Overview
Climate Action Plan Interim Report

1.0 Climate Change and the Imperative for Action

Humans are conducting a vast experiment on Earth's systems. Combustion of fossil fuels and land use change on a global scale are driving alterations to the Earth's climate. Human-made global climate change is underway. Scientists have spent the past several decades intensively studying our planet's temperature and climate history, assessing how our natural climate has changed and projecting how future human emissions of greenhouse gases (GHGs) will trap still more excess heat in the Earth's land, ocean, and atmosphere, further changing the climate. Key findings include the following:

- That our climate is changing is no longer in question. Worldwide temperature measurements of land, oceans, and air document that the average temperature of the earth is rising. A considerable portion of this temperature rise is attributed to human activities—primarily deforestation and the combustion of fossil fuels.
- Natural processes required hundreds of millions of years to turn the stored carbon from ancient plants into our fossil fuels. In the short time (geologically speaking) since the Industrial Revolution, fossil fuel combustion has injected large amounts of this long-stored carbon into our atmosphere as heat-trapping carbon dioxide, while other modern industrial practices have increased emissions of powerful GHGs such as methane and nitrous oxide. The additional heat that these GHGs trap is altering our climate system.

> *Scientists conclude that an 80 percent reduction of GHG emissions is needed by mid-century to avoid potentially catastrophic climate change impacts.*

- Although heat already trapped by past emissions of GHGs will continue to increase global temperatures for some decades, actions taken now can dramatically decrease impacts for current and future generations. Decisive emission reduction that keeps atmospheric GHG concentrations below threshold levels could mean the difference between climate changes to which humans can likely adapt and very severe impacts. Scientists forecast that an 80 percent reduction in GHG emissions, achieved by mid-century, has a good chance of minimizing the worst of the potential impacts. Integrating climate adaptation into current decision making can reduce the costs and disruption of the unavoidable impacts already built into the climate system.
- The best available information suggests that, for the most part, the "new" climate that will result if emissions continue on today's path will be less hospitable to human civilization than the climate that has prevailed for millennia—possibly different enough to lead to widespread social disruptions, and certainly enough to impose huge costs.
- In New York State, climate change has begun to affect, and will continue to affect the natural resources that support our economy and quality of life: air quality, water quality, marine and freshwater fisheries, plant and wildlife species, salt and freshwater wetlands, surface and subsurface drinking water supplies, forests, and other wildlife habitats.

- Our economy, communities, and natural systems are vulnerable to higher temperatures, rising sea level, and more variable, intense weather: agriculture and forestry (e.g., new pests, reductions in crop yields and viability); electric transmission efficiency and power demands (e.g., hotter days mean more air cooling); communications and transportation infrastructure, especially structures in low-lying areas; public health (e.g., increases in heat-related deaths and in cardiovascular, respiratory, and vector-borne illness); and interruptions in food and drinking water availability.

The human role in planetary warming and climate change gives us both the opportunity and the responsibility to avert or limit the impending changes. Climate science suggests that we can avoid the worst consequences of climate change if we mitigate (reduce or sequester) our emissions of GHGs and take measures to adapt to unavoidable climate change.

Major Greenhouse Gases Emitted from Human Activities

Carbon dioxide (CO_2)
Methane (CH_4)
Halocarbons
(Industrial gases)
Nitrous Oxide (N_20)
Sulfur hexafluoride (SF_6)

Climate change is a global problem requiring global solutions and local action. Businesses and communities, states and nations are beginning to respond to the challenge by fostering low-carbon energy and economic development patterns. Leaders of this response are positioned to reap economic and social benefits from the transition, while rigid, inflexible economies risk losing competitive positions in the global marketplace. If we fail to reduce GHG emissions and adapt to unavoidable changes, future generations will be forced to bear significant consequences.

2.0 Responding to Climate Change: Climate Action Planning in New York

New York State is leading a candid discussion of responses to the threats and opportunities of a changing climate. The context for this discussion is the goal established by Executive Order 24 for a reduction of GHG emissions by 80 percent below 1990 levels by 2050 (80 by 50). This goal is based on the consensus of the scientific community that this magnitude of emission reduction is needed to avoid potentially catastrophic impacts from climate change.

This Interim Report is an important element in the planning process. It presents for consideration by decision makers, businesses and citizens the overarching goals and initial outcomes of New York's climate planning process:

- A long-term vision for a climate-resilient, low-carbon, clean energy future for New York
- The long-term 80 by 50 goal and a mid-term benchmark target of reducing GHG emissions by 40 percent by the year 2030 (40 by 30)
- A preliminary list of policy options that, if broadly adopted, have the potential to dramatically reduce emissions and increase resiliency to a changing climate, while providing other benefits to New Yorkers in the near term
- Initial expert analysis on the relative costs of different GHG mitigation policy options

- Initial strategies to link climate and energy policy with economic development opportunities, in particular those associated with growing a clean energy economy.

In 2011, the Climate Action Council will further refine these preliminary ideas, finalize cost information and economic potentials, analyze the macroeconomic impacts of the policies, and outline a strategy for implementation.

As climate change is a long-term issue that touches on many facets of our society and economy, New York's climate planning process must be ongoing and iterative—establishing needs; raising and refining ideas, action plans, and cost estimates; adopting policies at various time scales; and checking to see whether the policies are accomplishing the goals. The Climate Action Plan is intended to lead and motivate a sustained effort by business, government, and individuals to mitigate GHG emissions, adapt to a changing climate, and reap the societal and economic benefits of a low-carbon economy.

Policies to address climate change cannot be developed in isolation. Using energy has been characterized as "the metabolism of modern industrial society." As such, development of climate policies cannot be separated from energy security, energy affordability, economic activity, and overall quality of life. These linkages and constraints must be considered in formulating and developing realistic policy options.

Transformation of our fossil fuel economy into a clean energy economy will be the work of a generation, involving large numbers of investors and workers, a wide variety of skills, and action and support by both public and private sectors. The Council recognizes the magnitude of the 80 by 50 challenge and acknowledges that New York's success in achieving the economy-wide GHG reduction goal ultimately depends on coordinated policy and action by federal, state and local governments.

> *Using energy is the metabolism of modern industrial society.*
>
> *Daniel Sarewitz, Arizona State University*

Overarching Goals of New York's Climate Action Plan

- Provide a set of long-term objectives to guide State decision making.
- Set out the policies that will enable both climate change adaptation and mitigation, helping to ensure that New York State does not make decisions in the near term that will lock in a high-carbon future or increase our vulnerability to changes in climate (such as building long-lived infrastructure that is carbon intense or climate vulnerable).
- Identify core solutions and strategically allocate available funding to effectively reduce GHG emissions and stimulate economic activity, while promoting constructive responses by other states and the nation as a whole.
- Provide a foundation for New York to gain advantage in the emerging low-carbon, clean energy economy, advancing the state's economic and strategic interests in the short and long term.

New York State Climate Action Policy Options

At the center of this Interim Report are policy options to achieve GHG emissions mitigation and climate change adaptation. The policies were selected for their potential to minimize costs, maximize co-benefits, and integrate environmental justice and other important public policy objectives. Additional analysis and further development of these policies will be carried out in the next phase of climate action planning.

Mitigation: policy options to reduce emissions cover four categories of GHG emission sources: Residential, Commercial/Institutional and Industrial buildings and processes (RCI); Transportation and Land Use (TLU); Electric Power Supply and Distribution (PSD); and Agriculture, Forestry, and Waste (AFW).

Adaptation: policy options to increase climate resiliency cover eight sectors (Agriculture, Coastal Zones, Ecosystems, Energy, Public Health, Transportation, Telecommunications, and Water Resources).

The Climate Action Council's website,* www.nyclimatechange.us, *provides access to New York's climate planning process.

These policy options were developed through a collaborative process that included more than 100 technical experts and stakeholders, along with staff experts from 13 State agencies. The Climate Action Council convened New York stakeholders, calling on experts from New York and beyond to take part in Technical Work Groups and an Integration Advisory Panel. Since February 2010, these groups have been examining mitigation and adaptation policy options available to the State. The Council's comprehensive web site offers detailed information about the process at www.nyclimatechange.us.

This Interim Report builds on extensive previous work. Data on emissions and policy design came from New York's experience with programs supporting development of renewable energy systems and energy efficiency and the development of the Regional Greenhouse Gas Initiative (RGGI). In particular, the *2009 New York State Energy Plan* significantly advanced understanding of GHG mitigation, through preliminary technical assessments of greenhouse gas science, emissions, and the scope of needed mitigation actions. The State Sea Level Rise Task Force, the *Assessment for Effective Climate Change Adaptation Strategies in New York State* (ClimAID), PlaNYC, and New York City's extensive adaptation analyses provide foundational data for statewide adaptation recommendations.

Public Input, Further Planning Work, and Implementation

With this Interim Report, the Climate Action Council is seeking stakeholder and public response to the initial climate action planning work, including input on the policy options. During 2011, the Council will complete additional analyses and design of the policy options and transmit its recommendations in a Climate Action Plan. That plan will include the following:

- Economic assessments, including both the cost of inaction and macroeconomic impacts in New York, such as creating jobs and retaining some of the $38 billion dollars that is exported annually from New York to pay for energy imports

- Refinement of policy options based on public comment
- Assessment of policy interactions (reinforcement and conflicts) among individual policy options; there are many such interactions, given the multi-sector nature of aggressive GHG mitigation policies
- Creation of a mitigation cost curve (comparing net costs and reduction potentials of individual climate policy options)
- Assessment of the GHG reduction potential of the full policy package, and determining whether it puts New York on the path to meet the 40 by 30 benchmark target and the 80 by 50 long-term goal
- Further analysis of funding options and availability of capital, as well as of societal benefits and externalities.

Implementation of policies to achieve a transformation as significant as 80 by 50 will require substantial investments in some sectors of the economy. Although many policy options offer substantial savings to consumers, there are notable exceptions that demonstrate deep carbon emissions reductions but come at a cost to achieve.

Climate Smart Communities

More than 80 New York villages, towns, and counties have declared themselves *Climate Smart Communities*, working to reduce energy use, protect the climate, and save taxpayer dollars.

Across New York, Climate Smart Communities are

- Inventorying greenhouse gas emissions, setting reduction goals and developing action plans.
- Carrying out projects that reduce emissions from municipal facilities and vehicles.
- Reducing community emissions through more efficient municipal services, such as traffic systems and waste disposal.

To learn more about Climate Smart Communities, visit: http://www.dec.ny.gov/energy/50845.html

To fund some policy proposals, New York State will need to identify new funding mechanisms of sufficient magnitude and duration to catalyze a change in how we produce or use energy. Such funding sources could be created by a combination of carbon pricing, federal cost sharing, and public-private partnerships. Leveraging private capital will be absolutely critical to achieving a goal as bold as 80 by 50. Public funding should come from sources that directly link revenue generation to GHGs, promoting efficiency and low-carbon technologies, and avoiding burdens on desired activities such as economic activity and employment.

Policies must be crafted in a way that promotes clean energy and low-carbon investment, optimizes public investment dollars, and places New York at a competitive advantage both nationally and globally. Recognizing the current fiscal constraints, the Council recommends a staged or phased approach to this grand challenge.

3.0 A Clean Energy Economy in New York

New York could become the regional, national, and international hub of clean technology industry and innovation—creating good jobs for New Yorkers. A portfolio of State policies strategically designed to support the critical building blocks of a clean energy economy would

maximize economic development potential, turning climate policy into an engine for economic growth.

NYS Climate Action Plan Energy Terminology

Low-carbon and near-zero-carbon energy refer to energy from sources whose carbon intensity (CO_2 emitted per unit of energy) is significantly lower than that of traditional fossil fuels. Low-carbon sources include renewables (solar, hydroelectric, sustainable biomass, wind, marine, tidal, and geothermal power), nuclear power, and energy produced by processes that capture and sequester CO_2 from fossil fuel combustion.

The term clean energy includes the suite of environmentally sustainable energy supply and demand technologies and systems in all industries. It includes renewable energy, energy storage, and efficient transportation technology, as well as technologies and systems that improve energy efficiency.

Much has been written about the potential growth of the burgeoning clean energy economy and the competition for these emerging markets is fierce and global. New York is well positioned to compete in this economic race: New York has long been a leader in energy technology innovation and commercialization, with a well established world-class research infrastructure and a major financial and venture capital industry. New York has a superior higher education system, natural resources necessary to power a low-carbon economy, and a productive and skilled labor force that can readily transition into new energy industries and markets.

The clean energy economy includes these critical building blocks:

1. Robust Market Demand for Clean Energy Products and Services: Strong market demand must exist to motivate companies to make investments in facilities, manufacturing, services infrastructure, and research and development. Policies at the international, national, and state level can help create this demand. Such policies include market-pull policies (e.g., a Renewable Portfolio Standard, or RPS), financial incentives/disincentives (e.g., a price on carbon emissions), regulations/codes, procurement guidelines, and a variety of other mechanisms analyzed in this Interim Report. Market demand is the critical foundation for advancing a clean energy economy.

2. Skilled Clean Energy Workforce and Dynamic Workforce Development System: A skilled workforce will help companies to grow and locate in New York State. In an innovation-based economic model, a full spectrum of skill levels is needed—from the technician servicing customers' repair and installation needs to the CEO who attracts investment and runs the company. A dynamic workforce development system meeting the needs of a clean energy economy must take a long view to develop the human capital needed to prepare New York to capture the benefits of a clean energy economy.

Jobs involved with weatherizing buildings and other aspects of the clean energy economy keep energy dollars in the local community.

3. Technology Innovation and Commercialization Ecosystem: To provide more options and lower cost solutions, substantial and sustained investment in energy technology research and development and new approaches to accelerate technology

Working to reduce the cost of mounting and installing solar arrays, this start-up company is part of the New York City Accelerator for a Clean and Renewable Economy (NYC ACRE), a joint effort of New York State, New York City, the investment community, and several universities. NYC ACRE is developing entrepreneurs and innovative local businesses that provide climate and energy solutions while growing the clean technology sector and creating jobs in New York. Located in Buffalo, Rochester, Syracuse, Albany, Long Island and New York City, New York's six Clean Energy incubators support a total of 72 clean energy start-up companies. (Photo courtesy of Polytechnic Institute of NYU.)

commercialization must be developed. A fully integrated network of inventors, entrepreneurs, financiers, and market experts—with many vital connections much like a natural ecosystem—will together spur creation of new clean energy companies that will take the risks needed to produce new products and services. New York has the key ingredients for robust job-creating, energy-technology innovation. With State policies that support the entire innovation ecosystem, New York could reap substantial economic gains by developing and manufacturing high-value clean energy products for local use and for international markets.

4. Focused and Sustained Economic Development Strategies that Support Clean Energy: New York must embrace a model for economic development that builds on its strengths as a knowledge-based economy and that recognizes that the state will struggle to compete in low-cost commoditized markets. State economic development policies should support the retention of jobs and the creation of new businesses and jobs in emerging high-growth markets, such as clean technology industries. Economic development policies must embrace the new emerging economy of the 21st century— an economy whose growth is based on innovation, knowledge, and entrepreneurship.

