# Chapter 6
# Residential, Commercial/Institutional, and Industrial Mitigation

## Sector Vision for a Low-Carbon Future

In 2050, New Yorkers will enjoy safe, comfortable, well-functioning and sustainable buildings and communities whose construction and renovation activities, building operations, and Industrial Process Incentives 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. More specifically, buildings in New York will have the following characteristics:

**Building design and renovation:** Building design and renovation along with integrated site planning will optimize resource conservation opportunities from envelope, mechanical, lighting, site/landscaping, and other building systems. Building and site designs will emphasize passive solar energy, solar thermal systems, and onsite or local renewable electricity generation. Performance-based building codes will continue to save consumers substantial energy costs while avoiding unnecessary power generation and greenhouse gas (GHG) emissions. Design, renovation, and enforcement activities will be supported by a well-trained workforce.

**Building operation:** Supported by marketing, outreach, and education efforts, building owners, designers, operators, and users will implement building operations, upgrades, and Industrial Process Incentives that achieve high levels of energy efficiency, while improving occupant comfort and indoor air quality. Building upon RD&D efforts, equipment that meet advanced efficiency standards will minimize the energy demand of buildings and industrial processes.

**Building energy supply:** Instead of relying on combustion of fossil fuels for comfort control and daily operations, buildings will primarily use customer-sited renewable energy resources and import low-carbon resources as needed. Sources of waste heat, especially industrial process heat, will be used to the maximum extent possible; supplementary heating and cooling draws on carbon-neutral energy sources, such as wind, solar photovoltaic, or geothermal.

**Land use planning and community development:** Building developers and communities maximize location efficiency by integrating patterns of home, work, shopping, and entertainment, in accordance with Smart Growth principles and methods, maximize resource conservation, and minimize GHG emissions.

**Adaptation:** Through building codes and siting guidelines that place buildings and other facilities away from projected flood zones and favor designs and materials appropriate for future climate conditions, New York's communities will make themselves resilient to climate change.

# Overview of GHG Emissions

The RCI sector is the largest source of gross greenhouse gas (GHG) emissions in New York, accounting for about 40 percent of gross GHG emissions in 2008. The residential, commercial/institutional, and industrial (RCI) sector includes onsite fuel combustion, industrial process, and manufacturing emissions, as well as fugitive[1] methane emissions from natural gas transmission and distribution. Energy-related RCI emissions result principally from the onsite combustion of oil and natural gas, with a smaller contribution by onsite combustion of coal.[2] The onsite combustion of these fuels in the RCI sector accounted for an estimated 75 million metric tons of carbon dioxide equivalent (MMt$CO_2$e) gross GHG emissions in 2008. Industrial process emissions, primarily fluorinated gases and emissions from cement production, added another 9 percent of statewide emission in 2008. Fugitive emissions of methane from natural gas transmission and distribution contributed another 5.7 MMt$CO_2$e (2 percent of total emissions) in 2008.

