimums and/or parking maximums in consideration of decreased household need, given proximity and accessible of transit. State

programs, for instance, can recognize and reward applications for TOD funding in municipalities that have enacted such parking management reforms.

- **Structured parking:** The State should support planning to facilitate appropriate structured parking to achieve a desired TOD density and explore opportunities to defray the cost of structured parking in conjunction with TOD development—e.g., state funding, low-cost financing, and tax credits, as well as the development of best practices for design and construction of structured parking that integrates ground-level retail and that can be retrofitted for other uses should the demand for parking decline in the future.
- **Improve municipal coordination with transit entities:** The State should require municipalities to notify the relevant transit entities of planning, zoning and projects that will impact transit ridership and parking needs to allow transit agencies an early opportunity to offer input on such potential impacts.

Chapter 20. Local Government

20.1 Local Government and the Climate Act

Local governments in every region of the state – small and large, urban, rural, and suburban – are taking significant action in ways that contribute directly to meeting the requirements of the Climate Act. Local governments are well positioned to have a far-reaching impact on community action. State programs that partner with communities and local governments are helping drive rapid adoption, widespread participation, and big impact.

Partnership with local governments is a keystone of the state's clean energy, adaptation and resilience, and GHG mitigation strategies, and support for local efforts will help ensure access to the benefits of these actions for all New Yorkers. Local governments have an important role to play in meeting Climate Act mandates. They control assets like street lighting systems, wastewater treatment plants, landfills, and public transit systems. They enact codes, develop projects, adopt policies, and regulate land use. When communities lead by example, clean energy and sustainability are more likely to be priorities for residents, businesses, and institutions.

In developing the following recommendations, several discussion sessions were held with local officials from across the state to gather input. A number of important themes emerged from these discussions. Counties and regional organizations have important roles as leaders and conveners in efforts to address GHG mitigation. Local governments are increasingly engaged in providing education and training,

outreach, and technical assistance. Many local governments are motivated by a desire to achieve cost savings that come from efficiency in municipal operations and facilities. Local governments also face challenges with aging infrastructure and housing stock. Local officials stressed the importance of existing state technical assistance, incentives, and resources provided to local governments for GHG mitigation actions. They also identified the need for uniformly applied state mandates in accelerating change at the local level and reducing competition between local governments and between regions. Leaders suggested a regional approach that acknowledges the different needs of municipalities, based on geographic location, population size, and density, to support meeting Climate Act requirements.

State programs, including Clean Energy Communities and Climate Smart Communities, were identified as providing value to local governments, whether through grants, free technical assistance, or recognition for local leadership. NYSERDA's Clean Energy Communities program creates a clear path forward for communities to implement clean energy actions that have the greatest potential for impact. To date, 639 communities – representing more than 18 million New Yorkers – have completed more than 2,200 high-impact actions. These actions empower the constituents of participating communities to choose clean and efficient energy as part of their everyday lives. The Climate Smart Communities program is jointly sponsored by seven state agencies: DEC, NYSERDA, NYPA, DOS, DOH, DOT, and DPS. Started in 2009, the program provides guidance, and financial and technical support to local governments to take locally driven climate action. The first step is to register by pledging to reduce emissions and adapt to climate change.

These programs are supported by a state-wide coordinator network consisting of regional planning and development boards, associations, and councils, like the Central New York Regional Planning and Development Board and the Genesee/Finger Lakes Regional Planning Council. These organizations have long-standing relationships with local governments in their regions, and state programs can leverage those relationships for the benefit of the programs. These coordinators are trusted local partners to the government officials and staff in their regions. In addition to free, on-demand technical support, state programs offer online toolkits that include step-by-step guides, calculators, case studies, and model language that communities can incorporate into legislation.

20.2 Key Strategies to Support Local Climate Action

There are five key strategies highlighted in this sector, as shown in Table 12.

Table 17. Local Government Sector Key Strategies

Strategies
LG1. Clean Energy Community Dashboard
LG2. Local Energy Policies
LG3. Planning Support for Local Governments
LG4. Community Initiatives
LG5. State Support and Guidance

LG1. Clean Energy Community Dashboard

The strategy for supporting local climate action is to develop a statewide dashboard of community GHG emissions inventories to promote local climate action planning, monitor equity considerations, measure progress, and ensure data consistency at the county and municipal levels.

This strategy calls for a community dashboard that local governments and other stakeholders can use to understand energy use trends and identify opportunities for improvement. The dashboard would bring together data from several sources to describe the community energy picture.

Not all required data—like fuel oil, gasoline, and diesel consumption, as well as VMT and fuel mix—is currently reported at the county, city, town, and village levels. The dashboard must be easy to use and provide good, actionable information that local government officials and staff, and community stakeholders can use to inform decision making at the local level. The process could establish aggregated data reporting requirements for suppliers of fuels in a manner similar to the PSC requirement that electricity and natural gas consumption data be reported by utilities (see PSC "Order Adopting the Utility Energy Registry" in CASE 17-M-0315 issued April 20, 2018). The dashboard could include data on energy production and clean energy actions. As part of the effort, the state will explore methods for estimating GHG emissions associated with transportation at the county, city, town, and village levels.

Components of the Strategy

- **Form a community GHG working group:** NYSERDA should establish a Community GHG Working Group consisting of MPOs, utilities, state agencies, academic institutions, consultants, and regional and municipal officials. The group may consider several activities:

- Review existing guidance including ICLEI's U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions to identify methods.
- Work with state agencies, MPOs, utilities, and other stakeholders to identify and secure New York-specific data needed to complete the emission inventories.
- Develop standard GHG inventory reporting formats for regional and local community inventories.

- **Launch the community dashboard:** NYSERDA, working with community stakeholders, should launch and maintain the dashboard, ensuring it is accessible to all communities.

LG2. Local Energy Policies

This strategy is intended to encourage local governments to demonstrate leadership in energy efficiency by developing model above-minimum energy conservation codes and construction policies. This includes adopting the NYStretch Energy Code and promoting its adoption, enhanced code enforcement including streamlined permitting, third party inspections, and shared enforcement, and Property Assessed Clean Energy financing.

Many local governments, especially small, resource-constrained communities, struggle with tight budgets and limited staff capacity, which limits their ability to take local climate actions. State programs, like Clean Energy Communities and Climate Smart Communities, that offer clear guidance, grants, technical assistance, and recognition can motivate communities to take local climate action and demonstrate climate leadership with a focus on equity.