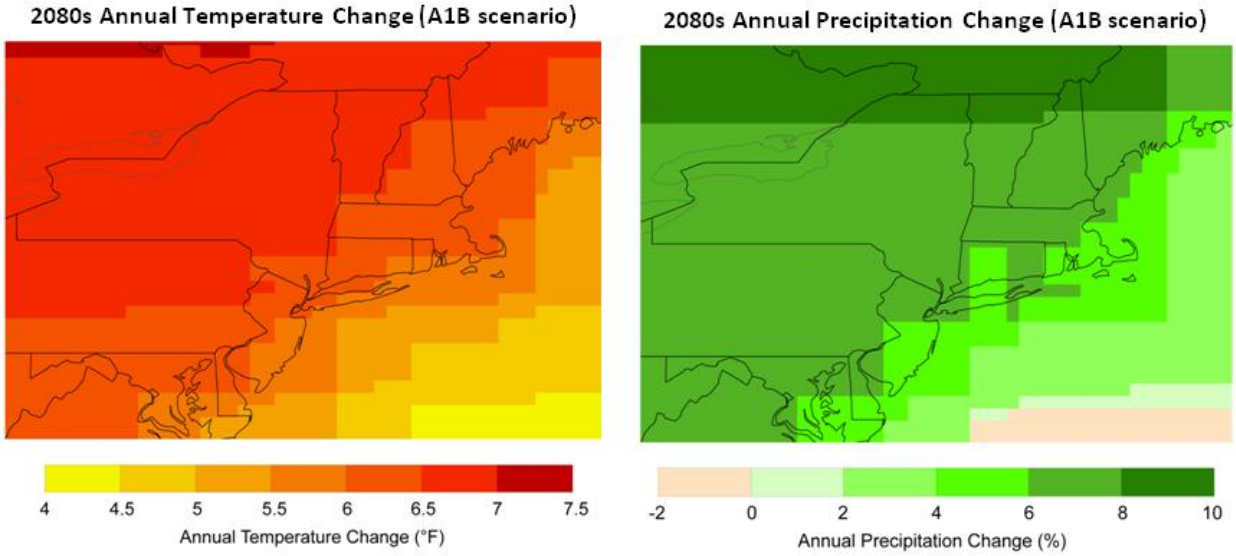
5. Fully Engaged Private and Public Sector: Achieving a goal as transformational as 80 by 50 is possible only with the full and sustained commitment of all levels of the public and private sectors. The clean energy revolution will ultimately depend on linkages and support from the federal government, State government, businesses, academic institutions, not-for profits and municipal governments—each of which plays an important role in the transformation to a clean energy economy. And support from the public at large is a prerequisite for policymakers in New York to advance and sustain the climate-energy policy options presented here.

4.0 Potential Climate Change Impacts and Vulnerabilities in New York

Global climate models project that the Earth will warm in the next century, in a consistent geographical pattern. This climate change threatens New York's natural resources, economy, and the health and lifestyle of its residents. For example, New York State's average air temperatures are projected to increase significantly over the coming decades, and heat waves are expected to become more frequent and intense. Summertime rain is expected to fall more often as heavy downpours, leading to more flooding; at the same time, the periods between these rainstorms are likely to be drier, leading to droughts. By the year 2100, sea levels along our coast and the Hudson River estuary are projected to rise between 12 and 55 inches, increasing storm-related coastal flooding.

The *Integrated Assessment for Effective Climate Change Adaptation Strategies in New York State* (ClimAID) is a comprehensive project to provide New York State decision makers with the best available climate science and other information on the state's vulnerability to, and possible benefits from, climate change. The study also aims to facilitate development of adaptation strategies informed by both local experience and scientific knowledge. To make it easier to assess potential impacts under future conditions, the ClimAID team developed a set of climate change scenarios for New York State. Figure OV-1, from ClimAID, shows the projected changes in average annual temperature and precipitation for New York for a mid-level emission scenario of future greenhouse gas emissions. A synthesis report summarizing the findings of ClimAID can be found in Appendix H to the Interim Report.

Figure OV-1. Projected changes in annual temperature and precipitation for the 2080s in the Northeast, under the A1B ("middle") emissions scenario, relative to the 1970-1999 baseline



Many climate changes projected by scientists are already occurring, with impacts to New York State's society, economy, and natural ecosystems. The summaries presented here by sector list some of the expected specific impacts to New York State as the climate continues to change.

Apple crops are vulnerable to late spring freezes and other weather aberrations that accompany climate change.

Agriculture

Some crops may have yield or quality losses associated with increased frequency of drought, increased summer high temperatures, increased risk of freeze injury as a result of more variable winters, and increased pressure from weeds, insects, and disease. Dairy milk production per cow will decline in the region as temperatures and the frequency

of summer heat stress increase. Warmer temperatures, a longer growing season, and increased atmospheric carbon dioxide could create opportunities for farmers who are able to transition to new crops.

Coastal Zones

Sea level rise will greatly amplify risks to coastal populations and will lead to permanent inundation of low-lying areas, more frequent flooding by storm surges, and increased beach erosion. Saltwater could reach farther up the Hudson River and into estuaries, contaminating urban water supplies. Tides and storm surges may propagate farther up the Hudson River, increasing flood risk far from the coast.

Tidal wetlands are expected to be flooded by rising seas faster than new wetlands can establish themselves further inland.

Ecosystems

Widespread shifts in species composition will occur in the state's forests and other natural landscapes, with the loss of spruce-fir forests, alpine tundra, and boreal plant communities. Warmer temperatures will favor the expansion of some invasive species into New York. Some habitat and food generalists (such as white-tailed deer) may also benefit. Higher levels of carbon dioxide may increase the growth rate of fast-growing species, which are often weeds and invasive species. Lakes, streams, inland wetlands, and associated aquatic species will be increasingly vulnerable to changes in the timing, supply, and intensity of rainfall and snowmelt, groundwater recharge, and duration of ice cover. Increasing water temperatures will negatively affect brook trout and other native coldwater fish. Sea level rise will lead to loss of coastal wetlands, reducing populations of fish and shellfish.

Energy Systems

More frequent heat waves will cause an increase in the use of air conditioning, stressing power supplies and increasing peak demand loads. Transformers and distribution lines for both electric and gas supply are vulnerable to extreme weather events, temperature, and flooding. Coastal infrastructure in downstate areas is vulnerable to flooding as a result of sea level rise and severe storms. Hydropower is vulnerable to drought and changes in precipitation patterns while power plant efficiencies may be reduced due to increased air and water temperatures.

Public Health

Heat-related illness and death are projected to increase, while cold-related deaths will likely decrease. Increases in heat-related death are projected to outweigh reductions in cold-related death. Cardiovascular and respiratory-related illness and death will be increased by worsening air quality, including more smog, wildfires, pollens, and molds. Allergy and asthma cases are projected to increase and become more severe. Vector-borne diseases, such as those spread by mosquitoes and ticks, may expand or their distribution patterns may change. Water- and food-borne diseases are likely to increase. Water supply, recreational water quality, and food production will be at increased risk due to increased temperatures and changing precipitation

patterns. More intense storms and flooding could lead to increased stress and mental health impacts and impaired delivery of public health and medical services. Demand for health services and the need for public health surveillance and monitoring are likely to increase.

Telecommunications and Information Infrastructure

Communication service delivery is vulnerable to hurricanes, lightning, ice, snow, wind storms, and other extreme weather events, some of which are projected to change in frequency and/or intensity. Communication lines and other infrastructure are vulnerable to the observed and projected increase in heavy precipitation events and resulting flooding and/or freezing rain. In coastal and near-coastal areas, sea level rise in combination with coastal storm surge flooding will be a considerable threat especially later this century. The delivery of communication services is reliant on the electric power grid, which may experience increased stress resulting from the additional demand associated with heat waves.

Transportation

Low-lying transportation systems such as subways and tunnels, especially in coastal and near-coastal areas, are at particular risk of flooding as a result of sea level rise and heavy-precipitation events. Materials used in transportation infrastructure, such as asphalt and train rails, are vulnerable to increased temperatures and frequency of extreme heat events. The Great Lakes may see a shorter season of winter ice cover, leading to a longer shipping season. However, reduced ice cover is also likely to mean an increase in "lake effect" snow events, which often cause transportation-related problems. Air- and land-based transportation systems are vulnerable to ice and snowstorms, although requirements for salting and snow removal may decrease as snow tends to turn more often into rain. The number of freeze/thaw cycles, which disturb roadbeds, may increase as winter temperatures rise.

Railroad tracks that run only a few feet above the Hudson River illustrate the vulnerability to climate change and sea level rise of infrastructure located near water bodies. Tidal as far north as Troy, the Hudson will directly experience higher ocean levels and storm surges.

Water Resources

Increasing water temperatures in rivers and streams will affect aquatic health and reduce the capacity of streams to assimilate effluent from wastewater treatment plants. Heavy downpours have increased over the past 50 years and this trend is projected to continue, causing an increase in localized flash flooding in urban areas and hilly regions. Flooding has the potential to increase pollutants in the water supply and inundate wastewater treatment plants and other vulnerable development within floodplains. At the same time as downpours occur more often, more moderate rain events are expected to become less frequent during the summer, resulting in additional and possibly longer summer dry periods and stressing water supply systems with limited storage. Reduced summer flows on large rivers and lowered groundwater tables could lead to conflicts among competing water users.

Economic Impacts

The economic cost associated with climate change mitigation and adaptation is a growing concern for national, state, and local governments around the world. While the cost of combating climate change often impedes action on this threat, inaction has its own significant costs.

Some economic sectors in New York State are more at risk from climate change than others. Because of heavy concentrations of assets in coastal areas, the largest financial impacts likely will occur there, including impacts on transportation, energy, and other coastal infrastructure, as well as natural areas. Other likely costs include decreased agricultural crop yield and dairy production, as well as tourism dollars lost in the winter-recreation industry.

5.0 New York State's GHG Emissions

Emission inventories and projections provide the basis for identifying GHG emissions reduction opportunities and for planning to minimize the economic and environmental impacts of policies.

New York's Emissions Inventory

In 2005, the latest year for which global emissions data are available, New York's share of emissions within the U.S. (3.8 percent) was smaller than its share of the U.S. population (6.5 percent). In contrast, the U.S. share of the world's GHG emissions (18 percent) was much greater than its share of the 2005 population (4.6 percent). Nonetheless, New York's GHG emissions accounted for 0.7 percent of the world's GHG emissions in 2005, while its share of global population was 0.3 percent.

In 2008, New York emitted approximately 254 million metric tons of carbon dioxide equivalent (CO_2e), an average of a little more than 13 metric tons of CO_2e for each state resident. New York's per capita GHG emissions are considerably (43 percent) below the U.S. average.

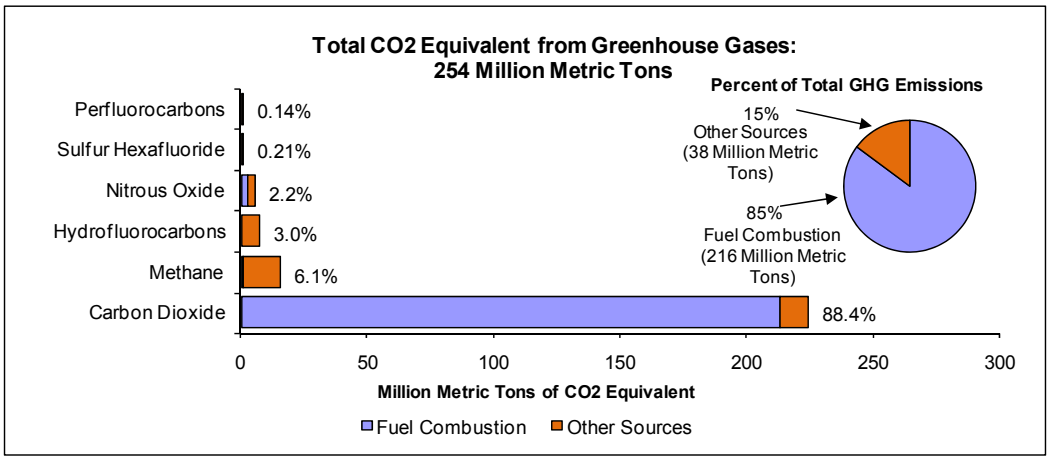
For each of the six major GHGs, Figure OV-2 depicts the portions of New York's emissions that result from fuel combustion and from other sources. Prominent non-fuel combustion GHG sources are cement production, ozone depleting substitutes, natural gas leakage, landfills, agricultural animals, municipal waste combustion, municipal wastewater, and agricultural soil management.

Carbon Dioxide Equivalent (CO_2e)

Because GHGs vary in their ability to retain heat, GHG emission inventories and projections are given in the metric CO_2e. CO_2e expresses any GHG's global warming potential as a multiple of the potential of carbon dioxide (CO_2).

For instance, methane has a CO_2e of approximately 22 – that is, methane in the atmosphere produces about 22 times as much warming as the same weight of CO_2.

Figure OV-2. 2008 Percentage of GHG Emissions by Gas and Source (Includes Net Imports of Electricity)



CO_2 = carbon dioxide; GHG = greenhouse gas

As Figure OV-2 shows, carbon dioxide (CO_2) is the predominant GHG emitted in New York (88 percent, including both combustion and non-combustion emissions). Methane is second (6 percent); most of New York's methane results from non-fuel combustion sources such as municipal waste and natural gas leakage. The state's small amounts of nitrous oxide emissions (2 percent of total emissions) are mostly attributable to automotive fuel combustion. Other industrial gases make up the remaining GHG emissions.

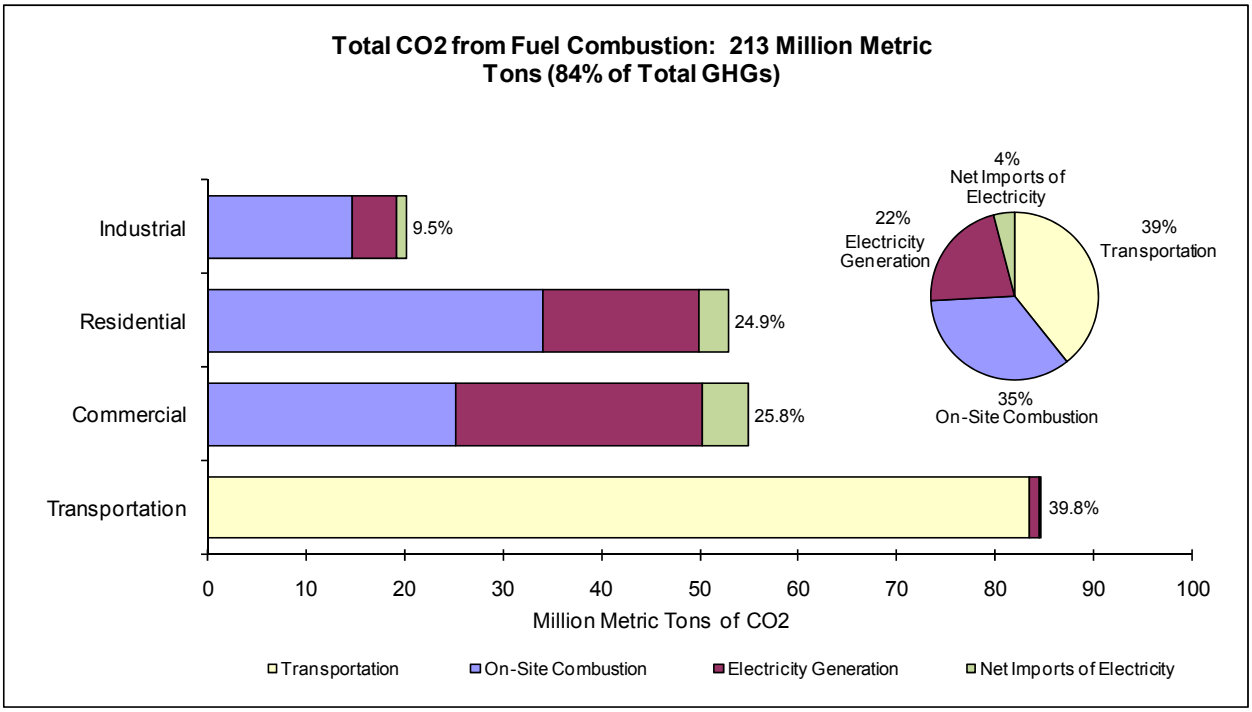
Combustion of fossil fuels is the dominant source CO_2 emissions—CO_2 from fuel combustion makes up 84 percent of New York's GHG emissions. Fossil fuel combustion occurs in power plants to generate electricity, on building sites for space heat and industrial process power, and in vehicles to transport goods and people.

Carbon Dioxide Emissions from the Major Economic Sectors

The GHG inventory divides CO_2 emissions into four main end-use sectors: industrial, residential, commercial/institutional, and transportation. The emissions inventories for the residential, commercial/institutional, and industrial sectors include the emissions resulting from each sector's share of electricity generation, whereas the Climate Action Plan policy option analysis separates out electricity sector emissions because they must be mitigated within the power supply and distribution sector.