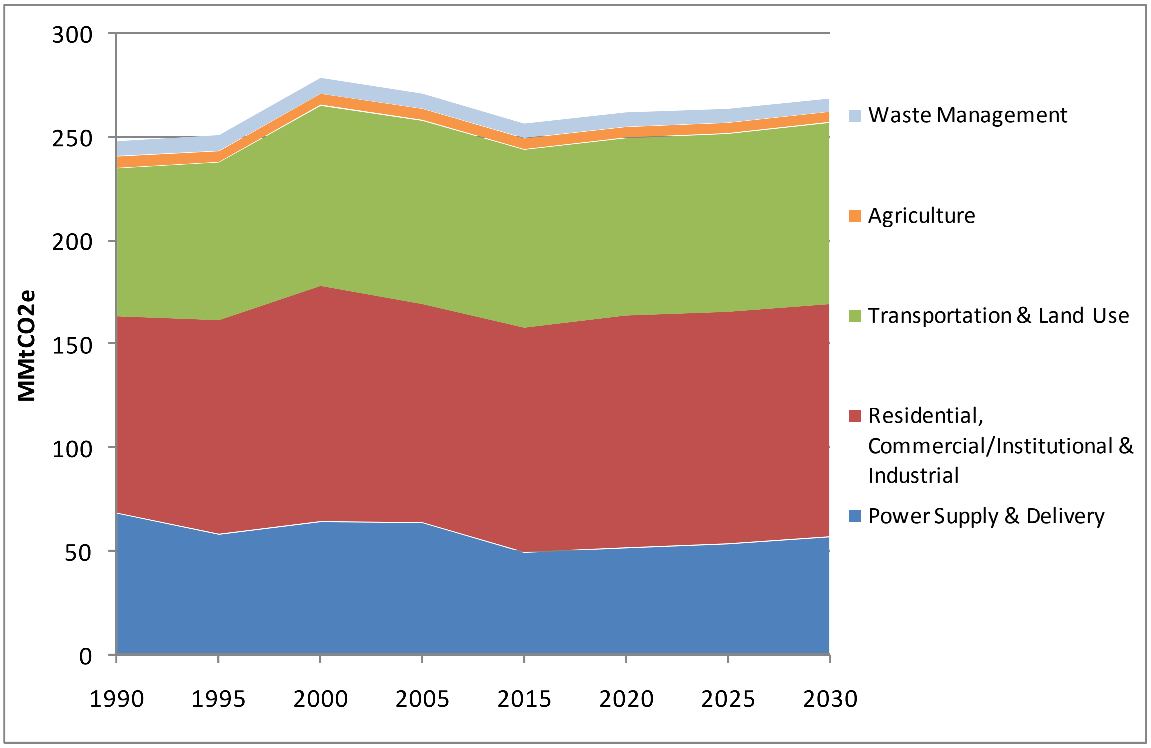
Considering only the onsite fuel combustion emissions that occur within buildings and industries, however, ignores the fact that nearly all electricity sold in the state is consumed as the result of RCI activities.[3] Emissions from the generation of electricity that RCI buildings consume contribute an additional 20 percent of emissions. Together with electricity generation, these sources of emissions that are all attributable to RCI sector activities are responsible for about 60 percent, or 151 MMt$CO_2$e, of total statewide GHG emissions in 2008. Figure 6-1 shows the relative contributions of the RCI, electricity, and industrial process sectors to New York State emissions from 1990 to 2030 under the reference scenario. New York's future GHG emissions will depend heavily on future developments in the consumption of electricity, industrial processes, and fuel use in these critical subsectors.

[1] The general definition of fugitive emissions given in the IPCC Guidelines is "an intentional or unintentional release of gases from anthropogenic activities excluding the combustion of fuels". http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_6_Fugitive_Emissions_from_Oil_and_Natural_Gas.pdf p.3

[2] The RCI inventory and forecast methodology accounts for only emissions from direct fuel and electricity usage. Thus, the GHG estimates presented here do not include GHG emissions associated with the extraction, processing, and transportation of RCI fuels, with the exception of natural gas leakage. Electricity sector emissions include GHG emissions from electricity imported from outside the state as well as from transmission and distribution losses.

[3] Emissions associated with the electricity sector (discussed in Chapter 8) have been allocated to each of the RCI subsectors for comparison of those emissions to the emissions associated with on-site fuel combustion. Note that this comparison is provided for informational purposes and that emissions are not double-counted in the total emissions for the state.