Components of the Strategy

- **Leverage existing NYSERDA and DEC programs:** NYSERDA and DEC should continue to update the Clean Energy Communities and Climate Smart Communities programs to encourage adoption of emerging local energy policies and pro-active climate action.
- **Expand NYPA Clean Energy Services Program:** NYPA should continue the existing Clean Energy Services program and expand the program to reach more communities.
- **Expand the Regional Coordinator Network**: NYSERDA and DEC should expand the type of services offered by the regional coordinator network to enhance and strengthen assistance to local governments and related entities across a range of climate actions within. This expansion should increase support to small, resource-constrained, and underserved communities.

LG3. Clean Energy Siting Support for Local Governments

This strategy facilitates clean energy siting through development and promotion of model local laws and streamlined permitting. Local governments often have limited capacity to anticipate and plan for solar and energy storage development in their communities. State programs like Clean Energy Communities and Climate Smart Communities that offer clear guidance, grants, technical assistance, and recognition can motivate communities to adopt appropriate siting policies at the local level.

Components of the Strategy

- **Create model local laws and regulations:** NYSERDA, DEC and DOS should work with community stakeholders and the solar industry to develop and promote model local laws and development regulations through the Clean Energy Communities and Climate Smart Communities programs.
- **Promote New York State Solar Permit Adoption:** Within one year, NYSERDA and DOS should work with code enforcement officers to promote local adoption of the New York State Solar Permit and other local actions to streamline the permitting process for clean energy technologies, including energy storage, at a variety of scales.

LG4. Community Clean Energy Initiatives

This strategy connects homes, businesses, and community institutions with clean energy products and services through CCA programs, microgrids, district systems, and community-scale campaigns to encourage adoption of innovative technologies to generate savings for consumers in an equitable manner.

To achieve Climate Act mandates, broad-based consumer demand for clean energy products and services is necessary. Communities have tremendous capacity to use bulk purchasing, shared-services, community campaigns, and other forms of aggregation to drive this demand to new heights. This strategy calls for state programs to encourage local governments to adopt policies aimed at the widespread deployment of clean DERs. The intent is to allow more consumers to participate in the energy markets in ways that advance Climate Act goals and requirements while improving project economics, saving money, and generating new sources of revenue and ownership for consumers.

This strategy also calls for state programs to support policies, including CCA, which is a local program to purchase power in bulk for virtually all homes and small businesses in a participating community. CCA allows local elected officials to choose the source of energy for their communities. . Most communities that have implemented CCA procure 100% renewable energy as their default supply. Many CCA

programs are working to capture the economic benefits of clean energy more broadly. CCAs, including Sustainable Westchester's Westchester Power program, have developed opportunities around opt-out community solar, energy efficiency, heat pumps, EVs, demand response, and energy storage.

Components of the Strategy

- **Encourage the adoption of clean technologies:** NYSERDA should work with community stakeholders to promote community-scale campaigns to encourage the adoption of clean technologies to generate value and savings for consumers.
- **Expand workforce development for the clean energy economy:** NYSERDA, in collaboration with unions and the clean energy industry, should expand workforce development programs focused on training and job placement in clean energy and emerging technologies.

LG5. State Support and Guidance

This strategy discusses continuing and expanding program opportunities, incentives, technical assistance, and centralized procurement services to motivate local governments and related public entities to improve assets they control with high-impact actions. This includes LED lighting, energy efficiency upgrades, heat pump projects, methane recovery for energy production from wastewater treatment and landfills, solar on municipal premises, and municipal and school district fleet electrification.

Local governments and related public entities could achieve greater savings if they worked through shared services models. State programs that offer clear guidance, grants, technical assistance, and recognition can motivate local governments and related public entities to improve the assets they control. Shared services can come in different forms. For example, to accelerate adoption of clean technologies and policies, local governments may be encouraged to work together through intermunicipal conference calls, planning institutes, roundtables, or work groups

Components of the Strategy

- **Technical support for clean energy projects:** NYSERDA should work with community stakeholders to provide technical support to help local governments and related public entities develop and implement clean energy projects.
- **Reduce grid interconnection costs:** NYSERDA, in collaboration with the solar industry, should evaluate options to reduce interconnection costs for municipally owned priority sites.

- **Prioritize methane recovery:** NYSERDA, working with community stakeholders, should prioritize funding for projects that recover methane from wastewater treatment and landfills for on-site energy production.
- **Support direct energy purchasing:** NYSERDA and DPS should develop tools and resources to help municipalities procure energy and enable direct purchases of energy by municipalities from the wholesale market.
- **Support fleet electrification:** NYSERDA and DEC should support electrification of municipal and school district fleets while increasing fleet-wide fuel economy.
- **Encourage energy benchmarking:** NYSERDA should encourage local governments to track and report the energy use of municipal buildings and facilities (benchmarking).
- **Increase recycling and reduce waste:** DEC should seek to increase waste reduction and recycling rates in municipal operations and in the community.

Chapter 21. Adaptation and Resilience

21.1 Adaptation and Resilience Overview

Even with strong and innovative strategies in place to curb GHG emissions, the impacts of climate change are already being felt and are only projected to accelerate. Climate change mitigation strategies alone are not sufficient to prepare for the impacts of present and future climate change. Therefore, New York State must take bold action to adapt to climate change and enhance resilience in communities, infrastructure, and systems. Resilience is the capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption. For energy systems, specifically, resilience is the ability of the energy infrastructure to be prepared for, withstand, adapt, and quickly recover from disruptions such as severe weather, natural, and man-made disasters. Adaptation is the process of adjusting to new climate conditions to reduce risks to valued assets.[193]

This chapter contains strategies to enhance climate resilience and adaptation organized under the following three themes:

Building Capacity

The "Building Capacity" theme comprises four strategies related to statewide planning, consideration of future conditions in state decision making, enhancement of general understanding of climate change, improving the public's adaptive capacity, and identifying options for financing adaptation actions and reducing or shifting risk.

Communities and Infrastructure

Enhancing resilience of communities and infrastructure includes strategies to assist municipalities to prepare for and react to increasingly severe climate hazards. The strategies include recommendations to expand state support for regional and local planning, assist municipalities in their efforts to incorporate future conditions into local planning and regulatory decisions, recommendations to address risks due to flooding and extreme heat, and recommendations to ensure resilience of the energy system.