Figure OV-3 details 2008 CO_2 emissions from fossil fuel combustion by end-use sector. The transportation sector accounts for approximately 40 percent of CO_2 emissions from fuel combustion; the residential and commercial/institutional sectors are each responsible for roughly 25 percent of fuel combustion CO_2 emissions, including emissions from the share of electricity generation required by each of these sectors. The residential sector shows greater emissions from fuel combustion on-site than from electricity generation or imported electricity, while the commercial/institutional sector shows the reverse—emissions from electricity generation and imported electricity are higher than emissions from on-site fuel combustion. The industrial sector's fuel combustion CO_2 emissions are the lowest (approximately 10 percent), with most of these emissions coming from on-site fuel combustion.

Figure OV-3. 2008 CO_2 Emissions from Fuel Combustion by End Use Sector (Includes Net Imports of Electricity)



CO_2 = carbon dioxide; GHG = greenhouse gas.

Of the different fuels, natural gas, which is burned in all fuel combustion sectors, accounts for the largest amount of fuel combustion CO_2 emissions (almost 30 percent). The transportation sector emits nearly as much fuel combustion CO_2 (28 percent), from burning gasoline in vehicles.

Trends in Emissions and GHG Sinks

New York's gross GHG emissions increased by about 2 percent (or 6 million metric tons of CO_2e) between 1990 and 2008, with a peak around the year 2000. New York's transportation sector showed by far the greatest growth in gross GHG emissions, with an annual increase of 14 million metric tons from 1990 to 2008. In contrast, during this same period annual CO_2e emissions from electricity generated in-state decreased by about 18 million metric tons, although emissions associated with electricity imported from other states grew.

It should be noted that gross emission figures do not take into account uptake of carbon by GHG sinks, while net emissions do. New York's forests, including urban forests, wetlands, and fields, function as sinks of CO_2 emissions. Agricultural cultivation practices also are found to contribute to removal of CO_2 from the atmosphere.

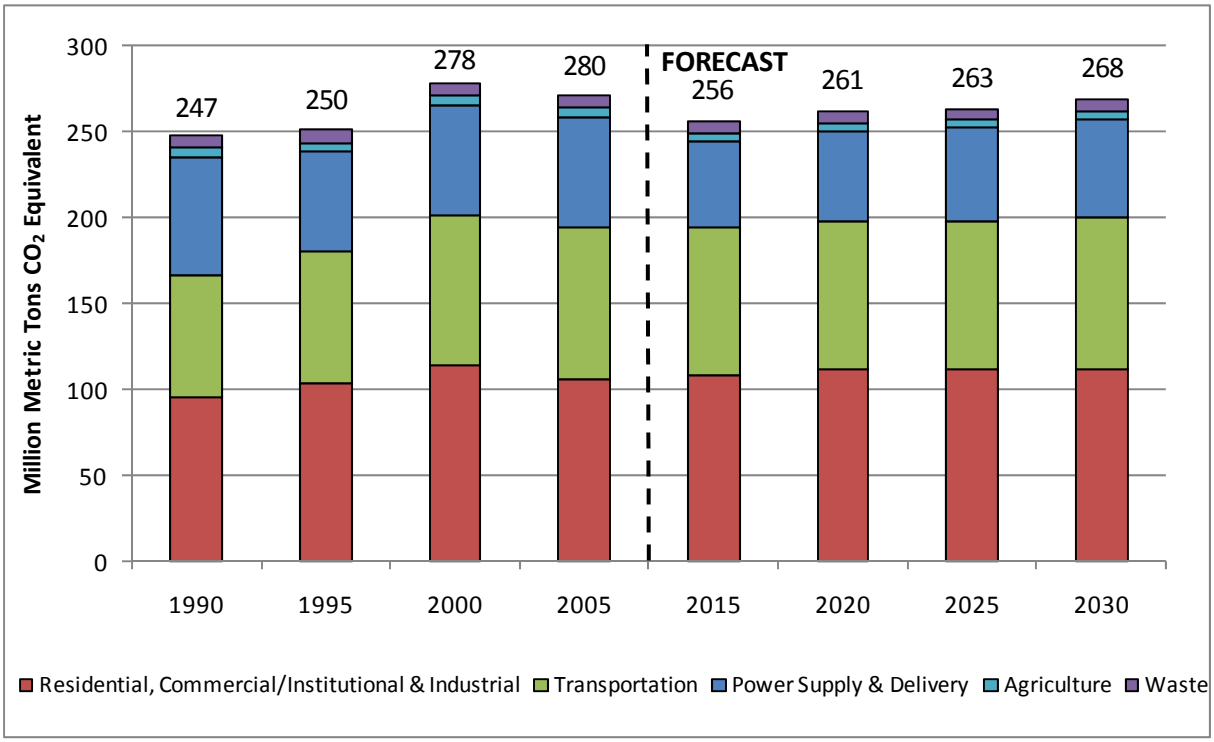
Greenhouse Gas Emissions Forecast through 2030

Relying on a variety of sources for forecasts (as described in Chapter 3 of the full Interim Report on Inventory and Forecast), a reference case forecast of GHG emissions through 2030 was developed. The reference case assumes implementation of policies that are currently approved

and funded at the state and federal level. It assumes no additional policy action, and is sometimes referred to as a "business-as-usual" scenario.

Figure OV-4 shows estimates of annual GHG emissions through 2030 (based on forecasts for Mid-Atlantic fuel demand, along with natural gas projections). Forecasts for on-highway diesel and gasoline fuel use were based on forecasts of New York vehicle miles of travel provided by the Department of Transportation and federal projections of vehicle fuel economy. The forecasts do not take into account the effects of a changing climate.

Figure OV-4. Greenhouse Gas Emissions by Source Category, 1990–2030



Under the reference case forecasts, New York's gross GHG emissions decrease slightly from 2005 over the forecast period, to about 268 million tons of CO_2e by 2030, or 8 percent above 1990 levels. Relative to 2005, the shares of 2030 emissions associated with residential, commercial/institutional and industrial sector fuel use, transportation, and power supply and delivery are still the highest, in the same order. The greatest increase in the share of emissions is in the transportation sector, with an increase from 29 percent of total gross emissions in 2005 to 33 percent in 2030.

Growth rates of fuel use for space heating, industrial processes, transportation, and electricity demand, the principal determinants of New York's future GHG emissions, are driven by economic, demographic, and land-use trends, which are difficult to predict. Improving forecasts of growth patterns and transportation system impacts will be a crucial task for climate planners going forward.

6.0 Visioning

New York's 2050 Analysis

The 80 by 50 goal and the year 2050 vision drive New York's Climate Action Plan. In the 2050 vision, with GHG emissions at only 20 percent of today's level, New York would boast a vibrant economy, its resilient communities and natural resources meeting citizens' needs in a changing climate and thriving as the nation's and the world's low-carbon economy matures.

To give definition and specificity to this 2050 vision, the Climate Action Council conducted a visioning exercise. The visioning exercise made use of four tools:

- **2050 Scenario development**, based on a coupled energy-sector model and sets of assumptions about future energy demand, patterns of energy use, and low-emission technologies that might reasonably be available to power the low-carbon economy
- **Visioning workshop,** held at the New York Academy of Sciences on January 5, 2010; full session and presentations available online at http://nyclimatechange.us/2050
- **White paper** incorporating workshop outcomes and information from other expert sources: *Envisioning a Low-Carbon 2050 for New York State*, Brookhaven National Laboratory (Appendix F).
- **2050 Sectoral visions** developed by the Technical Work Groups for each sector of New York's economy: Residential, Commercial/Institutional and Industrial (buildings and processes); Power Supply and Delivery; Transportation and Land Use; Agriculture, Forestry, and Waste (with Materials Management). Detailed discussions of the visions for each sector are part of the mitigation sector chapters of this Interim Report.

The City of Syracuse, a Climate Smart Community, sets an example and achieves GHG reduction by partnering in a car sharing program through which residents rent low-emission hybrid vehicles for short time periods. (Photo courtesy of City of Syracuse)

This visioning exercise led to the following key findings:

- Meeting the 80 by 50 goal will require substantial investments in new energy systems and infrastructure that have very low- or zero-net carbon emissions. Changes in patterns of energy use also will be needed.
- Transportation systems and buildings (residential and commercial) will have to move away from reliance on combustion of fossil fuels to alternate sources with significantly lower carbon or no carbon emissions.
- A broad shift from reliance on fossil fuels to generate electricity to carbon-free low- or zero-carbon sources will be needed with a concurrent increase in energy storage and generation capacity. Local fossil fuel combustion yields to electrification and other alternate technologies.

- Energy efficiency must be aggressively pursued today, but it alone is not sufficient to achieve New York's 80 by 50 GHG emission reduction goal.
- Development and redevelopment based on smart growth principles, along with efficient building design practices, building technologies, and construction methods, can significantly reduce the energy demand for buildings and transportation.
- An informed and engaged citizenry that values wise, efficient use of clean energy as part of their everyday lives is absolutely critical to achieving New York's 80 by 50 goal. The goal must be pursued in part through extensive, long-term partnering among all levels of government and across the region, and between the public and private sectors. It will take sustained, unprecedented effort on the part of all.

The Climate Smart Community of New Castle informs and engages its citizens and helps to reduce GHG emissions with an e-waste recycling day. (Photo courtesy of Town of New Castle)

7.0 Greenhouse Gas Mitigation Options

The Technical Work Groups explored policy options to reduce GHG emissions in four key energy-related sectors of New York's economy, as shown in Figure OV-5: Power Supply and Delivery; Residential, Commercial/Institutional and Industrial; Transportation and Land Use; and Agriculture, Forestry, and Waste. The Technical Work Groups developed policy options after reviewing technologies and projections of future demand and screening a large number of possible State policies. As the figure shows, the policy options target all the core 80 by 50 strategies developed in the visioning process.

Figure OV-5. Policy Options and Vision Strategies Map

POLICY OPTIONS	CORE VISIONING STRATEGIES						
	Maximize Energy Efficiency & Conservation	Near- Zero-Carbon Electricity Generation	Smart Electric Transmission, Distribution & Storage	Carbon-Free Transportation Systems	Net Energy-Neutral Buildings	Low-Carbon Liquid Fuels	Carbon Sink Maintenance / Enhancement
RESIDENTIAL, COMMERCIAL/INSTITUTIONAL, AND INDUSTRIAL							
Building Codes, Appliance Standards, & Enforcement, RCI-7	■	■		■	■		
Building Commissioning, Benchmarking, & Upgrades, RCI-8	■				■		
Energy Efficiency Incentives, RCI-2	■				■		
Customer-Sited Renewable Energy Incentives, RCI-3		■			■	■	
Industrial Process Incentives, RCI-11	■	■			■		
Workforce Training & Development, RCI-6	■	■	■	■	■	■	■
Outreach, Education, and Behavior Change RCI-5	■	■	■	■	■	■	■
Rate Restructuring & Flexible Metering, RCI-10	■	■	■	■	■		
Energy Efficiency and Clean Energy Fund, RCI-1	■	■	■		■	■	
Tax Structure & Private Financing, RCI-4	■	■			■	■	
Research, Development, & Demonstration, RCI-9	■	■	■		■	■	
TRANSPORTATION & LAND USE							
Vehicle Efficiency, TLU-1	■		■	■		■	
Vehicle Incentives & Disincentives, TLU-2	■		■	■		■	
Fleet Incentives & Disincentives, TLU-3	■			■			
Alternative Fuel & Infrastructure, TLU-4	■		■	■		■	
Research, Development, & Demonstration, TLU-5	■			■		■	
Decreased Travel & Less Commuting, TLU-6	■			■			
Mass Transit & Rail, TLU-7	■			■			
Freight Strategies, TLU-8	■			■			
Priority Growth Centers, TLU-9	■			■			■
Transit-Oriented Development, TLU-10	■			■			■
Location Efficient Land Use, TLU-11	■			■			■
Intergovernmental & Regional Initiatives, TLU-12	■		■	■			
POWER SUPPLY & DELIVERY							
Renewable Portfolio Std & Renewable Incentives, PSD-2		■		■	■		
Cap-and-Invest & Low-Carbon Portfolio Std, PSD-6	■	■	■	■	■	■	■
Siting and Permitting of New Generation, PSD-1		■		■	■		
New Facility Emissions and Nuclear Power, PSD-10	■	■		■	■		■
Existing Fossil Plant Policies, PSD-8	■	■		■	■		
Distribution Network Upgrade, PSD-4	■	■	■	■	■		
Transmission Network Upgrade, PSD-5	■	■	■	■	■		
Energy Storage, PSD-3		■	■	■	■		
Research, Development, & Demonstration, PSD-9	■	■	■	■	■	■	■
AGRICULTURE, FORESTRY, & WASTE							
Production of Sustainable Feedstock for Bio-Energy, AFW- 1		■		■	■	■	■
Conversion of Sustainable Feedstock for Bio-Energy, AFW-2		■		■	■	■	
Maximize Waste Reduction, AFW-3	■						
Integrated Farm Management, AFW-4	■	■					■
Farm Efficiency & Renewable Energy, AFW-6	■	■			■		■
Conserve Open Space, AFW-5							■
Improved Forest Management, AFW-7				■			■
Local Food Production, AFW-8	■						
Research, Development, & Demonstration, AFW-9	■	■				■	■

Figure OV-5 lists the policy options by sector (each option is designated throughout the Interim Report by a combination of sector initials and numbers). Greater detail about the policy options is available in the Interim Report mitigation chapters (Chapters 6 through 9). Evaluating policy option effectiveness, their net cost and the interactions among them, and selecting policies for final recommendations to the Governor, will be the work of the second phase of New York's Climate Action Plan.

Analyzing Cost and Potential Emission Reductions from the Policy Options

Where possible, the cost and/or savings associated with a policy and the total GHG emissions expected by the 2030 benchmark year were quantified. The 1990 baseline emission levels (referenced in Executive Order 24), along with current levels, are presented in Figure OV-6. The 2030 forecasted GHG emission level, 268 million metric tons ($MMtCO_2e$), is also presented, along with the emission limits implied by the 2030 benchmark target (148 $MMtCO_2e$) and the 2050 goal (50 $MMtCO_2e$). The required emission reduction for 2030 is therefore 120 $MMtCO_2e$, as shown in Figure OV-6. While the precise pathway to the 80 by 50 goal cannot be known, the benchmark goal does provide a plausible mid-point target for the purpose of policy evaluation.

Figure OV-6. GHG Emissions Reductions to Meet the 80 by 50 Goal

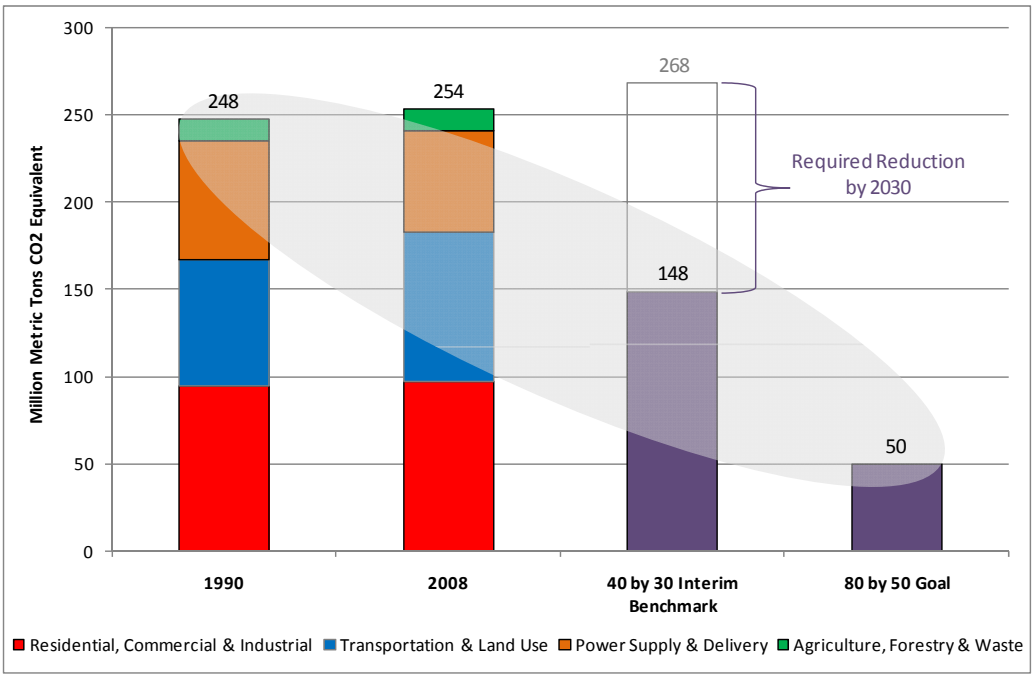


Figure OV-7 presents quantitative analysis of the Interim Report's mitigation policy options over the study period (2011-2030). The preliminary analytical results presented here describe the potential effectiveness of the mitigation policy options on a stand-alone basis, without considering interactions among policies or overlapping emissions reductions. Figure OV-7 presents an estimate of the annual GHG emission reduction anticipated by 2030 of the individual policy options (i.e., as measured by Million Metric Tons CO_2e). To make this estimate, the Technical Work Groups developed specific targets (policy scenarios), where possible, for

individual policy options. (Note that not all policy options are amenable to this type of quantification.) The results also present an estimate of the total cost or savings of the policy option through 2030, as measured by net present value (NPV). NPV reflects the total capital costs, anticipated operation and maintenance costs/savings, and fuel costs/savings associated with the policy. A negative NPV reflects a savings and implies an economically desirable investment. Figure OV-7 also presents a rough indicator of cost-effectiveness for the policy option, as measured by \$/ton CO_2e avoided, to determine which policy options will deliver the most CO_2e on a dollar-for-dollar basis. As with NPV, a negative \$/ton CO_2e implies that we save money as we reduce GHGs.