**Figure 6-1. Historical and Forecasted New York GHG Emissions by Sector, 1990–2030**




GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

## RCI Sector Greenhouse Gas Emissions by Fuel

Figure 6-2 shows historical and forecasted RCI GHG emissions by fuel and source.[4] Emissions from the four relevant RCI subsectors including RCI onsite fuel combustion, RCI electricity consumption, industrial processes, as well as fugitive methane emissions are expected to increase from 152 to 166 $MMtCO_2e$ between 2008 and 2030. Figure 6-2 also indicates that the vast majority of GHG emissions from the RCI sector come from electricity and natural gas (76 percent). RCI emissions associated with electricity use are expected to be largely unchanged between 2008 and 2030, at about 55 $MMtCO_2e$ under the reference scenario. However, as discussed below, the unchanged overall emissions from electricity generation mask large forecasted declines in emissions from the residential and industrial subsectors and an increase in the commercial/institutional subsector's GHG emissions. While GHG emissions from the onsite combustion of petroleum remain flat or slightly decline, emissions from the onsite combustion of coal are forecasted to increase moderately by 15 percent from 2008 to 2030. Coal is expected to remain an important source of fuel for the industrial sector throughout the period in the reference case forecast. Natural gas is also expected to remain an important industrial fuel during this time, with a forecasted increase of 13 percent in emissions from onsite combustion.

[4] See Chapter 3 for reference case forecasts.

## RCI Sector GHG Emissions and Trends

Figure 6-3 shows historical and forecasted GHG emissions by RCI subsector, including those associated with electricity consumption. Overall, Figure 6-3 shows that emissions from the RCI sector are forecasted to increase by 17 percent between 2008 and 2030 under the reference case scenario. Emissions associated within the RCI subsectors are forecasted to experience a wide variety of emissions growth and decline. Residential emissions are forecasted to decline by 6 percent between 2008 and 2030, while commercial/institutional and industrial sector emissions are expected to increase by 21 percent and 14 percent, respectively.

## RCI Subsector GHG Emissions and Trends

### Residential Subsector Emissions

Figure 6-4 shows that between 2008 and 2030, emissions for the residential subsector are expected to decrease by 6 percent to reach approximately 50 $MMtCO_2e$. The GHG emissions associated with the generation of electricity for this subsector are forecasted to decline by 17 percent from 2008 to 2030, while emissions associated with the onsite combustion of natural gas are forecasted to increase by 7 percent over this 22-year period. Figure 6-4 also shows that residential subsector emissions associated with the onsite combustion of petroleum are forecasted to decline by 14 percent from 2008 to 2030.

### Commercial/Institutional Subsector Emissions

Figure 6-5 shows commercial/institutional subsector emissions are expected to increase by 21 percent from 2008 to 2030 to nearly 67 $MMtCO_2e$. Figure 6-5 also indicates that the increase in emissions from the subsector is due primarily to emissions from electricity used by commercial/institutional consumers, which are forecasted to increase by 24 percent. Emissions from the onsite combustion of natural gas are also forecasted to increase by 24 percent from 2008 to 2030. Commercial/institutional subsector emissions associated with the onsite combustion of petroleum are also expected to increase by 9 percent during the period.

### Industrial Subsector Onsite Fuel Combustion and Process Emissions

Figure 6-6 indicates that industrial subsector emissions are expected to increase by 14 percent from 2008–2030 to almost 47 $MMtCO_2e$, although this aggregate forecast masks wide variation in emissions by fuel source. GHG emissions associated with the generation of electricity to meet industrial demand are forecasted to decrease by 84 percent from 2008 to 2030 due to less carbon-intensive electricity generation as well as decreased electricity demand from the subsector. However, emissions associated with the onsite combustion of coal, petroleum, natural gas, and wood are forecasted to increase by 17 percent, 8 percent, 1 percent, and 12 percent, respectively.