Living Systems

As used in this document, the term "living systems" refers to the state's natural ecosystems, its agricultural systems and its forested lands. Strategies recommended to enhance resilience of living

[193] U.S. Climate Resilience Toolkit (2021). Glossary. https://toolkit.climate.gov/content/glossary

systems include addressing risks to ecosystems and biodiversity, enhancing resilience and adaptation of the agricultural sector, and protecting the ability of forests to serve as carbon sinks.

21.2 Key Strategies

The recommended actions are derived from the initiatives and their respective components recommended to the Council by the Land Use and Local Government Advisory Panel. A detailed description of the strategies and components can be found in Appendix XXX. The adaptation and resilience strategies are organized into three themes, listed below in Table 18.

Table 18. Adaptation and Resilience Strategies by Theme

Theme	Strategies
Building Capacity	AR1. Commit to Creating, Implementing, and Updating a Comprehensive and Equitable State Climate Change Adaptation and Resilience Plan AR2. Incorporate Equitable Adaptation and Risk-Reduction Considerations into Relevant State Funding and Regulatory Programs, Projects, and Policies AR3. Strengthen Meaningful Community Engagement and Public Education and Build Adaptive Capacity across All Sectors AR4. Identify and Evaluate Options for Supporting Equitable Adaptation and Resilience Practices and Projects, and to Enhance Insurance Protection
Communities and Infrastructure	AR5. Provide State Agency Planning and Technical Support for Equitable Regional and Local Adaptation and Resilience Plans and Projects AR6. Evaluate Opportunities to Ensure Equitable Consideration of Future Climate Conditions in Land-Use Planning and Environmental Reviews AR7. Develop Policies, Programs, and Decision Support Tools to Reduce Risks Associated with Coastal and Inland Flooding AR8. Develop Policies and Programs to Reduce Human Risks Associated with New Patterns of Thermal Extremes AR9. Ensure the Reliability, Resilience, and Safety of a Decarbonized Energy System
Living Systems	AR10. Develop Policies and Programs to Reduce Risks Threatening Ecosystems and Biodiversity AR11. Enhance Climate Resilience and Adaptive Capacity of the Agricultural Community, while Preparing to Take Advantage of Emerging Opportunities AR12. Preserve and Protect the Ability of Forest Ecosystems to Sequester Carbon

Priority Actions

Each strategy contains several actionable components. Actions that provide the leadership, direction and resources necessary for New York to fully address its substantial vulnerabilities, while prioritizing equitable treatment for all are listed here as the highest priority for implementation. These highest-priority actions are to appoint a chief state resilience officer (CSRO) and convene an adaptation and resilience sub-cabinet; commence preparations for development of a comprehensive state climate change adaptation and resilience plan; an evaluation of equity and justice impacts of state adaptation and resilience decisions

and provide guidance on use of such evaluation to prioritize action in Disadvantaged Communities; establish a campaign to build student and public awareness of climate change effects and solutions; and create a resilient infrastructure fund through bonding.

Additional actions that are important to ensure availability of information, financial resources, and regulatory authority to adapt to reduce risks associated with climate hazards are listed here as high priority. These are to continue ongoing update to New York climate change assessment and initiate other research; adopt a process to ensure integration of state infrastructure investments to ensure efficient use of land and other resources, and consideration of adaptation and resilience; report on options to enhance hazard mitigation funding and to prefund disaster recovery, and to transfer catastrophic risk to the insurance and capital markets; support development of local resilience, continuity and adaptive capacity; facilitate consideration of climate change into local regulatory and planning programs; develop or update guidance for mitigation of climate change risks in permit and SEQRA reviews;.

Indicators, Metrics and Monitoring

Development and tracking of indicators and metrics will be critical components of planning and implementation of the recommended actions. Process metrics should be developed during work planning, and program plans and policies should include descriptions of indicators and metrics to be tracked and, where appropriate, reported. However, as most of the following strategies comprise recommendations to develop plans, detailed discussion of indicators and metrics, and the means to monitor them, is beyond the scope of this document and premature for most of the recommended actions. Indicators, metrics and monitoring programs should be developed during work planning for each recommended action. The website, Resilience Metrics, is one of numerous resources available regarding selection of indicators and metrics.

Building Capacity

AR1. Commit to Creating, Implementing, and Updating a Comprehensive and Equitable State Climate Change Adaptation and Resilience Plan

New York is vulnerable to a variety of climate hazards, many of which will become more severe as the climate changes, and suffers substantial property loss, as indicated in Table 19. Note that the values reported in the table include only personal and public property losses and do not include long-term economic losses, medical costs, or loss of life. Despite this vulnerability, New York has not committed substantial resources to comprehensive adaptation planning and coordination. The Council recommends

that the state couple its nation-leading goals to mitigate climate change with similarly ambitious goals to adapt to it.

Table 19. Average Annual Property Loss from Severe Hazard Events in New York, 1996–2017

Hazard	Avg. loss	Hazard	Avg. loss	Hazard	Avg. loss
Flooding	$67,100,000	Ice Storm	$1,670,000	Lightning	$176,000
Wind	$11,300,000	Coastal Hazards	$1,620,000	Heat Wave	$86,000
Snowstorm	$9,400,000	Cold Wave	$836,000	Tsunami/Seiche	$18,000
Hail	$3,330,000	Hurricane	$470,000	Wildfire	$4,640
Tornado	$1,810,000				

Components of the Strategy

- **Staffing:** The Governor should appoint a CSRO and convene adaptation and resilience sub-cabinet.
- **Adaptation and resilience plan:** Prepare for development of a comprehensive state climate change adaptation and resilience plan.
- **Vulnerability assessments and adaptation plans:** DEC, with support from OGS and AECOM, should complete preliminary agency vulnerability assessments and adaptation plans, and identify and prioritize state adaptation and resilience projects.
- **Assessments and research:** NYSERDA should continue ongoing update to New York climate change assessment, and DEC or other agencies should initiate or fund additional research.

AR2. Incorporate Equitable Adaptation and Risk-Reduction Considerations into Relevant State Funding and Regulatory Programs, Projects, and Policies

Incorporating equity into adaptation considerations in state programs is important for ensuring disadvantaged communities are protected against the effects of climate change. This would include incorporating equity and justice considerations in these programs, consistent use of science-based projections in state decision making, and development of climate-resilient design guidelines for state-funded projects, among others.

Components of the Strategy

- **Guidance:** DEC should release guidance describing projected climatic changes to support relevant decision making.