While further analysis is needed to better understand the full range of economic impacts and to eliminate potential overlap, some general observations can be made from the analysis to date:

- No single policy can deliver the level of emission reduction needed to achieve a 40 by 30 target. A portfolio of policies will be needed to reduce emissions from the many different GHG sources throughout our economy.
- A linear path to achieving 80 by 50 may not be feasible nor optimal for a state like New York, which is already one of the most carbon-efficient states in the country on a per capita basis. We may need to ratchet up the stringency of the policies over time to increase the rate of emission reduction as technologies and markets mature.
- There are a number of policies—particularly in the Buildings, Industry, and Transportation sectors—that represent cost-effective ways to take a meaningful step toward a low-carbon future. These No Regrets policies, which are primarily efficiency policies, could represent options for early action. Further analysis of benefits and costs, and strategies to finance and/or fund, will be needed.
- Energy efficiency policies alone, however, will not deliver the level of emission reduction needed to achieve a 40 by 30 target (and ultimately the 80 by 50 goal). To make appreciable progress toward these aggressive goals and to break our dependence on finite fossil-fuel resources, the State will need to continue to strategically advance low-carbon energy supply-side policies and infrastructure investments, particularly focusing on policies that provide significant co-benefits to New Yorkers (e.g., improvements in local air and water quality, opportunities for economic development and job creation).

Figure OV-7. Preliminary Analysis of Mitigation Policy Options: Greenhouse Gas Reduction Potential and Costs and Savings Estimates

***Note: Negative values denote a savings**.

Policy No.	Policy Option	Annual GHG Reductions by 2030 (Million Metric Ton CO_2e)	Net Present Value: Cost/Savings* (Million $)	Net Cost/Savings per Avoided Emissions* ($/ Metric ton CO_2e)
RCI-2	Energy Efficiency Incentives	17	-$29	$0
	Combined Heat and Power (CHP) Incentives	1.1	$14	$2
RCI-3	Solar Electricity Incentives	3.3	$4,400	$200
	Solar Thermal Incentives	2.8	$2,600	$130
	Bioenergy Incentives	5.1	-$5,100	-$61
RCI-7	Building Codes, Appliance Standards, and Enforcement	6.3	-$1,200	-$27
RCI-8	Building Commissioning, Benchmarking, and Upgrades	3.3	-$790	-$23
RCI-11	Industrial Process Incentives	2.6	-$2,500	-$95
TLU-1	Vehicle Technology and Operations	17	$7,900	$62
TLU-2	Vehicle Incentives and Disincentives	2.0	-$2,300	-$120
TLU-3	Fleet Incentives and Disincentives	0.6	-$750	-$130
TLU-4	Alternative Fuel-Related Measures and Infrastructure—Low Carbon Fuel Standard (LCFS)	8.5	$6,700	$79
TLU-6	Commuter & Traveler assistance	1.0	-$15,000	-$870
	Parking Pricing — Upstate	0.3	$720	$1,400
	Parking Pricing — NYMTC Region	0.4	-$480	-$610
	Telecommuting	1.0	-$15,000	-$870
	Congestion Pricing	0.2	-$1,100	-$460
TLU-7	Expanded Transit	4.9	$25,000	$390
TLU-9	Priority Growth Centers	0.3	-$1,600	-$610
TLU-10	Transit-Oriented Development/ Transit Supportive Development	0.5	-$5,000	-$870
TLU-11	Location Efficient Land Use	1.2	-$15,000	-$870
PSD-2	Renewable Portfolio Standard (RPS) and Incentives for Grid-Based Renewable Generation	7.9	$1,700	$27
PSD-4	Distribution System Upgrades	0.8	-$460	-$73
PSD-6	Low Carbon Portfolio Standard (LCPS): High penetration of renewables	29	$5,600	$26
AFW-3	Maximize Waste Reduction, Recycling, and Composting—In-State Only	0.7	$280	$35

Policy No.	Policy Option	Annual GHG Reductions by 2030 (Million Metric Ton CO_2e)	Net Present Value: Cost/Savings* (Million $)	Net Cost/Savings per Avoided Emissions* ($/ Metric ton CO_2e)
AFW-4	Integrated Farm Management Planning and Application	0.6	–$201	–$31
AFW-5	Conserve Open Space, Agricultural Land and Wetlands	5.5	$1,500	$16
AFW-6	Increase On-Farm Energy Efficiency and Production of Renewable Energy	0.4	$3	$1
AFW-7	Forest Restoration	4.7	$290	$6
	Urban Forestry	2.0	$3,200	$140
	Reforestation	2.4	$1,200	$36

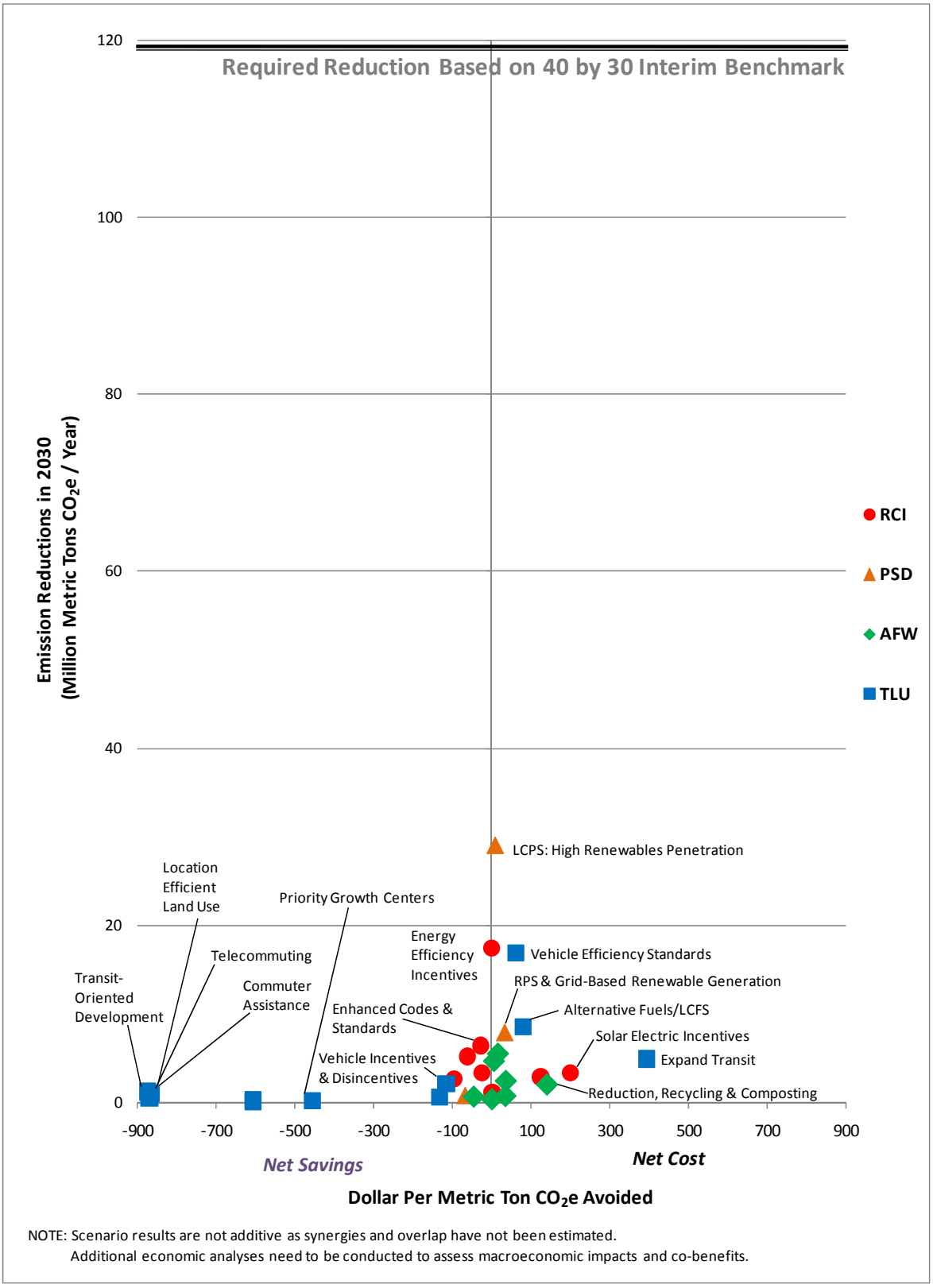
***Note: Negative values denote a savings**.

The data presented in Figure OV-7 are also illustrated in Figure OV-8. Figure OV-8 shows the potential annual emission reductions in 2030 and the net-savings or net-cost per ton CO_2e avoided for each policy. The 2030 benchmark goal has been drawn as a line in the figure to provide a basis for judging effectiveness of each policy. Some general observations can be provided:

- Policies that provide the largest potential emission reductions in 2030 include the low-carbon fuel standard for vehicle fuels (TLU-4), increased vehicle fuel efficiency and/or CO_2 emission standards (TLU-1), building energy efficiency incentives (RCI-2), and a low-carbon portfolio standard for electricity generation (PSD-6).
- Polices that provide the largest savings per avoided metric ton of emissions include smart growth policies (TLU-9, -10, and -11) and commuter assistance (TLU-6).
- Policies that provide both significant emission reductions and net savings include building energy efficiency incentives (RCI-2), improved building codes, appliance standards, and enforcement (RCI-7), and vehicle incentives (TLU-2).

The Interim Report also presents estimates of fuels savings associated with these policies, where appropriate. Based on the estimated reductions in 2030 derived from the policy option and on current consumption levels, RCI-2 would save enough electricity to power 4.6 million homes and enough home heating oil and natural gas to heat more than 1.9 million homes for a year. Similarly, based on the estimated reductions in 2030 derived from the scenario analysis and on current consumption levels, TLU-1 would save enough motor gasoline to power 7.3 million cars for a year.

Figure OV-8. Preliminary Analysis of Mitigation Policy Options Relative to 40 by 30 Benchmark Target



NOTE: Scenario results are not additive as synergies and overlap have not been estimated.
Additional economic analyses need to be conducted to assess macroeconomic impacts and co-benefits.

7.1 Residential, Commercial/Institutional and Industrial Sector (RCI)

RCI Sector Vision for 2050

New Yorkers will enjoy safe, comfortable, well-functioning, and sustainable buildings and communities whose construction and renovation activities, building operations, and industrial processes are designed and operated to maximize energy and resource efficiency, to minimize fossil fuel inputs, and to meet remaining energy needs from a mix of local low-carbon resources and low-carbon imports.

Reaching the Vision: Transforming the Residential, Commercial/Institutional, and Industrial Sector

To reduce GHG emissions 80 percent by 2050, New York's residential, commercial/institutional, and industrial buildings and industrial processes will need to adopt technologies, management efficiencies, and operational practices that support maximum energy and resource efficiency, while substituting low- and zero-carbon sources for fossil fuel in meeting their remaining energy needs.

The City of Schenectady is sponsoring construction of affordable, highly efficient homes to replace deteriorating buildings.

New York has instituted policies that will provide the clean electricity needed for the reduced energy needs of efficient buildings and industrial processes; for example, the 45 by 15 clean energy policy challenges the state to reduce electricity end-use in 2015 by 15 percent below forecasted levels, while simultaneously meeting 30 percent of electricity supply needs through renewable resources. While these policies are among the most progressive in the country, they barely begin to address the level of GHG reduction needed in RCI to achieve the State's 80 by 50 goal.

Long Island Green Homes is an energy efficiency retrofit program created by the Town of Babylon. This program is saving residents an average of $1,085 per year on utility bills by providing upfront funds to upgrade insulation, boilers, furnaces, water heaters, ventilation, air sealing, ducts and weatherstripping. (Photo courtesy of Town of Babylon LIGH Program)

RCI Policy Options

The Technical Work Group identified ten key policy options with the potential to transition New York's buildings and industrial sector to use significantly less energy, improve resource efficiency, and reduce fossil fuel inputs, with additional energy supplied from low- or zero-carbon imports. Chapter 6 of this Interim Report gives technical information, specific targets, and preliminary estimates of cost and effectiveness for each policy option based on the 2030 benchmark; more definitive economic analyses will be developed during the next planning phase.

Figure OV-9. RCI Policy Options with Brief Descriptions

RCI Policy Options and Descriptions
Building Codes, Appliance Standards, and Enforcement (RCI-7) Establish more aggressive codes regarding energy use, including movement to performance-based codes. Provide a statewide "stretch code" that encourages municipalities to achieve additional savings and informs the building sector of planned future changes. Continue to establish and update energy efficiency performance standards for products that are not federally preempted, as specified under Article 16 of the Energy Law, and lobby the federal government to increase performance standards for those appliances with federal preemption.
Building Commissioning, Benchmarking, and Upgrades (RCI- 8) Measure and provide information about buildings' energy use, increasing incentive to reduce energy consumption. Require regular energy audits and cost-effective energy efficiency measures.
Energy Efficiency Incentives (RCI-2) Provide incentives and resources for greater energy efficiency in new buildings and better energy performance in existing buildings. Employ whole-building integrated analysis and design to identify high performance efficiency measures.
Customer-Sited Renewable Energy Incentives (RCI-3) Provide incentives and resources for greater penetration of solar electricity, solar thermal, and low-carbon bioenergy solutions.
Industrial Process Incentives (RCI-11) Assess and reduce industrial process energy use. Provide funding and resources to reduce GHG emissions per unit of industrial production.
Workforce Training and Development (RCI-6) Assess and develop workforce capabilities in New York to meet the needs of a low-carbon future.
Education, Outreach, and Behavior Change (RCI-5) Change energy use behaviors by affecting retail purchase patterns, education in schools, increasing New York State government lead-by-example, and providing information and resources to New York State communities and individuals.
Rate Restructuring and Flexible Metering (RCI-10) Redesign electric rates to vary by time-of-use for all electricity users and expand installation of meters that provide real-time electric cost/use information.
Research, Development, and Demonstration (RCI-9) Invest in next-generation technologies that will produce lower cost solutions to achieve climate-energy goals in the RCI sector and advance a clean energy economy in New York State.
Efficiency and Clean Energy Fund (RCI-1) Fund efficiency and clean energy programs that reduce GHG emissions; build on existing funding sources and explore expanding to include all fuels.
Tax Structure and Private Financing (RCI-4) Conduct a two-phase comprehensive financing and tax policy review that will indentify changes needed to support GHG emission reduction and encourage both public and private investment in low-carbon energy.