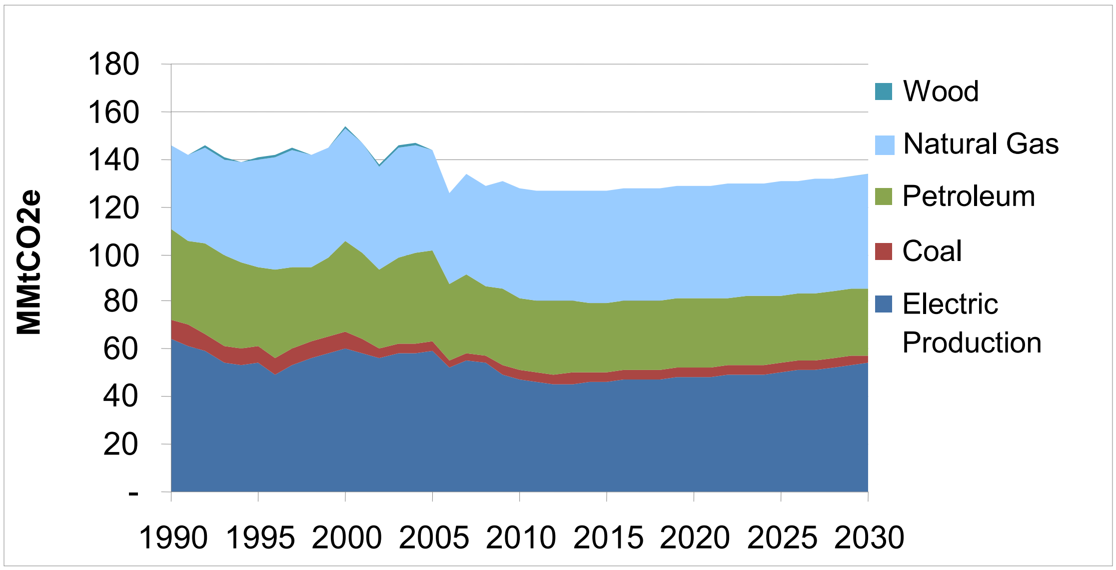
Figure 6-7 shows forecasted industrial process GHG emissions in New York State, which are dominated by emissions from cement production and substitutes for ozone-depleting substances.[5] Emissions from this source are expected to grow in line with national forecasts at

[5] New York emissions from substitutes for ozone-depleting substances (ODS) for 2010, 2015, and 2020 were scaled from EPA's estimates of total US emissions based on state and national population projections. New York's emissions for the missing years from 2008 through 2020 were estimated using linear interpolation. From 2021 through 2030, New York emissions were estimated by applying the New York projected population growth rate to the 2020 New York ODS emissions value.

over 5 percent a year, which equates to emissions more than doubling of GHG emissions between 2008 and 2030 from 7.5 to 16.4 $MMtCO_2e$.

Finally, Figure 6-8 shows methane emissions from the transmission and distribution of natural gas in New York State. The New York estimate is extrapolated from forecasted national fugitive methane emissions. The forecast shows an increase in methane emissions of 10 percent from 2008 to 2030 to approximately 6.2 $MMtCO_2e$.

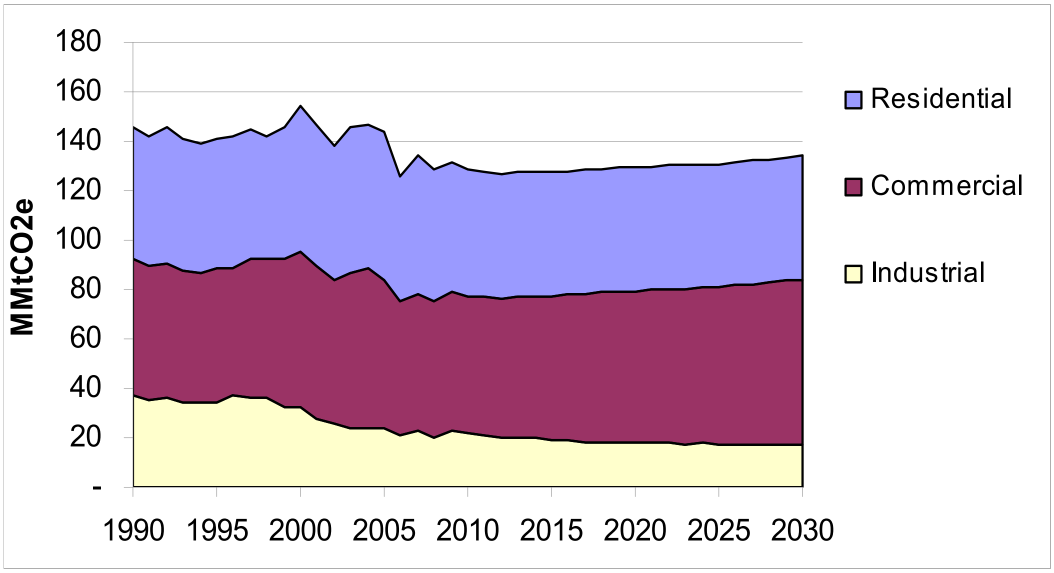
**Figure 6-2. Historical and Forecasted Residential, Commercial/Institutional, and Industrial (RCI) GHG Emissions by Type of Fuel, 1990–2030**