- **State infrastructure investments:** CSRO should provide recommendations to the Executive Chamber to adopt a process to ensure integration of state infrastructure investments to ensure efficient use of land and other resources, and consideration of adaptation and resilience.
- **Evaluation of equity and justice:** The CSRO should develop a formal policy on evaluation of equity and justice impacts of state adaptation and resilience decisions and provide guidance on use of such evaluation to prioritize action in Disadvantaged Communities
- **Resilient design:** OGS and DEC should convene work group to adopt climate resilient design guidelines for state-funded projects.
- **Amend the Smart Growth Public Infrastructure Policy Act:** Amend the Smart Growth Public Infrastructure Policy Act and similar statutes to require consideration of climate hazards; DEC should develop implementation guidance.
- **Consideration of future climate:** OGS should convene work group to establish policies and procedures to require design professionals and contractors on state-funded projects to consider future climate conditions.
- **Assessment of climate vulnerabilities:** DEC, DOS and other agencies that fund land or water planning activities should adopt policies to ensure all state-funded land and water use plans include assessment of climate vulnerabilities and, as appropriate, strategies to promote resilience and reduce risk.

AR3. Strengthen Meaningful Community Engagement and Public Education and Build Adaptive Capacity across all Sectors

Public awareness of the need for the Climate Act and its implementing actions is critical to its ultimate success. Ensuring individual and household resilience will be crucial in reducing risks associated with climatic events. Climate adaptation provides significant opportunity for vocational training and job growth that can be targeted to vulnerable communities and those in transition from reliance on fossil-fuel based industries.

Components of the Strategy

- **Student and public awareness:** State Education Department should convene work group to establish a campaign to build student and public awareness of climate change effects and solutions.
- **Disaster preparedness and response training:** NYSERDA and partner agencies should establish a program to train building operations staff in disaster preparedness and response.

- **Resilience audit program:** NYSERDA, in consultation with DEC, HCR, OTDA, and the Division of Homeland Security and Emergency Services (DHSES) should establish a residential and small business resilience audit program.

AR4. Identify and Evaluate Options for Supporting Equitable Adaptation and Resilience Practices and Projects, and to Enhance Insurance Protection

The costs of dealing with the effects of climate change will be significant and will continue to rise as the planet warms. These costs may include investments to reduce risk or costs to respond to, and recover from, natural events, exacerbated by climate change. Unfortunately, the benefits of these investments are often difficult to quantify as they generally consist of avoided remedial costs, and the payback is generally realized only after an event occurs, or some dangerous threshold is crossed. The components of this strategy are intended to secure the funds necessary to make necessary investments in resilience.

Components of the Strategy

- **Resilient infrastructure fund:** Create a resilient infrastructure fund through bonding.
- **Insurance premiums:** Impose a surcharge on insurance premiums for select lines of insurance to support risk-reduction and adaptation projects.
- **Community preservation funds:** Adopt legislation authorizing all municipalities to establish community preservation funds.
- **Investment and wealth building:** DOH should encourage anchor institution (large, usually nonprofit organization tethered to their communities, like universities, medical centers, or local government entities) to focus community benefit investments on projects to equitably address climate change and build local community wealth.
- **Hazard mitigation funding:** The Division of Budget, or other appropriate agency, should report on options to enhance hazard mitigation funding and to prefund disaster recovery, and to transfer catastrophic risk to the insurance and capital markets.
- **Strategies to increase insurance rate:** DEC and partners should implement strategies to increase take-up rates of flood insurance and other coverage related to climate hazards.
- **Adopt legislation:** Adopt legislation to prohibit or restrict anti-concurrent causation clauses for sewer backup insurance coverage where flooding is the cause.

Communities and Infrastructure

AR5. Provide State Agency Planning and Technical Support for Equitable Regional and Local Adaptation and Resilience Plans and Projects

Local officials have consistently advised that they lack resources, including not only funds, but technical expertise and access to information and decision-support tools to support effective adaptation planning. This strategy would accelerate current efforts to provide guidance, and financial and technical support for community and regional planning and implementation, for mainstreaming of climate change considerations into local planning and regulatory programs, and for consideration of local economic resilience under future climate conditions in planning decisions.

Components of the Strategy

- **Climate resilience:** DEC and DOS should support development of local resilience, continuity and adaptive capacity; consideration of climate change in local regulatory and planning programs.
- **Economic resilience:** DOS, ESD, and other relevant agencies should support development of local economic resilience strategies, climate-adapted economic development, business continuity planning, and local government climate financing and budgeting.
- **Online tools:** DEC and partner agencies, including DOS, NYSERDA, DHSES, and the Office of Information Technology Services, should support deployment of online tools to facilitate vulnerability assessments, adaptation planning and implementation.
- **Recovery planning:** DOS and DEC support pre-event, long-term recovery planning.
- **Managed retreat and buyouts:** NYSERDA, in consultation with DEC, HCR, and DOS, should analyze managed retreat and buyout of properties in extreme risk and repetitive loss areas.
- **Strike teams:** Establish strike teams to equitably assist municipalities with resilient post-disaster recovery.
- **Climate migration strategy:** DEC should convene a work group, to include NYSERDA, DOS, HCR, DHSES, Governor's Office of Storm Recovery, subject experts from SUNY or other universities, and refugee resettlement agencies, to develop a strategy to address climate migration.

AR6. Evaluate Opportunities to Ensure Equitable Consideration of Future Climate Conditions in Land-Use Planning and Environmental Reviews

Work to mainstream consideration of climate change in environmental reviews is ongoing, but much remains to be done, and local governments require more explicit authority to consider climate change and biodiversity in comprehensive plans.

Components of the Strategy

- **Climate risks in permit and SEQRA reviews:** DEC should accelerate ongoing efforts to develop or update guidance for mitigation of climate change risks in permit and SEQRA reviews; amend SEQRA Handbook and workbooks.
- **Facilitate adaptive projects:** DEC should amend the project review process to facilitate approval of climate adaptation projects.
- **Consider climate in comprehensive plans:** Amend relevant legislation to include consideration of climate mitigation, adaptation and resilience as potential topics in comprehensive plans.

AR7. Develop Policies, Programs, and Decision Support Tools to Reduce Risks Associated with Coastal and Inland Flooding

Flooding is New York's primary climate hazard, and we can expect both insured and uninsured losses to increase as sea level continues to rise and more frequent extreme precipitation events result in more extensive and deeper floods, including dangerous flash flooding in urban areas not previously considered flood prone. Components of this strategy would provide improved map and other information resources, funding and regulations to reduce flood risks.