How the RCI Policy Options Would Work

At the core of the RCI policies are two statutory and regulatory policies that will produce long-term emission reductions in code-compliant new and renovated existing buildings: Building Codes, Appliance Standards, and Enforcement (RCI-7), and Building Commissioning, Benchmarking, and Upgrades (RCI-8). By promoting upgraded building envelopes and equipment, furnished with energy-saving appliances governed by State or federal energy efficiency performance standards, these policies will reduce building operating costs and achieve substantial energy savings and emission reductions.

Solar panels on the Town Hall roof in the Climate Smart Community of Red Hook are reducing power bills so successfully that the town has applied to expand the installation and develop renewable energy improvement projects for other local government facilities. (Photo courtesy of Town of Red Hook)

Because the RCI policy options do not require most existing buildings to undergo code-mandated improvements, incentives for voluntary upgrades will be vital to meeting New York's GHG emission reduction goals. It is important to note that by 2030, the total building stock in New York State is not expected to increase by more than 6 percent. Therefore, reducing emissions from existing buildings will be absolutely critical to reducing emissions from this sector.

Energy Efficiency Incentives (RCI-2) would promote whole-building, integrated analysis to identify high performance efficiency measures for existing and new buildings. Customer-Sited Renewable Energy Incentives (RCI-3) would increase use of onsite renewable energy, and Industrial Process Incentives (RCI-11) would enhance industrial activity and reduce carbon intensity through more efficient, productive, and cost-effective operations.

Six supporting policies promote developments that are critical to successful statutory and voluntary emissions reduction in buildings, including developing a workforce with the knowledge, skills, and ability to directly meet the energy service demands driven by other RCI policies (RCI-6), and investing in next-generation technologies that will produce lower cost solutions to achieve climate-energy goals (RCI-9).

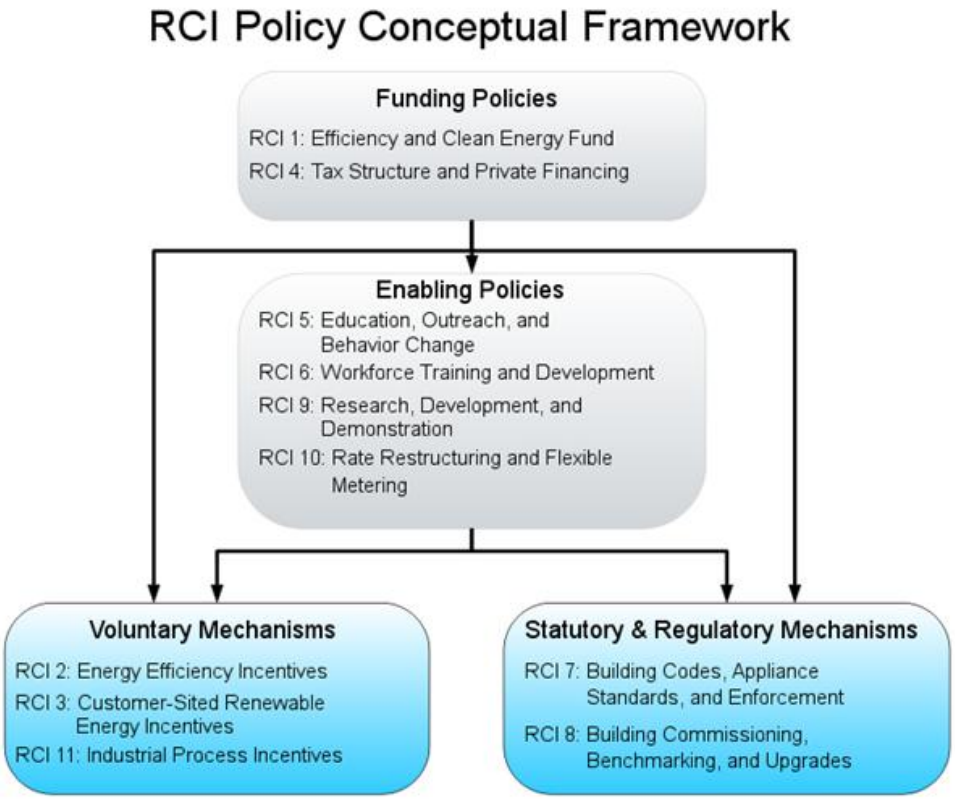
Weatherizing buildings reduces building heating/cooling needs and GHG emissions, and also provides employment to local workers.

Consumers play a key role in investing in energy efficiency and renewable energy equipment and infrastructure. Education, Outreach, and Behavior Change (RCI-5) will promote consumer and State agency staff awareness of the benefits of clean energy and energy efficiency. Redesign of electric rates to vary by time-of-use for most electricity users, along with expanded installation of "smart" meters

that provide real-time information about electricity consumption and cost, would provide more effective price signals reflecting time-of-use and the GHG burden of source fuels, enabling customers to reduce electricity consumption, and save money in Rate Restructuring and Flexible Metering (RCI-10).

Dedicated and continuous funding is essential for the overall success of the RCI policy options and attainment of long-term carbon reduction goals. An Energy Efficiency and Clean Energy Fund (RCI-1) and Tax Structure and Private Financing (RCI-4) initiatives would work in unison to leverage public funding and private financing for low-carbon energy activities. Figure OV-10 illustrates how the RCI policies cover all aspects of a developing low-carbon RCI sector to accomplish significant GHG emission reductions.

Figure OV-10. Residential, Commercial/Institutional, and Industrial Policy Framework



The next phase of climate action planning will evaluate policy interactions, preparing the way for policymakers to select, design, and efficiently implement policies that will avoid conflicting outcomes and make the most of beneficial interactions.

7.2 Transportation and Land Use Sector (TLU)

TLU Sector Vision for 2050

Most New Yorkers will live in smart growth communities and have access to an efficient, reliable, extensive transit network with a variety of modes of low-carbon public and mass transportation within and between communities. Smart Growth will be the predominant land use and development pattern, minimizing GHG emissions by 1) enabling and supporting widespread use of public transit and 2) mixing land uses to minimize the need for driving. Individuals will travel in low-carbon, highly efficient vehicles powered by electricity, hydrogen fuel cells, or sustainably derived biofuels. A significant portion of freight will move on low-carbon modes like rail and barge; trucks will become more efficient and use alternative fuels.

Getting to the Vision: Transforming the Transportation and Land Use Sector

A low-carbon transportation future for New York requires transforming all factors that determine GHG emissions when people and goods are transported: vehicles, fuels, travel activity, and transportation system efficiency. The TLU policies deal with both transportation and land use—deployment of new transportation technologies, provision of new transit choices, and adoption of land use patterns that allow people to meet their daily needs with less vehicle travel.

Climate Smart Community New Rochelle, New York is working to raise the efficiency of its municipal vehicle fleet. (Photo courtesy of City of New Rochelle)

TLU Policy Options

The Technical Work Group identified 12 Transportation and Land Use policy options with the potential to guide a transition to a low-carbon transportation system. Chapter 7 of the full Interim Report gives technical information, specific targets, and preliminary estimates of cost and effectiveness for each policy option based on the 2030 benchmark; more definitive economic analysis will be developed during the next planning phase.

Figure OV-11. TLU Policy Options with Brief Descriptions

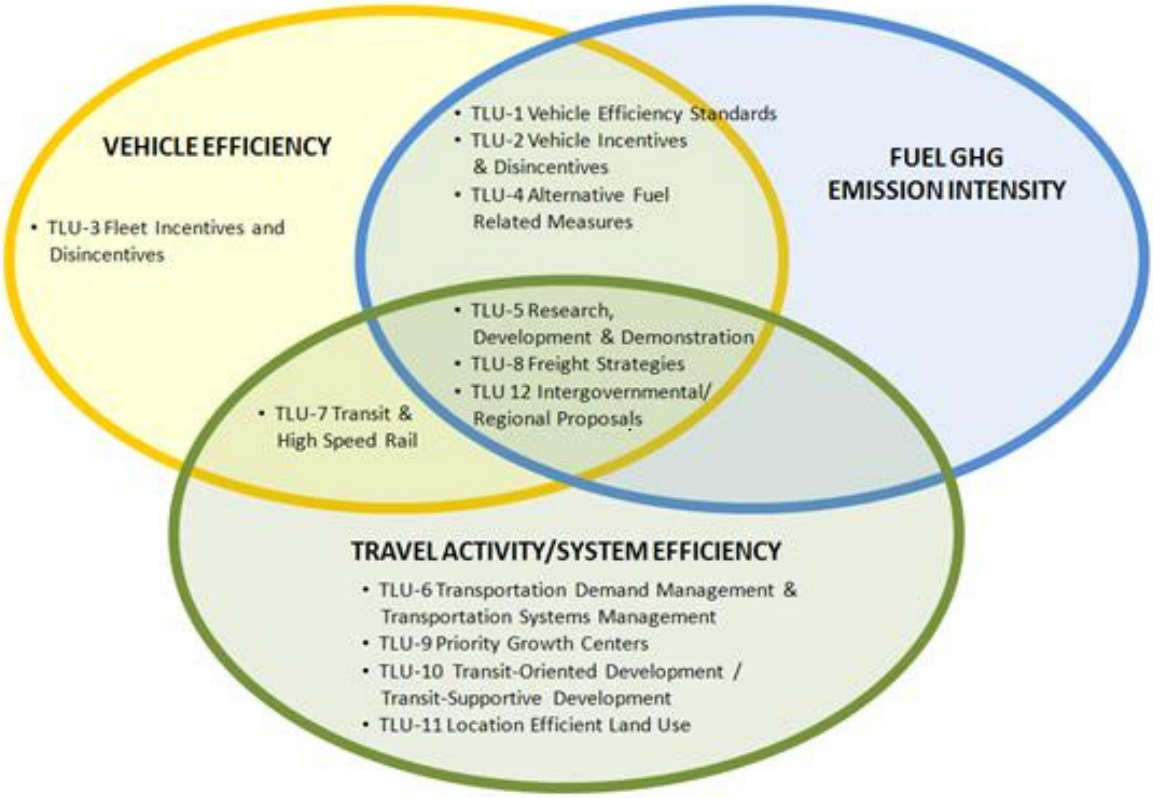
TLU Policy Options and Descriptions
Vehicle Efficiency (TLU-1) Advocate for and implement strict vehicle emissions standards that move vehicle fleet to near zero-carbon emissions.
Vehicle Incentives and Disincentives (TLU-2) Establish feebate system to provide incentive for New Yorkers to purchase more efficient light-duty vehicles.
Heavy-Duty Fleet Incentives and Disincentives (TLU-3) Establish public low-interest revolving loan fund to facilitate the accelerated turnover of fleet vehicles, especially heavy-duty vehicles.
Alternative-Fuel Related Measures and Infrastructure (TLU-4) Establish a regional low-carbon fuel standard to reduce fuel carbon intensity.

TLU Policy Options and Descriptions
Research, Development and Demonstration (TLU-5) Invest in next-generation technologies that will produce lower cost solutions to achieve climate-energy goals in the TLU sector and advance a clean energy economy in New York State.
Travel Demand Management and Transportation Systems Management (TLU-6) Implement measures that reduce dependency on vehicles, encourage and facilitate the use of shared modes of transportation, and allow for the more efficient use of vehicles.
Transit and High Speed Rail (TLU-7) Invest in the maintenance, enhancement, and expansion of public transit systems, including high speed rail.
Freight Strategies that Promote GHG Reductions (TLU-8) Invest in freight rail infrastructure, and research and implement the optimal freight system; provide other incentives for freight mode-shift; promote more efficient or alternatively fueled trucks.
Priority Growth Centers (TLU-9) Promote centralized growth to reduce vehicle miles traveled (VMT).
Transit Oriented Development (TOD)/Transit Supportive Development (TSD) (TLU-10) Promote growth where transit is available to provide transportation choices and reduce VMT.
Location Efficient Land Use (TLU-11) Implement mixed-use, smart growth land-use, and planning policies that result in communities that require less driving.
Intergovernmental/Regional Proposals (TLU-12) Coordinate regional initiatives, including multi-state land use planning incentives, multi-state transportation system GHG allowance system, coordination of high speed rail planning and investment, and federal advocacy.

How the TLU Policy Options Would Work

The policy options identified by the technical work group would seek to influence the future mix of technologies in New York's fleet of vehicles (low-carbon vehicles, or vehicle efficiency) and the fuels used (low-carbon fuels, or fuel GHG emission intensity), and would aim to reduce total vehicle-miles travelled and system energy loss (travel activity/system efficiency). Vehicle Miles Traveled, or VMT, is a key measure of travel activity and transportation system efficiency—a smaller VMT means a more efficient system. Figure OV-12 portrays the relationships among transportation and land use policy options.

Figure OV-12. Transportation and Land Use (TLU) Policy Options



7.3 Power Supply and Delivery Sector (PSD)

PSD Sector Vision for 2050

New York will have a safe, reliable, diverse, and extremely low-emitting electric power system that meets the needs of all citizens and accommodates the widespread conversion of buildings and transportation from fossil fuel to electricity in a manner that maximizes societal benefits, minimizes societal costs, and avoids imposing an undue burden on any community.

Getting to the Vision: Transforming the Power Supply and Delivery Sector

Reducing GHG emissions 80 percent by 2050 economy-wide means that by mid-century, close to 100 percent of New York's electricity must come from *low-carbon* sources—sources with near zero-carbon emissions. Existing State policies have begun this crucial transformation: by 2015, the State's electricity grid is expected to be powered 60 percent by renewable or other low-carbon sources, as a result of the 30-percent renewable energy from the renewable portfolio standard combined with the 30 percent of power currently provided by nuclear power plants. By 2018, the current RGGI cap requires electric power sector emissions to be 10 percent below historic levels. However, these existing programs alone cannot reach the 80 by 50 goal.

PSD Policy Options

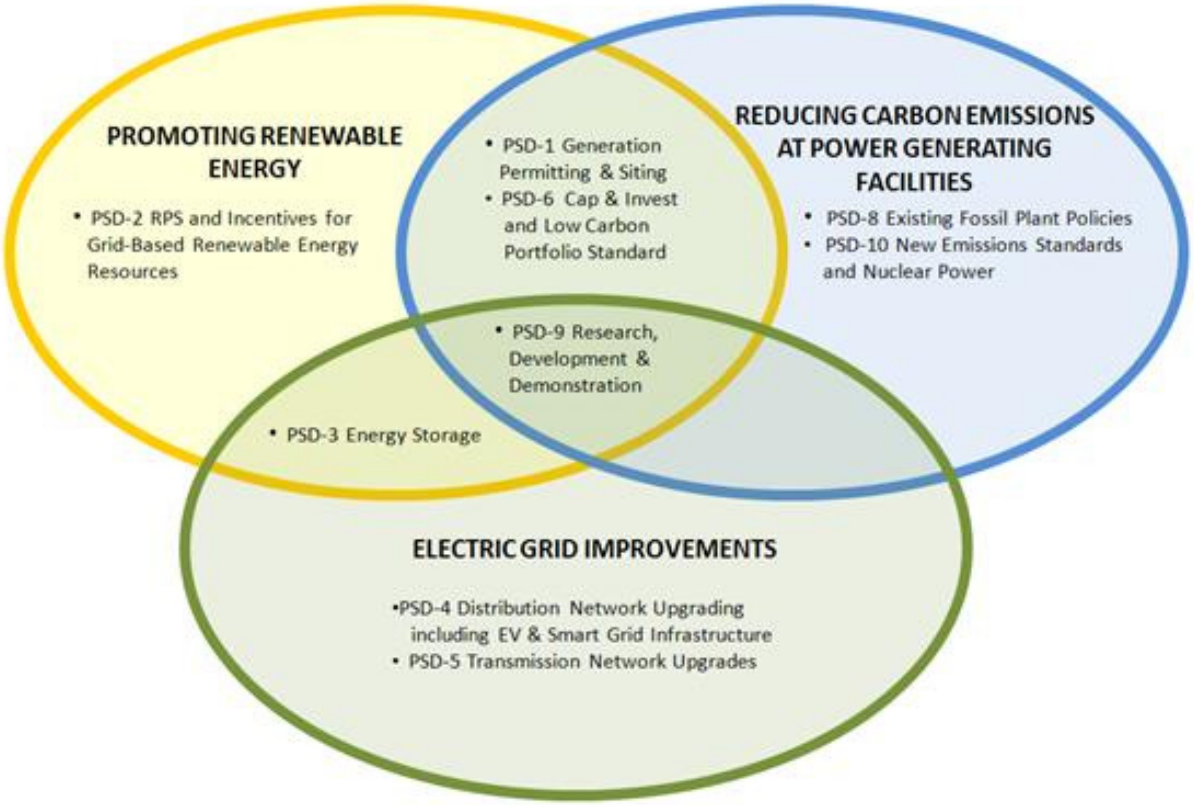
The Technical Work Group identified nine policy options with potential to transition power supply and delivery from its current status of more than 50 percent essentially carbon-free sources (including nuclear, hydroelectric, and other renewable power) to nearly 100 percent. This transition will require substantial investments to maintain system reliability. Chapter 8 of this Interim Report gives technical information, specific targets, and preliminary estimates of cost and effectiveness for each policy option based on the 2030 benchmark; more definitive economic analyses will be developed during the next planning phase.