* Figure 6-2 does not include fugitive methane and industrial process emissions. GHG = greenhouse gas; MMtCO2e = million metric tons of carbon dioxide equivalent.

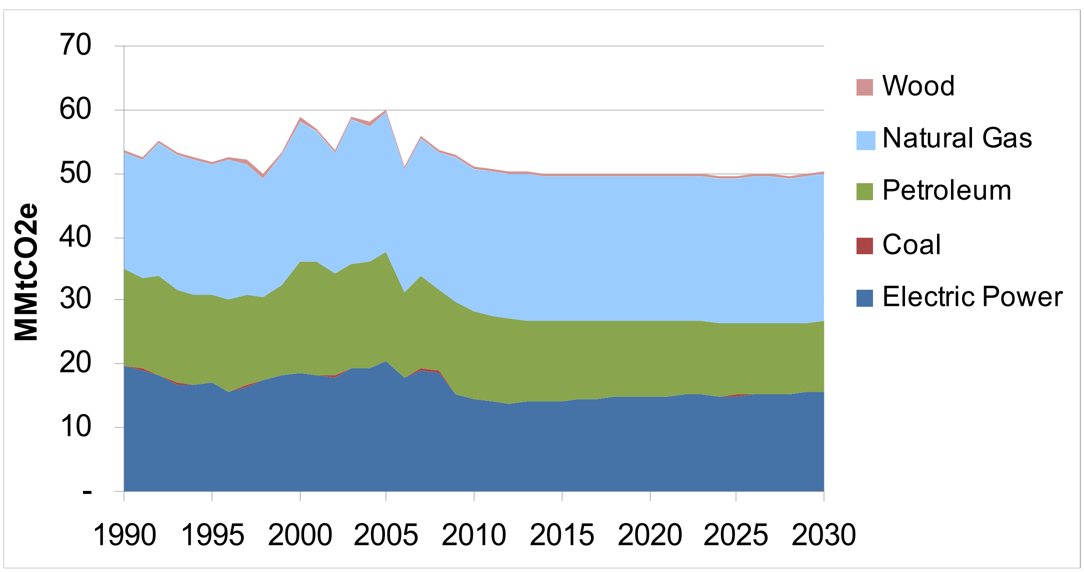
Substitutes for ozone-depleting substances, which include chlorofluorocarbons, halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HFCs), are used in a variety of industrial applications including refrigeration and air conditioning equipment, aerosols, solvent cleaning, fire extinguishing, foam blowing, and sterilization. Although their substitutes, HFCs, are not harmful to the stratospheric ozone layer, they are powerful GHGs. (EPA's *Draft User's Guide for Estimating Carbon Dioxide, Nitrous Oxide, HFC, PFC and* $SF_6$ *Emissions from Industrial Processes Using the State Inventory Tool*, February 2010)

**Figure 6-3. Historical and Forecasted Residential, Commercial/Institutional, and Industrial (RCI) Greenhouse Gas Emissions by Subsector, 1990–2030**