Components of the Strategy

- **Increase pace of floodplain assessments:** DEC should increase the pace of local floodplain assessments to identify flood hazards.
- **Right-sizing infrastructure:** DEC should hire a statewide technical assistance coordinator to support to municipalities for right-sizing culverts and bridges to reduce flood risk and improve habitat connectivity.
- **Incentives for community rating system:** DEC and DHSES should provide support and incentives for municipal participation in the Federal Emergency Management Agency's Community Rating System.
- **Amend state building code:** DOS should amend state building code to account for sea-level rise and enhanced riverine flooding, and potential use of innovative structures, such as amphibious buildings.
- **Statewide mapping strategy:** DEC should develop a statewide flood-risk mapping strategy.
- **Digitize dam failure inundation maps:** DEC should digitize dam failure inundation maps and integrate with other geographic resources to improve emergency planning and response and explore approaches to use these maps to enhance public information and outreach efforts.

- **Support dam removals:** DEC should support dam removals that reduce flood risk and improve aquatic habitat quality.

AR8. Develop Policies and Programs to Reduce Human Risks Associated with New Patterns of Thermal Extremes

In most years, more Americans die from the effects of extreme heat than from flooding and frequency of extreme heat events is one of the most direct effects of global warming. At the same time, changes in atmospheric circulation patterns, perhaps precipitated by loss of sea ice, may lead to periods of extreme cold in New York.

Components of the Strategy

- **Cooling centers and accessibility:** DEC and DOH should continue to support development and operation of cooling centers, including assessments to increase accessibility via public transportation.
- **Regional and local heat emergency plans:** DOH should support development of regional and local heat emergency plans that prioritize the health and stability of vulnerable communities.
- **Weatherization in building codes:** DOS should amend state building code to require more effective weatherization from thermal extremes.
- **Support for vulnerable populations:** OTDA and NYSERDA should promote and facilitate access to programs that provide cooling, weatherization and solar assistance to vulnerable populations.

AR9. Ensure the Reliability, Resilience, and Safety of the Energy System

The increasing frequency of severe climatic events has exposed vulnerabilities in the state's energy system and the need to improve the reliability and resilience of the energy system, as well as the resilience of those who depend on that energy system in both buildings and for transportation. Assessment of system vulnerabilities to increasing climate hazards and investment to ensure system resilience will be required. Energy system providers must continually reassess infrastructure vulnerabilities across the entirety of their service territories to determine appropriate resilience initiatives to mitigate potential disruptions due to the effects of climate change and make their infrastructure more adaptable to weather extremes.

Components of the Strategy

- **Resilience standards and assessment of vulnerabilities:** The PSC should establish resilience standards and require public and investor-owned utilities and generators to assess vulnerabilities to climate hazards and to develop and implement agency-approved risk-reduction plans.
- **Develop strategies for grid outages and extreme weather events:** The CSRO or other designated individual should convene a work group, comprising DPS, DHSES, DOT, DEC, NYSERDA, NYPA and other relevant entities, to develop strategies to ensure availability of fuel and power for emergency vehicular fleet operations and essential public transportation during power grid outages. Establish a resilience plan for EV-charging infrastructure to ensure access to transportation, including evacuation during extreme weather events.
- **Capital improvements:** NYSERDA, in consultation with DPS, DOS, and other relevant entities, should promote capital improvements in buildings to endure grid failures and to facilitate buildings' ability to accept power when system re-energized.
- **PV and EV-charging in building code:** DOS, in consultation with NYSERDA, should include requirements for PV and EV-charging readiness in building code.
- **Strategy for local renewable systems:** NYSERDA, in consultation with DPS and DHSES, should develop a comprehensive strategy to support development of islandable microgrids and district systems using renewable sources of energy to provide locally generated power, especially in critical facilities during grid emergencies.

Living Systems

AR10. Develop Policies and Programs to Reduce Risks Threatening Ecosystems and Biodiversity

The components of this strategy provide for a variety of mechanisms to ensure conservation or protection of the most important pieces of our life-sustaining ecosystems. These initiatives include a focus on intentional planning to identify and protect critical ecosystems and to establish and protect connectivity at several scales ranging from the landscape scale to enable populations to migrate northward and upward as the climate warms, to project-specific planning to ensure wildlife and aquatic organism connectivity.

Components of the Strategy

- **Improve local wildlife and aquatic connectivity:** DEC and DOT should improve local wildlife and aquatic connectivity, including through use of standardized environmentally friendly design

features, during transportation infrastructure improvement projects, as practicable, and as identified by statewide critical terrestrial and aquatic habitat and conservation planning efforts.

- **Expand conservation easements to include other areas:** DEC and AGM should expand development of conservation easement and incentive programs (such as the Source Water Buffer Program) to include areas of farms set aside for conservation of wetlands, stream corridors, riparian buffers, or wildlife corridors.
- **Incorporate BMPs from species management plans:** DEC, DOS, ORES and NYSERDA should incorporate BMPs from species management plans into state and federally funded or regulated projects, including renewable energy projects, in or near occupied habitats to reduce and mitigate ecosystem impacts.
- **Amend Real Property Tax Law to incentivize private forest stewardship:** Amend Real Property Tax Law to incentivize private forest stewardship for a broader range of goals, including biodiversity, wildlife habitat protection, water resource protection, outdoor recreation and carbon sequestration.
- **Prioritize biodiversity and carbon sequestration:** DEC should heighten consideration of biodiversity and enhancement of carbon sequestration among the priorities in state forest land planning. Adopt guidance for development of unit management plans that includes conservation of biodiversity and increased carbon sequestration as priorities.
- **Expand implementation of ISCMP:** DEC and AGM should advance biocontrol of forest pests, and expand implementation of relevant parts of the ISCMP, including two key ISCMP priorities: advance prevention and early detection, and improve the response to invasive species.
- **Ensure protection of stream buffers:** Create a regulatory program to ensure protection of stream buffers to protect and enhance water and habitat quality, reduce flood risk and prevent soil erosion.

AR11. Enhance Climate Resilience and Adaptive Capacity of Agricultural Communities, while Preparing to Take Advantage of Emerging Opportunities

Included below are recommendations to improve water and energy efficiency on farms, incorporate other climate-resilient practices into farm operations and continue research and outreach to help farmers prepare for the effects of a changing climate. However, these recommendations do not address the entire gamut of climate hazards New York growers face and should not be interpreted as a complete agricultural adaptation plan.