Figure OV-13. PSD Policy Options with Brief Descriptions

PSD Policy Options and Descriptions
Incentives for Grid-Based Renewable Generation (PSD-2) Promote renewable energy with a goal of increasing the renewable energy attributable to the Renewable Portfolio Standard by 130-140%
GHG Reduction Market Mechanisms: Low Carbon Portfolio Standard, Cap & Invest (PSD-6) Require 75% low-carbon power by 2030 via utilities and other load-serving entities. Cap and reduce emissions across the economy.
Generation Infrastructure Permitting and Siting (PSD-1) Create a new plant siting process that facilitates public participation.
New Facility Emissions Standard and Nuclear Power (PSD-10) Establish standards for new facilities based on GHG emissions from state-of-the-art natural gas-fired plants.
Existing Fossil Plants Policies (PSD-8) Encourage repowering of existing plants, so that they meet emission standards after 2030.
Distribution Network Upgrade Including EV and Smart Grid Infrastructure (PSD-4) Promote smart grid and other distribution system improvements, facilitating electric vehicles and distributed generation.
Transmission Network Upgrades And Loss Reductions (PSD-5) Upgrade electric transmission system to facilitate the low-carbon grid.
Energy Storage (PSD-3) Encourage energy storage techniques that accommodate the variability of renewable energy sources.
Research, Development, and Demonstration (PSD-9) Invest in next-generation technologies that will produce lower-cost solutions to achieve climate-energy goals in the PSD sector and advance a clean energy economy in New York State.

Figure OV-14 portrays the relationships among PSD policies.

Figure OV-14. Power Supply and Delivery (PSD) Policy Options



How the Power Supply and Delivery Policy Options Would Work

Three policy options would lead to most of the emission reductions from the electricity sector:

- **Extension and expansion of the State's existing Renewable Portfolio Standard (RPS)**, a policy that seeks to increase the proportion of renewable electricity delivered to retail customers. The expanded RPS will more than double by 2030 the amount of electricity provided by new renewable energy, including off-shore wind energy and solar energy. The policy also would include complementary measures providing early support to bring low-carbon renewable sources on line.
- **A low-carbon portfolio standard** that will build on the RPS, requiring regulated utilities and other load-serving entities to procure an increasing amount of low-carbon energy.
- **Building upon and strengthening the RGGI program**, working with New York's regional partners to convert RGGI into a multi-sector cap-and-invest program that caps and reduces carbon emissions region-wide, sets a price on carbon emissions, and invests proceeds from allowance auctions in building the clean energy economy in New York.

The remaining policy options focus on lowering emissions from fossil-fueled power generation, modernizing the electric grid, and advancing technology to cost-effectively build the clean energy economy.

- **To ensure relatively low emissions from existing or new fossil-fired plants** by 2030, State policies initially can facilitate siting of new lower carbon power-generating facilities and ensure that all new plants meet a GHG emission standard based on the performance of modern, efficient natural gas-fired plants. After 2030, existing plants also would meet lower emission levels; incentives would encourage the repowering or replacement of older plants with more efficient, lower-emitting technology earlier than 2030.
- **To ensure electricity grid reliability** when drawing increasingly on renewable and other low-carbon power sources, policy options include extensions and upgrades to the electricity distribution system, along with continued deployment of smart grid technologies. These grid modernization options enable increased use of distributed renewable energy sources and electric vehicles, as well as efficient transmission from new renewable and low-carbon generation facilities to areas of high demand. Additional energy storage will help accommodate the variability that characterizes most renewable electricity sources.

Wind power is an important and growing source of low-carbon electric power. The Fenner Wind Power Facility, located in Madison County, New York, generates 89 million kilowatt hours of electricity each year.

- **To cost-effectively transition to a low-carbon power sector**, policy options emphasize continued investment in research, development, demonstration, and deployment. Options for Technology Research and Development are detailed in Chapter 10 of this Interim Report.

The next phase of climate action planning will evaluate any interactions among these policies, preparing the way for policymakers to select, design, and efficiently implement policies that will avoid conflicting outcomes and make the most of beneficial interactions.

7.4 Agriculture, Forestry, and Waste Sectors (AFW)

AFW Sector Vision for 2050

Agriculture: *A carbon-negative New York agricultural sector will help to meet the state's food and fiber needs, while also making a significant contribution to the energy supply mix. Farms will be profitable, valued by society, and highly adapted to a changing climate. Farms will be managed as multiple-resource concerns, successfully competing in a fossil-fuel dependent world that is undergoing major climate shifts.*

Forests: *Rural forest land conversion will be rare and long-term forest storage of carbon will realize its maximum potential. Urban green space and trees will reduce building heating and cooling loads. Working together, land owners, government officials, and the public will maximize the long-term carbon sequestration and bio-energy potential of the state's forests. Forests will deliver co-benefits that are vital to the economy and to New Yorkers' quality of life, maximizing the value of forest lands to private forest owners and to the public.*

Waste: *New York will have a sustainable and energy-efficient materials economy where environmental stewardship is pursued as a common societal value and where environmental considerations inform purchasing, production, and materials management, minimizing waste and reducing risks to human health and the environment. Materials management systems and infrastructure will maximize the recovery and re-use of water, wastewater, and other materials in ways that capture their economic value, conserve embedded energy, and minimize net life-cycle emissions of greenhouse gases and other pollutants.*

Getting to the Vision: Transforming the Agriculture, Forestry, and Waste Sector

Climate Smart Community North Hempstead targets schools (Manhasset School District, shown here), libraries and parks with a vigorous recycling program. Recycled materials do not require energy-intensive disposal, and re-manufacturing takes less energy than using virgin materials. (Photo courtesy of Town of North Hempstead)

The agriculture, forestry, and waste sectors all involve management and stewardship of resources. These sectors contribute only a small portion of total state GHG emissions (about 6 percent), but offer potential for relatively low-cost and low-technology GHG mitigation and sequestration policies. Policy options in the agriculture, forestry, and waste sectors would add GHG reduction as a goal of managing energy production and use, natural resources, materials management and waste. Intensive resource management offers significant environmental, economic, and social benefits beyond GHG reductions, including improved water and air quality, increased agricultural and forest productivity, and job creation.

AFW Policy Options

The Technical Work Group identified eight Agriculture, Forests, and Waste policy options with the potential to develop economically vibrant resource and materials management in New York, with sustainable production of food, fiber and fuel; energy-efficient operation; maximum GHG sequestration; and effective stewardship of New York's soils, natural resources, materials, and energy. Chapter 9 of this Interim Report gives technical information and preliminary estimates of cost and effectiveness for each policy option based on the 2030 benchmark; more definitive economic analysis will be developed during the next planning phase.

Figure OV-15. AFW Policy Options with Brief Descriptions

AFW Policy Options and Descriptions
Production of Sustainable Feedstock for Bio-energy (AFW-1) Encourage development of sustainability criteria and use of best management systems to minimize environmental, economic and social impacts.
Conversion of Sustainable Feedstock for Bio-energy (AFW-2) Advance development and commercialization of low-carbon biomass conversion processes.
Maximize Waste Reduction (AFW-3) Develop and provide tools designed to reduce waste and divert materials for reuse, recycling and composting.
Integrated Farm Management (AFW-4) Develop comprehensive farm-specific plans to reduce GHG emissions, increase carbon sequestration, and address agricultural adaptation challenges.
Conserve Open Space, Agriculture Land, and Wetlands (AFW-5) Support improved land management and land-use protection programs to maintain or increase forestland acreage and protect and restore freshwater and tidal wetlands.
On-Farm Energy Efficiency and Production of Renewable Energy (AFW-6) Increase on-farm energy efficiency and renewable energy production via comprehensive energy audits and coordination of energy services for the agriculture sector.
Improved Forest Management (AFW-7) Provide incentives, education, technical assistance, and support programs to improve forest health, sequester additional carbon, reduce fossil fuel energy consumption, and increase green infrastructure.
Locally Produced Food (AFW-8) Increase the availability of locally produced foods to help reduce the energy required for transportation, packaging and marketing.

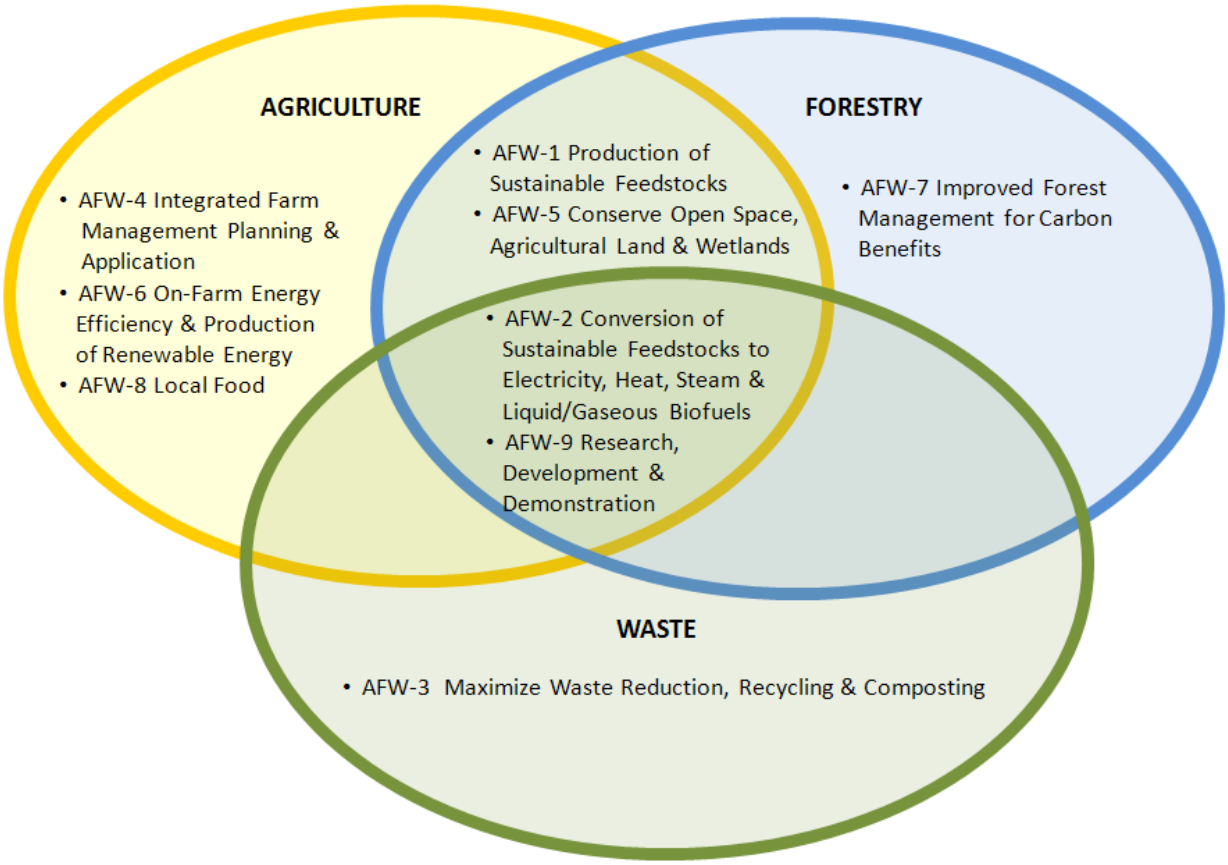
How the AFW Policy Options Would Work

Overall, the policy options seek to accomplish the following:

- Reduce energy-related emissions through the deployment of renewable energy technologies, including low-carbon bio-based energy solutions, and energy efficiency policies and measures that address direct and embedded energy usage.
- Conserve the embedded energy in materials by maximizing reuse and recycling.
- Reduce emissions of methane and nitrous oxide, both potent GHGs, from agricultural and waste-related activities by deploying a combination of systems.
- Capitalize on the large carbon storage capability of agriculture and forests, which sequester carbon from the atmosphere via natural processes.
- Coordinate climate change adaptation strategies with mitigation strategies wherever possible.

Figure OV-16 portrays the relationships among agriculture, forestry, and waste policies.

Figure OV-16. Agriculture, Forestry, and Waste (AFW) Policy Options



The next phase of climate action planning will evaluate any interactions among the policy options, preparing the way for policymakers to select, design, and efficiently implement policies that will avoid conflicting outcomes and make the most of beneficial interactions.

8.0 Research, Development, and Demonstration Investments for a Low-Carbon Future

Experts are calling for a three-to-five-fold increase in global public and private investment in energy technology research, development, and demonstration (RD&D) to develop lower cost solutions to the climate-energy challenge and to capitalize on the opportunities associated with new energy markets. This recommendation is strongly supported by a range of stakeholders including business leaders, academic leaders, the National Academy of Sciences, and the United Nations.

New York's Climate Action Plan must include a commitment to promote and support RD&D, in a coordinated partnership with the federal government and the private sector, to ensure continual development of innovative technologies necessary to cost-effectively reduce GHG emissions and promote the economic strength of local clean energy businesses. Statewide RD&D investments,

across all economic sectors, must be targeted to provide demonstrable benefits for New York companies.

Development of this RD&D investment strategy represents a critical follow-on task that will build upon the high-level policy options in this Interim Report. The investment strategy will further define New York's technological strengths, establish multi-disciplinary collaborative teams between universities and industry, and identify opportunities to further leverage limited in-state resources with federal and private sector funds.

The New York Battery and Energy Storage Technology Consortium (NY-BEST™) is a private-public coalition building a vibrant, world-class advanced battery and energy storage sector from R&D to commercialization.

Chapter 10 in the Interim Report provides an overview of the RD&D needs of the four mitigation sectors, identifies technology areas where New York can best leverage its investments and capabilities to benefit local businesses, and presents "order-of-magnitude" funding estimates to support a technical innovation network and advance low-carbon technologies. It is expected that any State-funded RD&D program established to support implementation of New York's 80 by 50 goal would be supported by a broad array of public stakeholders throughout the state – with active private sector involvement.

The Interim Report provides the following observations and recommendations:

- RD&D and innovation are responsible for over half the economic growth in this country over the past century.
- The energy industry invests only about 0.2 percent of its revenues on energy RD&D, while the average industrial investment in RD&D is closer to 2.6 percent.
- Federal investments in low-carbon energy R&D should increase five-fold from $5 billion per year to $25 billion according to many experts.
- Energy RD&D investment in New York State, currently $50 million per year, must be increased substantially to pursue a low-carbon future and stimulate a clean energy economy in New York.
- New York energy RD&D funds should be targeted toward helping New York businesses develop low-carbon technologies while also addressing local energy and infrastructure needs, thereby helping to stimulate a clean energy economy in the state.
- The State must actively promote innovation and commercialization to bring the fruits of RD&D investment to the market and to realize local economic benefits, as described further in Chapter 13 on the Clean Energy Economy.
- RD&D needs for buildings and industry of relevance to New York include deep-retrofit strategies for existing buildings, onsite energy storage systems, building-scale renewables, active power management, consumer behavior modification, whole-building/zero energy buildings, and non-fossil-fuel based industrial process technologies.