Components of the Strategy

- **Water and energy efficiency realization program:** AGM and NYSERDA should develop and support a water and energy efficiency realization program to meet agricultural needs related to climate change, including decision-support tools, power upgrades and strategies to reduce equipment costs.
- **Resilient crops:** Expand support for research and outreach on climate-resilient crop varieties, technology to provide freeze and frost protection, strategies to address invasive species, pathogens and pests, and increased use of perennial crops for food and feed.
- **Agricultural and watershed-based BMPs:** AGM should assess, develop and promote agricultural and watershed-based BMPs for flood attenuation, drought mitigation and water quality protection.

AR12. Preserve and Protect the Ability of Forest Ecosystems to Sequester Carbon

In recognition of the important role healthy forests play in sequestering carbon, ensuring forests retain their sequestration potential under future conditions should be considered in state acquisition programs. As with agriculture, this recommendation does not constitute a complete adaptation plan for our forests. Many recommendations described in strategy 21.2.10, Develop Policies and Programs to Reduce Risks Threatening Ecosystems and Biodiversity, also address the goal of protecting the ability of our forests to continue to sequester carbon. This strategy complements the strategies described in Chapter 15, Agriculture and Forestry, which serve to enhance the ability of our forests to remove CO_2 from the atmosphere and sequester it in healthy trees and forest soils.

Component of the Strategy

- **Resiliency criteria:** DEC, OPRHP, AGM, and other agencies and authorities should include resiliency criteria in state acquisition programs.

Measuring Success

Chapter 22. Essential Elements

With state-level actions such as the passage of the Climate Act and continued procurement of large-scale renewable energy resources, New York has proven to be a leader in addressing climate change. The development of this Scoping Plan advances New York to the next level. It has been well established that the threat of climate change is great and can only be fully addressed when stakeholders are in alignment and coordinate mitigation efforts. Success of this Plan requires active engagement across several essential elements including partnerships, outreach and education, and workforce development.

22.1 Partnerships

New York witnessed the importance of partnerships firsthand in the response to the COVID-19 pandemic. From supply chains, businesses, and people to science, resources, and policies, New York is inextricably linked to the international community. When New York leads, the results echo loudly to its peers, but it cannot stand alone. Partnerships with a wide range of entities will be critical to ensure the success of this Scoping Plan and reaching the State's climate mandates. New York has long been part of collaborative environmental projects and programs at the federal, regional, and local levels. Programs such as the RGGI and participation in the USCA have enabled New York to make progress at the state level while having a greater regional and national impact.

Climate change is a global issue and impacts in one region can affect the entire system. Collaborative efforts are critical to ensure successful and consistent climate policy on a greater scale. While New York continues to act at the state level, federal action, and continued cooperation at the regional and national levels, is vital to increase overall policy effectiveness and minimize leakage to the greatest extent. When all levels of government work together, climate action is accelerated, resources are shared more efficiently, and jurisdictions can address the impacts in a more wholistic way. New York recognizes this and signed the Under2 Memorandum of Understanding, acknowledging the limited progress and coordination witnessed thus far, and the state stands firm to work with partners around the world on ambitious action.[194]

[194] https://www.theclimategroup.org/sites/default/files/2020-10/new-york-state-signature-page.pdf

Climate change also presents a unique need and opportunity for interagency collaboration at the state level. New York recognizes that communication and collaboration are essential to the success of our efforts. State agencies came together as a team in supporting the development of this Plan. DEC and NYSERDA will continue to lead in the implementation of the Climate Act, but the collaboration must continue and expand as we move forward with implementing the Scoping Plan. Actions will be required by all state agencies in order to meet GHG reduction requirements and build resiliency to adapt to the changing climate, as noted in the sector strategies. Continued cooperation between the Legislature, agencies, and authorities will be important to ensure that the appropriate authority exists to carry out the different initiatives laid out in this Scoping Plan.

Federal Action

While New York will continue to lead on addressing climate change, action is needed at the federal level to reduce nationwide GHG emissions and protect businesses and communities from the harmful effects of global climate change. Only a national approach will provide the emission reductions of a scale necessary to mitigate potentially catastrophic climate change. The federal government has taken measures to address climate change and reduce GHG emissions through the Clean Air Act and related actions, such as the regulation of GHGs from cars, trucks, and buses. While other initiatives such as the Clean Power Plan are no longer being developed, the Biden Administration has set a target to reduce economy-wide GHG emissions by 50% to 52% of 2005 levels by 2030. Recent action to implement the American Innovation and Manufacturing Act and phasedown HFCs is reassuring to see the federal government once again taking responsibility for controlling HFC emissions and reinstating its leadership role in international policy.

The federal government's strides to increase offshore renewable energy development and expand transmission capacity is critical to the transition to a clean economy. New York will continue to advocate for additional statutory and regulatory measures to reduce GHG emissions and to green the electricity grid while communicating the importance of avoiding federal preemption and allowing states to take additional action.

The Biden Administration's Justice40 Initiative seeks to address the history of national environmental policy decisions that have failed to adequately account for environmental injustice, including the disproportionate, disparate, and cumulative impacts pollution and climate change have on low-income communities and communities of color. The consideration of environmental justice and impacts to

overburdened and underserved communities at the national level amplifies the benefits New York's Disadvantaged Communities will realize from the Climate Act.

EPA initiatives such as the State and Local Climate and Energy Program offer tools and data that can help states make informed energy efficiency and renewable energy decisions. Building on such a framework and expanding incentive opportunities is another way that federal partners will be critical to ensuring climate action on a greater scale.

A less direct federal program, such as the EPA's Clean Water State Revolving Fund, is another example of federal action that promotes climate change mitigation and adaptation. Providing these funds enables states to make critically needed improvements to wastewater and drinking water infrastructure, which in turn allows communities to be more prepared for increased heavy precipitation events.

New York has also recognized gaps that have been left by the federal government and has taken action to address those gaps. When the federal government withdrew from the Paris Agreement, New York worked collaboratively and formed the USCA, which enables states to set similar goals and share data and best practices to set and achieve climate goals.[195]

Regional Collaboration

Northeast and Mid-Atlantic states have a history of working together to explore regional policies to reduce carbon emissions and other pollutants. Most states in the region, as well as the District of Columbia, have set economy-wide GHG reduction goals through statute, executive order, or in climate change or energy plans. Working in partnership with other jurisdiction can magnify the benefits and reduce the costs of climate action.

As a member of RGGI, the first cap-and-invest program in the United States, New York has used this regional market-based mechanism to drive down GHG emissions in the power sector, while raising funds for environmental initiatives statewide. New York has also taken more recent regional action, including signing a MOU with 14 other states and Washington, D.C. to commit to a goal that 100% of all new sales

[195] https://static1.squarespace.com/static/5a4cfbfe18b27d4da21c9361/t/5f6cacb1258a2d77dedbf60c/1600957656553/USCA_2020+Annual+Report_Leading+the+Charge.pdf

of MHD trucks be ZEVs by 2035. New York has also been in discussions regarding TCI program, as discussed previously.

New York also participates in several and various regional research initiatives and programs:

- Great Lakes Commission
- Great Lakes St. Lawrence Governors and Premiers[196]
- Great Lakes Wind Feasibility Study
- Chesapeake Bay Watershed Program[197]
- The Peconic Estuary Partnership
- Hudson River Estuary Program
- Hudson River National Estuarine Research Reserve[198]

These initiatives enable governments to share data and collaborate on potential solutions to climate-related issues facing various communities. It illustrates that there are several different ways for states to participate on a regional scale. New York will continue to strive for regional participation in order to use the most cost-effective and efficient options for GHG mitigation.

Supporting Local Governments

Local governments are on the frontlines of addressing climate change. Local leaders are the most well-equipped to understand community needs and are uniquely positioned to take action that will reduce GHG emissions. Implementing many of the strategies in this Scoping Plan will require action by local governments. New York's local governments have their hands full meeting the day-to-day needs of their communities. These strategies will not be successful without providing adequate support for local governments. New York has worked to address this through programming across several agencies. The Climate Smart Communities program at DEC offers technical assistance and guidance, as well as grant opportunities to local governments. It enables participating governments to transition to a clean economy and improve their climate resiliency. Through its NY-Sun program, NYSERDA offers guidance and technical assistance to local governments to facilitate the expansion of solar development, and through its

[196] Members of Great Lakes St. Lawrence Governors and Premiers work as equal partners to grow the region's $6 trillion economy and protect the world's largest system of surface fresh water.

[197] The Chesapeake Bay is the largest estuary in the United States. It is home to more than 2,700 species of plants and animals and produces about 500 million pounds of seafood per year. The Bay's watershed covers portions of six states and Washington, D.C.

[198] https://www.hrnerr.org/usca-prioritizing-nys-coastal-wetlands-for-resilience-and-blue-carbon/

Clean Energy Communities program NYSERDA distributes grants to local communities that showcase actions that have a high impact on the community's ability to become more sustainable overall.

New York also supports local governments through the REDC initiative. Through a consolidated funding process, regional councils can apply for grants for different projects and programs, many of which are geared toward environmental protection.

Continued support of New York's local governments is critical to enable the state to take climate action. Strategies in the Land Use chapter and in the Local Government chapter of this Plan provide a solid foundation to support local government decision making to meet the emission limits. Initiatives in these chapters include the development of a community dashboard to promote local planning and measure progress and strategies to enable the deployment of renewable energy resources across the State.

Other Partnerships

Partnerships will need to expand beyond governmental actors in order to successfully mitigate and adapt to climate change. The sector strategies discuss the dozens of stakeholders that should be engaged when considering and implementing the GHG emissions mitigation strategies in this Plan. Stakeholder engagement in the implementation of the Scoping Plan is essential to ensure the policies and programs are responsive to the needs of the stakeholder community and meet the equity requirements of the Climate Act. New York will continue to seek collaborators such as educational institutions, community-based organizations, labor, industry, and not-for-profit organizations, as well as engage in public/private partnerships. The New York Smart Grid Consortium is one example of a wide variety of entities working together to improve the reliability and resiliency of the electric grid.[199]

Economy-wide cooperation is critically necessary to address climate change. These partnerships have proven successful and will need to expand moving forward. While New York can and will continue to set examples for other states through statewide action, this Plan recommends advocacy for additional action at the federal level, as well as cooperation with regional and local governments, and the broader stakeholder community to ensure that GHG reduction requirements are met.

[199] http://nyssmartgrid.com/

22.2 Outreach and Education

Outreach and education to empower every New Yorker to take part in the transition to a low carbon economy are essential elements to ensure successful implementation of the Climate Act and the strategies described in this Scoping Plan. Throughout this Plan there is the acknowledgement of the need for outreach and education, from increased outreach to farmers about nutrient management in the agricultural sector to engaging the public through marketing campaigns about the transition to energy efficient and all-electric buildings. The scale of change outlined in this Plan requires a coordinated effort on outreach and education across all sectors of the economy. There are efficiencies of cost and time to be gained by developing a comprehensive outreach and education campaign rather than conducting this outreach by sector or by programs. Avenues to accomplish this include public education campaigns, targeted outreach to current or potential regulated entities, engagement with researchers and innovators, and general engagement and outreach to the key stakeholders that will be involved in the implementation of the various strategies. Recommendations presented by the Advisory Panels to the Council related to outreach and education included commonalities across sectors such as developing new curricula in higher education and ensuring coordination between the State and local governments when engaging residents about climate action.

22.3 Workforce Development

Another essential element to the success of this Plan is workforce development. In addition to the recommendations from the JTWG in Chapter 7 (Just Transition), there are other sectors of the economy that will need to transition their workforce to meet the needs of the low carbon economy envisioned by this Scoping Plan. The chapter discussed the mechanisms that the State uses and should continue to use or expand upon to develop a skilled workforce that will be able to implement the strategies included in the electricity, industry, and buildings sectors, among others. Workforce development will also be essential in the transportation, agricultural, forestry, and waste sectors.

The strategies and principles detailed by the JTWG can be applied to these sectors to ensure a just and equitable transition across the whole economy and will generate numerous opportunities for New York's existing and emerging workforce.

Chapter 23. Reporting

Successful implementation of the Scoping Plan strategies requires monitoring and reporting on the results of our efforts and a robust public process. Reporting requirements are structured to provide transparency

and public access to information and awareness of where improvements can be made in our emissions reduction activities. Information ranging from annual GHG emissions to how well the policies implemented are working to meet the GHG emissions limits will be released in a range of reports that are required by the Climate Act. Some of these reports are annual while others have a longer process. Reporting will be important for tracking how New York is meeting the GHG emissions limits.

23.1 Annual Inventory

DEC will issue an annual inventory of GHG emissions in New York starting no later than January 1, 2022, as required by the Climate Act.[200] Due to the nature of emissions reporting and data collection, there is a lag in when emissions for a certain year are available to be incorporated into the inventory. This time lag is related to the cycles of reporting and processing of the data. This information delay will result in each inventory reporting the emissions from two years prior, as the most recent information available.