- RD&D needs related to transportation and land use include intelligent transportation systems, alternative fuel vehicles, and related infrastructure—in particular electric vehicle infrastructure, vehicle efficiency optimization for urban duty cycles, smart growth pilots, and improvements in electrified rail.
- RD&D needs in power supply and delivery include marine-based resource development, including off-shore wind, advanced wind resource forecasting, carbon capture and sequestration assessments, grid integration of large-scale solar and smart grid.
- RD&D needs in agriculture, forestry, and waste include carbon sequestration in agriculture and forest lands, and sustainable biomass resource development.

It is important to note that New York State cannot support the entire technology development process (*basic research*, *technology development*, *large-scale demonstration*, *commercial adoption*) on its own. The Interim Report acknowledges a clear role must be established for the federal government and the private sector that efficiently optimizes limited resources, appropriately assigns technical and business risk, and ensures a consistent and stable flow of investment capital to finance advanced energy technologies. Any State-level investment strategy must function as an advocacy tool to drive national RD&D energy policy and leverage private-sector RD&D investments.

9.0 Adapting New York to Climate Change

In this historic photo, storm surge is poised to wash over Battery Park in New York City. Rising sea levels will bring more dangerous storm surges, not only for communities at sea level, but also for upland communities near tidal rivers, such as the Hudson.

To create a more climate-resilient New York State, the Climate Action Plan places a strong emphasis on adaptation. Climate change already is affecting New York's society, economy, and natural ecosystems, and these impacts are expected to increase. Past climate is no longer a reliable guide to the future. New climate conditions and unpredictability in the climate affect all of New York's social and economic systems, particularly agriculture, infrastructure, public health, and natural resources.

Adaptation: Planning for a Changing Climate in New York State

Adaptation can be thought of simply as responsible planning, incorporating the most current information about projected climate change into a variety of decisions. Adaptation strategies can include changes in policies, operations, management, or infrastructure that reduce risk of harm and/or take advantage of potential opportunities associated with climate change.

Adaptation can take place at the individual, household, community, organizational, and institutional levels. New York State as a whole is generally considered to have significant resources and capacity for effective adaptation, but the costs and benefits of adaptation will not be evenly distributed throughout the State.

Climate Risks and Adaptation Planning

Incorporating adaptation into decision making requires the following:

- Understanding how the climate in New York State might change
- Identifying potential vulnerabilities to a changing climate—infrastructure or resources that could be harmed if the climate changes
- Assessing the risk levels of those vulnerabilities
- Developing adaptation strategies that will help to minimize those risks
- Prioritizing adaptation strategies and developing an adaptation plan that coordinates with GHG mitigation strategies and economic development.

Past climate conditions alone are no longer a reliable guide when planning for the future.

Prerequisites to Successful Adaptation Planning

The Adaptation Technical Work Group identified seven themes that emerged for all sectors as important first steps to implementation of adaptation policy options. These themes are summarized below:

- Develop a process to maintain, disseminate and explain to decision makers a set of best-available climate projections, potentially via a New York State Climate Science Institute.
- Identify and track key climate change indicators important to New York.
- Develop a framework to monitor, assess, and share progress on local, state, and federal government adaptation planning and implementation.
- Initiate research to develop new adaptation strategies and provide detail and confidence to support adaptation strategy decisions.
- Evaluate emergency preparedness, management and response capabilities (such as emergency warning systems, cooling centers, emergency evacuation, and preparation for power and/or communication outages) in light of climate projections, to determine where these capabilities will be compromised by climate threats in New York.
- Initiate widespread education and outreach, including both school curricula and community outreach, to build public support and awareness.
- Develop adaptation policies that protect those citizens and communities most vulnerable to the impacts from climate change.

The following sections outline the adaptation vulnerabilities and policy options developed by the Adaptation Technical Work Group for eight sectors of New York's economy and natural resources.

9.1 Agriculture Sector Adaptation

Agriculture Climate Vulnerabilities

Farmers are on the front lines of climate change, but the direct impacts on crops, livestock, and pests and the costs of farm adaptation will cascade throughout New York's economy. While climate change will create unprecedented challenges, there are likely to be new opportunities as well, such as possible new markets for food and energy crops suited to a longer growing season and warmer temperatures.

New York's agriculture sector encompasses more than 34,000 farms that occupy about one-quarter of the state's land area (more than 7.5 million acres) and contribute $4.5 billion annually to its economy. Many New York crops benefit from the state's historically relatively temperate climate. The state's farming community includes many large-scale wholesale operations, as well as small farms that are vital to the economy of rural areas.

Dairy farming, New York's top agricultural activity, is vulnerable to climate change because milk yields decrease in warmer temperatures.

Figure OV-17. Agriculture Adaptation Policy Options with Brief Descriptions

Agriculture Adaptation Policy Options
1: Support research, development, and deployment of agricultural adaptation strategies that simultaneously manage on-farm GHG emissions and adaptation concerns. A. Support the introduction of existing varieties and the development of new varieties that can take full advantage of the beneficial effects of climate change. B. Develop improved methods of responding to extreme weather events (frost, freeze, heat, precipitation). C. Develop improved responses to increased weed, disease, and insect threats. D. Increase the accuracy of the existing real-time weather warning systems. E. Support the development of decision-making tools to help the agricultural community adapt. F. Increase climate change impact education and outreach efforts to agricultural producers. G. Ensure equity is incorporated into programs targeting agricultural adaptation.
2: Incorporate anticipated increases in the incidence of weeds, diseases, and insect threats due to climate change in current detection, monitoring, and integrated pest management efforts. A. Evaluate the capacity of existing federal, state and local agriculture and forestry programs that are focused on identifying and monitoring weed, disease, and insect threats attributable to a changing climate. B. Develop and deploy pest-resistant plant varieties, regional coordination for early detection, and rapid-response approaches to emerging threats.

Agriculture Adaptation Policy Options
3: Evaluate and develop mechanisms to more effectively protect livestock from the effects of greater temperature variability and extremes. A. Continue research, development, and deployment of livestock protection measures and climate-related modifications to feed management systems and approaches. B. Increase installation of energy-efficient cooling systems and other structural or mechanical interventions.

9.2 Coastal Zones Adaptation

Coastal Zones Climate Vulnerabilities in New York

New York's coastal zone includes the shoreline, coastal wetland areas, and adjacent inland areas likely to be affected by sea level rise and coastal storms. Even in a densely populated urban environment such as New York City, coastal ecosystems provide numerous functions and values.

Adapting to climate change is urgent for coastal cities and communities. New York City already is planning for rising sea levels. Communities on the Hudson River also recognize that they are vulnerable to storm surges that propagate up the river.

Sea level rise will greatly amplify risks of permanent inundation of low-lying coastal areas, more frequent flooding by storm surges, and increased beach erosion. Saltwater could reach farther up the Hudson River, contaminating urban water supplies; increased water depth could allow faster propagation of tide and storm surges up the Hudson, increasing flood risk far from the coast.

Sea level rise will progressively affect both human and natural systems as it changes water levels on the ocean and estuarine coastline, shortens flood-recurrence intervals, and increases risk and geographic extent of coastal hazards such as storm-surge-related flooding, erosion, and groundwater intrusion.

Figure OV-18. Coastal Zones Adaptation Policy Options with Brief Descriptions

Coastal Zones Adaptation Policy Options
1: New York State should endorse a coordinated set of projections for sea level rise and associated changes in flood recurrence intervals in all coastal areas, including the Hudson River estuary, for use by state and local agencies and authorities for planning and decision-making purposes.
2: Integrate sea level rise and flood recurrence interval projections into all relevant agency programs and decisions.

Coastal Zones Adaptation Policy Options
3: Identify and map areas of greatest current risk from coastal storms and sea level rise to support risk reduction actions in those areas.
4: Reduce vulnerabilities in coastal areas at risk from sea level rise and storms (coastal risk management zone) and support increased reliance on non-structural measures and natural protective features to reduce impacts from coastal hazards. A. Develop Coastal Resilience Plans B. Assist in funding measures to reduce risk
5: Develop a long-term interagency mechanism to regularly evaluate climate change science; set research priorities to foster adaptation; coordinate actions; and assess progress

9.3 Ecosystems Adaptation

Ecosystems Climate Vulnerabilities in New York

New York State includes 47,047 square miles of land, 1,894 square miles of inland lakes and rivers, and 3,988 square miles of Great Lakes. Variation in topography and proximity to water bodies causes large climatic variations, and distinct ecological zones support biological diversity and provide important ecosystem services, including harvested products (food, timber, biomass, and maple syrup), clean water, flood control, soil conservation, carbon sequestration, genetic resources, recreation, wild places, and heritage sites.

Initial impacts of climate change on species are already apparent, with documented accounts of species range shifts and changes in the seasonal timing of bud-break or flowering. Climate change creates risks to biodiversity, net primary productivity, vegetation water use, and biogeochemical cycles, but to date, there is not unequivocal evidence of impacts on ecosystem services such as carbon sequestration or water storage and quality in New York State.

New York's brook trout population, already at risk from increasing temperatures, is likely to be severely reduced by continued warming.

Within the next several decades New York State is likely to see widespread shifts in plant species composition. Warmer temperatures will favor the expansion of some invasive species into New York, some habitat and food generalists (such as white-tailed deer) may benefit. Climate factors could increase the productivity of some hardwood tree species, provided growth is not limited by other factors such as drought or nutrient deficiency.

Figure OV-19. Ecosystems Adaptation Policy Options with Brief Descriptions

Ecosystems Adaptation Policy Options
1: Support the implementation of the recommendations of the Invasive Species Task Force to mitigate potential damage from climate change-induced growth of invasive species.
2: Ensure that New York State's ecosystems sustain healthy, diverse, well-distributed, and abundant populations of fish, wildlife, plants, and human communities that are adapted to survive in a changing climate. A. Support State agency efforts to incorporate an Ecosystem Based Management approach that factors ecosystem function, services, and biodiversity into decision making, including management plans, funding decisions, and policies. B. To enable ecosystems to better respond to changing climate conditions, incorporate adaptive management principles, techniques, and approaches into New York's forest management policies and programs. C. Protect and enhance the stability and function of stream, river, and aquatic coastal systems to accommodate changing climate conditions.
3: Develop a research and monitoring plan to detect, record, and analyze changes in species, habitat composition, natural cycles, and fish and wildlife health, and effectively address current and future threats in changing climate conditions.
4: Expand climate change education and outreach initiatives on the potential impacts of climate change to natural areas and ecosystem services.

9.4 Energy Adaptation

Energy Vulnerabilities in New York

Reliable energy systems are critical to commerce and quality of life. New York State's electricity and gas supply and distribution systems are highly reliable, but extreme weather events, temperature, and flooding can damage equipment, disrupt fuel supply chains, reduce power plant output levels or increase demand beyond the energy system's operational capacity. Downstate coastal energy infrastructure is vulnerable to flooding by sea level rise and storm surges. Renewable generation can be affected by drought, changes in precipitation patterns, cloud cover, or other factors characteristic of climate change.

Figure OV-20. Energy Adaptation Policy Options with Brief Descriptions

Energy Adaptation Policy Options
1: Ensure the accuracy of demand forecasting for planning purposes and build resilience for meeting peak demand. A. Incorporate best available projections of changes in seasonal average temperatures and increased frequency of extreme heat events in near and longer-term demand forecasting for electricity and natural gas. B. Plan for meeting regional demand growth and improved system resiliency through local implementation of demand response and energy efficiency measures, greater use of localized distributed generation, energy storage, other energy supply technologies, and smart-grid technologies, beyond those efforts already underway and planned.
2: Increase utilities' and energy providers' resiliency to climate-related impacts. A. Ensure that best available projections concerning the frequency and severity of extreme storm events are incorporated into State and regional emergency response plans. B. Ensure that detailed statewide maps are available to assist in identifying areas and infrastructure at high risk from storm and flood damage. C. Work with organizations such as the Electric Power Research Institute (EPRI) and NYSEARCH (a voluntary sub-organization within the Northeast Gas Association) to survey and assess utility industry best practices for increasing resilience to climate change.

9.5 Public Health Adaptation

Public Health Vulnerabilities in New York

Some current health conditions are considered sensitive to the changing climate. Cardiovascular disease, the leading cause of death in the state, is made worse by extreme heat and poor air quality. Childhood asthma, an important health challenge in many parts of New York State, especially New York City, is made worse by poor air quality. Several vector-borne diseases (those spread by carriers such as mosquitoes and ticks) have emerged in the past few decades.

A diverse state with populations spread unevenly over urban and rural service areas, New York relies primarily on a county-based system for public health service delivery. This highly decentralized system leads to non-uniform provision of core services, making public health adaptation measures more difficult to coordinate.

Figure OV-21. Ecosystems Adaptation Policy Options with Brief Descriptions

Public Health Adaptation Policy Options
1: Improve or establish robust public health mechanisms to reduce the potential for heat-related morbidity and mortality in New York State. A. Assess the adequacy of existing heat warning systems and, as necessary, expand the capacity of existing cooling center programs. B. Enhance existing education and outreach activities, employing multilingual and culturally sensitive approaches and targeting particularly vulnerable populations. C. Coordinate with utilities to develop an approach to address the public health needs resulting from power disruptions associated with extreme heat events. D. Establish and expand community-based volunteer networks, and identify and assist vulnerable populations. E. Develop and implement a statewide "Green Cool-down Plan" to reduce the "heat-island effect," with a particular focus on the most vulnerable communities.
2: Educate the public regarding the public health consequences of climate and take actions to reduce or eliminate those consequences. A. Raise the awareness of policy makers, State and local government officials, community leaders, businesses, institutions, health care providers, and the general public about the public health significance and related costs of climate change. B. Work with communities to create effective outreach materials and mechanisms focused on vulnerable and/or hard-to-reach populations.
3: Assess and improve the capacity of existing public health preparedness, response, and recovery programs to respond to climate-related impacts. A. Assess and enhance the capacity of existing preparedness programs. B. Determine how existing telecommunications technology and social networking systems can be better integrated into early warning and evacuation systems.
4: Build community resilience and integrated public health capacity to reduce human health impacts of climate change. A. Consider possible public health impacts of climate change in planning, programs, policies, and regulations. B. Increase the resilience of communities by providing additional support for healthy-built environment concepts, such as smart growth and green infrastructure, and for local and urban agriculture initiatives that strengthen food security. C. Require that emergency preparedness plans include coordination and communication among critical stakeholders.
5: Evaluate and enhance, monitoring and surveillance programs for diseases and disease-causing agents and respond to the anticipated climate change-related increase in such public health threats. A. Evaluate the capacity of existing public health programs that control disease-causing agents. B. Provide necessary assistance to local governments. C. Expand analytical laboratory capacity.
6: Assess and prepare for the significant public health risks associated with hazards related to sea level rise.

Public Health Adaptation Policy Options
7: Support research to better understand the public health consequences associated with climate change in New York State. A: Develop a priority research agenda that includes making use of health impact assessments, developing appropriate health indicators, and assessing the effectiveness of adaptation technologies. B: Assess effectiveness, accessibility, and quality of public health-related climate change adaptation programs.

9.6 Transportation Adaptation

Transportation Vulnerabilities in New York

Climate change has significant consequences for the transportation sector. Over the next few decades, heat waves, heavy precipitation events, and windstorms will likely be the dominant causes for moderate, frequent transportation problems such as flooded streets and mass transit delays. By 2050 at the latest, sea level rise and storm surge will become more significant threats. By the latter half of this century, these threats will be so severe that major adaptations will have to be in place, not only in the coastal zone, but all the way to cities in the way of sea level rise and storm surges propagating up the tide-controlled Hudson River. Low-lying transportation systems like subways and tunnels, especially in coastal and near-coastal areas, are at particular risk of flooding from sea level rise and heavy-precipitation events.

Transportation may be disrupted more often and more severely as heavier rains flood roads and bridges located near New York's many rivers and streams.

Materials used in transportation infrastructure, such as asphalt and train rails, are vulnerable to increased temperatures and extreme heat events. Air conditioning requirements in buses, trucks, and trains and ventilation requirements for tunnels will increase. Some aircraft runways may require lengthening, since hotter air provides less lift, necessitating higher takeoff speeds.