This annual inventory report will include information on all GHG emission sources in the State, including the relative contribution of each type of GHG and each type of source to the statewide total. The report will also include, as part of the statewide total, an estimate of GHG emissions from the generation of electricity imported into New York and from the extraction and transmission of fossil fuels imported into the state.[201] DEC will continually refine and improve the methodology used by the annual inventory report based upon the best available information and informed by public feedback.

23.2 Implementation Report

Every four years DEC will issue a report, after consultation with the Council and the CJWG, on the implementation of GHG reduction measures, as required by the Climate Act. The first implementation report will be released no later than January 1, 2028.[202]

The implementation report will include, but is not limited to, an analysis of whether New York is on track to meet the statewide GHG emissions limits and if the existing regulations are sufficient to meet the limits or require modifications. Information on the social benefits from the regulations and on the compliance costs for regulated entities, DEC, and other state agencies will also be included. The report will also highlight the impacts from regulations on Disadvantaged Communities and their access to or community

[200] ECL § 75-0105(1).

[201] ECL § 75-0105(3).

[202] ECL § 75-0119.

ownership of services and commodities identified in the Barriers and Opportunities Report. The Implementation report will provide information to the public on the progress towards achievement of the Climate Act requirements and will also serve to inform the regular updates to the Scoping Plan that are required under the Climate Act.

23.3 Review of Renewable Energy Program

Every two years, starting no later than July 1, 2024, the PSC will issue a comprehensive review of the renewable energy program established by the Climate Act. In this review, the PSC will evaluate the progress in meeting the overall targets for deployment of renewable energy systems and zero emission sources including factors that will, or are likely to, frustrate progress toward the targets. It will also examine the distribution of systems by size and load zone, and annual funding commitments and expenditures.

23.4 Air Quality Monitoring

The Climate Act establishes a Community Air Monitoring Program to be established by DEC by October 1, 2022. The Climate Act requires that DEC deploy community air monitoring systems in no less than four Disadvantaged Communities that have been identified as the highest priority for exposure to toxic air contaminants and criteria air pollutants. Information collected by these systems will be shared with the public and be used to inform the development of a strategy by June 1, 2024 to reduce emissions of these pollutants in Disadvantaged Communities affected by a high cumulative exposure burden.

This is an historic, new effort to monitor air quality in Disadvantaged Communities across the state and use the data collected to develop strategies to reduce pollution in these communities, including the GHGs that contribute to climate change. This statewide community air monitoring effort is the largest ever undertaken in the United States.

In consultation with the CJWG and community leaders, DEC and NYSERDA will identify 10 areas to deploy hyperlocal air monitoring technology to collect air quality data. Locations will include multiple Disadvantaged Communities statewide. Monitoring will include climate-altering GHG emissions and other co-pollutants that affect public health. In total, the monitoring will provide a comprehensive picture of air quality in communities that are home to up to five million New Yorkers. The results of this monitoring effort will advance the Climate Act's directive to reduce emissions in communities heavily impacted by air pollution and help to address the public health impacts due to this pollution, including higher rates of lung disease, asthma, heart disease, and premature death.

DEC will oversee the community air monitoring program, which will identify the areas experiencing the highest air quality impacts and help the State to better target mitigation activities, including a portion of carbon-free investments, to areas where these investments will provide the greatest public health and climate benefit. The monitoring will collect air pollution and GHG measurements to produce hyperlocal air quality insights for municipalities and researchers. To ensure robust community participation in the in the Community Air Monitoring program, DEC's Environmental Justice Program will provide Community Air Monitoring Capacity Building Grants to improve the ability of community groups working on the ground in these areas to contribute to the development and operation of air quality monitoring networks across the state. The increased capacity of community groups will also allow greater contribution in the identification and selection of carbon-free technology investments in their local neighborhoods.

Chapter 24. Future Work

This document is a draft of the Scoping Plan that is designed to lay out the policies and programs necessary to help New York meet the emissions limits established in the Climate Act. Following the release of this draft, the Council is required to hold at least six regional public hearings, with three located in the upstate region and three located in the downstate region. There will be at least 120 days to submit public comments on this draft Scoping Plan, providing meaningful opportunity for all segments of the population that will be impacted by this Plan, including New Yorkers living in frontline communities. Once the Council has conducted public outreach and the comment period has ended, it will evaluate the input received and make any appropriate changes. The final version of the Scoping Plan will be released no later than January 1, 2023. Going forward, New York will promulgate regulations, enact new laws, and adopt policies program to implement the strategies and recommendations in the final Scoping Plan.

The next State Energy Plan adopted by the State Energy Planning Board will incorporate the recommendations included in the final Scoping Plan. These recommendations will ensure that New York continues to reduce GHG emissions while also maintaining an affordable and resilient energy system.

The Climate Act requires that this Scoping Plan be updated at least once every five years. As updated information about New York’s progress on the GHG emissions limit is reported, an updated Scoping Plan will be released to ensure that the policies in place will keep New York on the path to meet the requirements of the Climate Act.

Appendices (Placeholder)

Appendix A: Land Use and Local Government Advisory Panel Adaptation & Resilience Recommendation Components

Appendix B: Quantifying Health Benefits of Climate Policy

Appendix C: Health Status of New Yorkers for Selected Health Outcomes Particularly Relevant for Climate Policy

Appendix D: Health Outcome Data

Appendix E: Air Quality

Appendix F: Transportation Advisory Panel Recommendations

Appendix G: Energy Efficiency & Housing Advisory Panel Recommendations

Appendix H: Power Generation Advisory Panel Recommendations

Appendix I: Energy Intensive and Trade Exposed Industry Advisory Panel Recommendations

Appendix J: Agriculture & Forestry Advisory Panel Recommendations

Appendix K: Waste Advisory Panel Recommendations

Appendix L: Land Use & Local Government Advisory Panel Recommendations

Appendix M: JTWG Recommendations to the Council on Issues and Opportunities Related to the EITE Entities

Appendix N: JTWG Recommendations to the Council on Measures to Minimize the Carbon Leakage Risk and Minimize Anti-Competitiveness Impacts of Potential Carbon Policies and energy Sector Mandates

Appendix O: Power Generation Sites Identified by the JTWG

Appendix P: CJWG Feedback on Advisory Panel Recommendations

Appendix Q: Integration Analysis Technical Supplement

Appendix R: Example case studies from other states and nations