Figure OV-22. Transportation Adaptation Policy Options with Brief Descriptions

Transportation Adaptation Policy Options
1: State, regional, and local transportation agencies and authorities should prepare detailed inventories and climate vulnerability assessments of critical transportation infrastructure. A. Designate key transportation corridors, based on the critical movement of people and/or freight and their importance to intra- and interstate travel. B. Endorse a coordinated set of climate change projections and provide these to transportation agencies and authorities and other transportation stakeholders. C. Integrate climate change into vulnerability assessments, including analyses of potential financial and social impacts based on climate projections endorsed by New York State. D. To facilitate investment decisions, evaluate which freight and passenger transport systems are most resilient to climate change.
2: Prioritize transportation infrastructure that is essential for emergency preparedness and response capabilities.
3: Incorporate State-endorsed climate change projections into all relevant decisions. A. State transportation agencies and authorities should develop specific design criteria and operational guidance based on climate change projections in transportation projects and investments. B. Stormwater management techniques and approaches should be incorporated wherever possible. C. Assist local governments in implementing adaptive measures for priority transportation infrastructure.
4: The State's transportation master plan should consider and incorporate State-endorsed climate change projections. A. Policy direction for the siting, design, operation, and maintenance of key transportation infrastructure elements should include climate change projections.
5: Transportation investments in New York State should be consistent with smart growth/transit-oriented development principles. A. Infrastructure investments should be designed and constructed to protect and preserve natural resources and ecosystems that provide essential climate adaptation services. B. Incorporate redundancy and travel choices into the transportation system.

9.7 Telecommunications/Information Infrastructure Adaptation

Telecommunications/Information Vulnerabilities in New York

Telecommunications infrastructure is vital to New York State's economy and welfare; its capacity and reliability are essential to the effective functioning of global commerce and the state's economy and is especially vital during emergencies.

Communication service delivery is vulnerable to hurricanes, lightning, ice, snow, wind storms, and other extreme weather events, some of which are projected to change in frequency and/or intensity. Communication lines and other infrastructure are vulnerable to the observed and projected increase in heavy precipitation events and resulting flooding and/or freezing rain. In coastal and near-coastal areas, sea level rise in combination with coastal storm surge flooding will be a considerable threat later this century. The delivery of communication services is

sensitive to power outages, such as those resulting from the increased demand associated with heat waves, which are expected to increase with climate change.

Figure OV-23. Telecommunications Adaptation Policy Options with Brief Descriptions

Telecommunications Adaptation Policy Options
1: Prepare detailed inventories of telecommunications facilities, network, and corridor-critical infrastructure, and complete vulnerability assessments of critical infrastructure and corridors. A. Prioritize infrastructure that is essential to support critical State and local functions such as emergency preparedness and response capabilities. B. Vulnerability assessments should use accepted climate change projections to assess the impact of projected climate change on high priority communication infrastructure.
2: Incorporate climate change projections into decision-making within New York State's telecommunication and information infrastructure sector. A. State agencies responsible for the management of communication infrastructure should develop specific design and operational guidance based on climate change projections, and incorporate it into communication projects and investments. B. Direct funding as available for adaptive changes to existing critical communication networks used for emergency preparedness and response that are at greatest risk from climate impacts. C. Develop models, guidance and standards, and financial support where possible to help local governments implement adaptive measures for priority communication infrastructure.
3: Where feasible and cost effective, reduce vulnerability of telecommunications infrastructure to extreme weather events. A. Foster a shift toward a more distributed network of communication infrastructure, including expansion of wireless services. B. Planning for investments in communications infrastructure or operational changes planning should support and be coordinated with adaptation and operations of other sectors, particularly the energy sector (e.g., smart grid). C. Ensure system redundancies for communications infrastructure at high risk of flooding and high winds, including communication towers.
4: Improve the dialogue on climate resiliency between State agencies and private telecommunications service providers and provide increased accountability for service disruptions. A. To provide increased accountability carriers and other communication service providers should be required to report compliance with the Federal Communications Commission's standards.

9.0 Water Resources Adaptation

Water Resources Vulnerabilities in New York

The state's water and wastewater treatment infrastructure is in dire need of repair and upgrade, requiring some $36 billion for water treatment and $40 billion for wastewater treatment improvements. Challenges associated with a changing climate will only exacerbate these needs.

New York is experiencing growing demand for water, both for human consumption and for energy production. As other parts of the country experience more frequent and intense drought,

New York's water resources may become a defining economic asset, drawing people and businesses into the state and presenting new water resource management challenges.

Figure OV-24. Water Resources Adaptation Policy Options with Brief Descriptions

Water Resources Adaptation Policy Options
1: Enact into law Governor's Program Bill 2010 #51- Water Withdrawal Regulation (S.8280-A/A.11436-B) to authorize implementation of a comprehensive statewide water withdrawal permitting program.
2: Build greater resilience to projected climate change impacts into drinking water and wastewater infrastructure systems. A. Prepare detailed inventories of critical water infrastructure and conduct climate vulnerability assessments. B. State and local agencies should update permit and design standards for drinking water and wastewater infrastructure to factor in projected climate impacts.
3: Adopt statewide and region-wide comprehensive sustainable water resources management strategies that consider climate change. A. All water-related permit programs and policies should minimize alterations and disruptions to the natural hydrologic cycle to the extent possible. B. Create mechanisms to foster development and state approval of regional intermunicipal watershed management plans that address expected climate change impacts.
4: Allow "room for rivers." Acknowledge the dynamic nature of rivers on the landscape and strive to reduce risk to critical infrastructure and human development as the risk of flooding increases with climate change. A. Coordinate with key federal and local stakeholders such as the Federal Emergency Management Agency (FEMA), U.S. Department of Agriculture, and county soil and water conservation districts to identify and map areas of greatest current risk from riverine flooding and erosion due to movement of rivers across the landscape. B. Work with federal agencies to reduce new development in areas at high risk of riverine flooding and undertake long-term managed relocation or elevation of existing structures in these areas. Restructure disaster recovery policies to ensure that redevelopment efforts strive to reduce long-term risk.
5: Incorporate water-related climate projections into state and local emergency management planning.

10.0 Identification of Cross-Sector Policies & Issues

Many issues associated with mitigating and adapting to climate change relate to more than one of the sectors examined in this planning process. To date, the climate planning process has identified several important cross-sector issues:

- Environmental justice and community-based concerns;
- Near- and long-term workforce training for a clean energy economy;
- Education, outreach, and behavior change;
- The transition to increased use of electric vehicles.

The second phase of climate action planning will seek to identify additional policy interactions among the final recommendations.

Environmental Justice and Community-Based Concerns

The Climate Action Council made a determined effort throughout the planning process to integrate input from community-based groups, regional/community focused organizations, and environmental justice (EJ) groups. These groups served as members of Technical Work Groups and of the Integration Advisory Panel; in addition, the council held statewide videoconferences and a series of teleconferences and surveyed community and EJ organizations on proposed policy options. Details of this discussion and the inputs that resulted are available in Chapter 12 of this Interim Report.

Effective Community Engagement and Public Participation

One of the key ingredients in communities across the world that have successfully engaged on climate change-related issues is the presence of strong and sustained local leadership. Local dialogues educate community members, build support for climate policies and facilitate the shift to a low-carbon economy. Acknowledging and addressing past concerns of the EJ community with official decisions and planning processes were identified as critical to developing and implementing the Climate Action Plan.

The plan's statewide awareness-raising is designed to include tools and guidance to help communities frame climate-related risks within a local context, along with resources and technical assistance for community capacity building.

Permitting, Siting, and Environmental Impact Assessment

Climate policy approaches should respect hard-won procedural safeguards designed to ensure adequate access to official decision making in areas such as permitting, the siting of facilities and infrastructure, and conducting environmental impact assessments. As part of the climate action planning process, EJ stakeholders emphasized the importance of assessing the cumulative risks and impacts of different types of stressors, facilities, and infrastructure on the health and quality of life of communities and adequately analyzing the public health implications of proposed policies. Transparency and timely access to information were advanced as critical in all the policy areas.

Waterfront Facilities and Public Health

Waterfront facilities, especially wastewater treatment plants, petroleum/chemical bulk storage sites, and solid waste management facilities, are particularly vulnerable to climate change impacts and represent risks to surrounding communities. Particular attention should be given to the medium- and long-term contamination and public health consequences associated with coastal flooding.

Fair Share of Burdens and Benefits

No single neighborhood or group should be forced to bear a disproportionate share of the environmental consequences resulting from industrial, commercial, or municipal operations or from the execution of government programs and policies. Community/EJ stakeholders pointed

out that a nuanced approach could help to balance the legacy of environmental pollution and burdens in EJ communities, such as awarding overburdened communities a greater proportion of beneficial climate projects and policy initiatives.

Near- and Long-Term Workforce Training for a Clean Energy Economy

The Residential, Commercial/Institutional, and Industrial (RCI) Technical Work Group identified **near-term** workforce training and development as a priority policy option (RCI-6). However, because workforce issues cut across all sectors, near-term training needs for all mitigation sectors are incorporated into the Workforce Training and Development Policy (RCI-6) (see Chapter 6). As we implement new clean energy technologies and practices and make permanent changes in the way we use resources, we need a trained workforce for projects in energy efficiency; site-based clean and renewable energy resources; power supply and demand; smart grid technologies; codes and standards; agriculture, forestry, and waste; transportation; and manufacturing and other related areas. Chapter 6 of this Interim Report summarizes the workforce policy discussion and details opportunities to expand upon current workforce training, continuing education, credentialing, licensing, on-the-job training, and recruitment and job placement.

Long-term workforce training is addressed in the Building Block #2 section of Chapter 13: *Stimulating a Clean Energy Economy in New York*. Over the long term, training must enable New York to identify and respond to workforce development needs as they arise and to prepare future generations of workers for the low-carbon economy.

The innovation-based model that will underlie New York's low-carbon economy requires a full spectrum of educational support. From the K-12 system, grounding is needed in math, science, environmental sustainability and alternatives to a carbon-based economy, and preparation for entrepreneurship. From higher education, new curricula, certifications and degrees for low-carbon technologies, and access for current workers to skills upgrades as technologies evolve are critical.

Education, Outreach, and Behavior Change

Government must lead by example and take responsibility for developing an implementation strategy that meets the 80 by 50 goal and guides the transition to a low-carbon economy in a cost-effective and politically and socially acceptable manner.

The first step for State agencies and local governments is internal outreach and education promoting the Climate Action Plan and making climate change considerations part of routine government activities and decisions. At the same time, robust, well-funded, and effective external outreach, education, and awareness raising should acquaint all citizens with the substantial economic, social, and environmental benefits the Climate Action Plan will generate.

Transition to Electric Vehicles

At present, the transportation sector produces nearly 40 percent of New York's combustion-based GHG emissions, the vast majority from gasoline-fueled light-duty vehicles. Plug-in electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and fuel cell vehicles powered by hydrogen derived from electrolysis could displace a significant portion of this petroleum

consumption by using electricity for all or portions of vehicle trips. If this electricity had a low or near-zero-carbon intensity, the carbon footprint from this segment could be nearly eliminated.

A cross-sectoral vehicle subgroup worked on a comprehensive, multisectoral strategy to achieve EV penetration as part of the Climate Action Plan, integrating issues applying to power supply generation, transmission and distribution, vehicles, and vehicle charging infrastructure. The following items were among its findings:

Fuel mileage of 125 mpg is the promise of this plug-in hybrid, newly introduced as a way to reduce GHG emissions and petroleum consumption. This year, several auto manufacturers are commercially introducing electric vehicles.

- PHEVs, EVs, and fuel cell vehicles having acceptable performance for many applications are a reality, and vehicles deriving their fuel from the electric grid are likely to become a cost-effective means of achieving carbon-free mobility.
- Through the mid-term (2025) New York's transmission grid has adequate capacity to accommodate the maximum (30 percent) anticipated penetration of EV and PHEVs with smart charging. Minor upgrades in the distribution system could be needed on a very localized basis.
- Policy and regulations should encourage the development of a variety of business models for charging/re-fueling, and policies should encourage off-peak charging to maximize benefits. In the near term, incentives will likely be necessary to induce EV adoption.

The full report of the Electric Vehicle Subgroup is found in Appendix G of this Interim Report.

11.0 National and Regional Action and Coordination

To successfully reduce the impacts a changing climate will have on New York's people, environment, and economy will require coordinated policy and action by all levels of government—federal, state, and local. Given the global nature of the climate change challenge, U.S. federal government action will be essential to successfully position the American economy in an evolving international marketplace and to enable the United States to lead efforts to achieve a global solution. Federal action will create a fertile arena for development of the new technologies that will be needed to achieve the scale of emission reductions needed, and it will enable New York businesses to compete on a level playing field with businesses in other states and nations.

New York's domestic energy, environment, and economic development interests can be successfully augmented through participation in regional efforts that achieve more change, in a more equitable manner, than New York acting alone. National and regional programs can result in greater reductions at a lower marginal cost than programs implemented by a single state, and State actions also are most effective when coordinated with local government activities.

Finally, climate change is, at its core, a global issue that will require the dedicated action and attention by all governments, industries, and citizens. New York already is working and should continue to work with other states, subnational entities, and other nations to achieve an international solution to climate change.

This chapter makes the following specific recommendations and observations:

- New York should seek implementation of national or regional market mechanisms to price carbon and reduce emissions. A national program can be implemented through Congressional action or a collaborative effort between states and EPA under the Clean Air Act.
- Leveraging the opportunities available under federal programs such as production and investment tax credits and a national renewable electricity standard can help create a robust market demand for clean energy.
- National electricity transmission policy should facilitate achievement of New York's climate goals rather than providing an avenue for importing coal-fired power.
- New York should take advantage of the federal government's advanced energy technology investment policy. Developing new clean energy technologies requires a substantial and sustained commitment from the federal government.
- Federal investment in, and support for, nuclear technology and carbon capture and sequestration will help New York achieve its climate protection goals, while preserving system reliability. Given the financial commitment needed to advance the technology in these areas, the federal government is best positioned to make the necessary investments.
- Regional and national transportation initiatives will be essential to achieving New York's climate goals, including strong national vehicle emission and fuel economy standards and regional low-carbon fuel standards, regional transportation pricing strategies, and regional rail initiatives.
- New York should advocate for strict national standards for appliances and other products that are sources of greenhouse gas emissions.
- Federal agencies should cooperate to create and implement regulatory frameworks that foster energy efficiency and distributed renewable energy. For example, the federal government should facilitate Property Assessed Clean Energy (PACE) financing.
- National education policy to foster innovation and technology is important to achieving New York's climate protection goals.

Climate change is a global issue that will require dedicated action and attention by all governments, industries and citizens.

- The federal government should target infrastructure investments that advance climate change objectives, such as high-speed rail and a more intelligent electricity grid.
- Federal and state policy should engage localities and communities as active participants in achieving climate goals.

- New York should support efforts to achieve an international solution to climate change. New York can play a critical role in providing an example of the policies that can be implemented worldwide to mitigate climate change.

Achieving a comprehensive solution to global climate change requires New York to collaborate with regional partners and the federal government on emission reduction strategies, and to seek action across the community of nations. Although comprehensive federal legislation is preferable, until such legislation is in place, the federal government should seek to target its broad suite of policies and programs toward promoting low-carbon technology and behavior.

12.0 Next Steps

With this Interim Report, the Climate Action Council is seeking stakeholder and public response to the initial climate action planning work, including input on the mitigation and adaptation policy options. During 2011, work will continue to complete the required analyses of the policy options, which will inform a final Climate Action Plan.

New York State will then need to develop more specific near-term implementation strategies to effectuate policy and practice. The State will need to establish clear targets and evaluate progress toward those targets. A mechanism to update this long-term plan on a regular basis will be needed, as the technology, the state-of-science, and the broader public policy environment will continue to change.

Further, given the strong linkages between GHG emissions and energy policy, strategies to reduce GHG emissions will also need to be considered further in the development of New York's State Energy Plan as well as in other planning processes, such as state implementation plans for various co-pollutants.

The recently enacted Article 6 of the Energy Law requires the State Energy Plan to include an inventory of greenhouse gas emissions, and strategies for facilitating and accelerating the use of low-carbon energy sources and carbon mitigation measures. Thus, the State Energy Plan will become a mechanism to deliberate and advance appropriate energy policy that fully accounts for the climate change impacts from New York energy production and use.