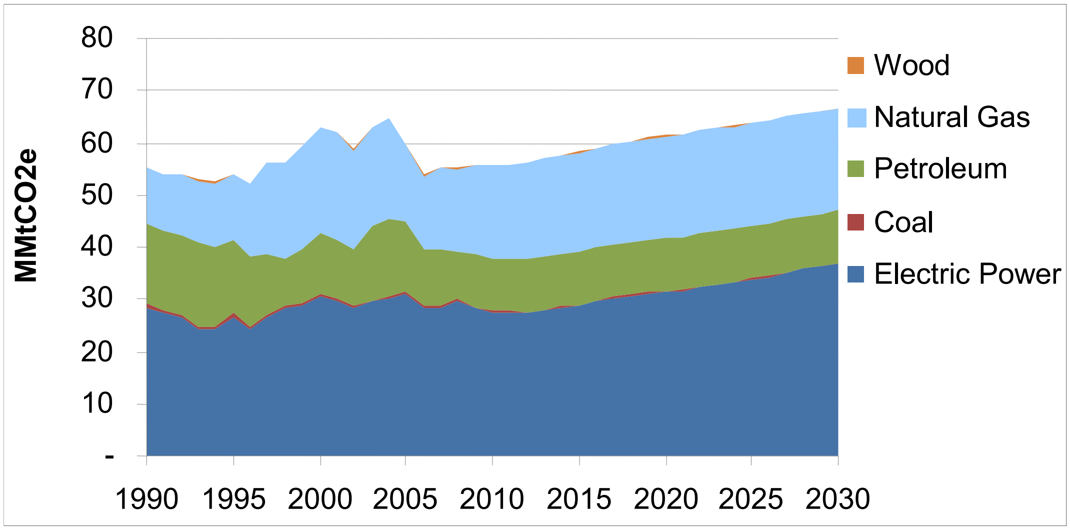

Emissions associated with the direct use of natural gas, petroleum, coal, and wood and the consumption of electricity. Figure 6-3 does not include fugitive methane and industrial process emissions. GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

**Figure 6-4. Historical and Forecasted Residential GHG Emissions by Fuel Type, 1990–2030**



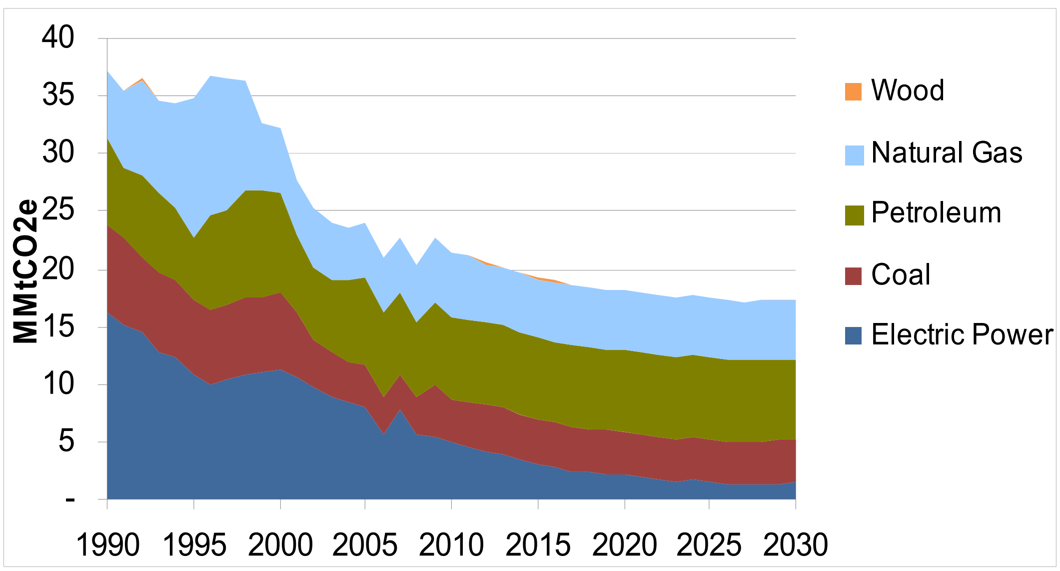

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

**Figure 6-5. Historical and Forecasted Commercial/Institutional GHG Emissions by Fuel Type, 1990–2030**



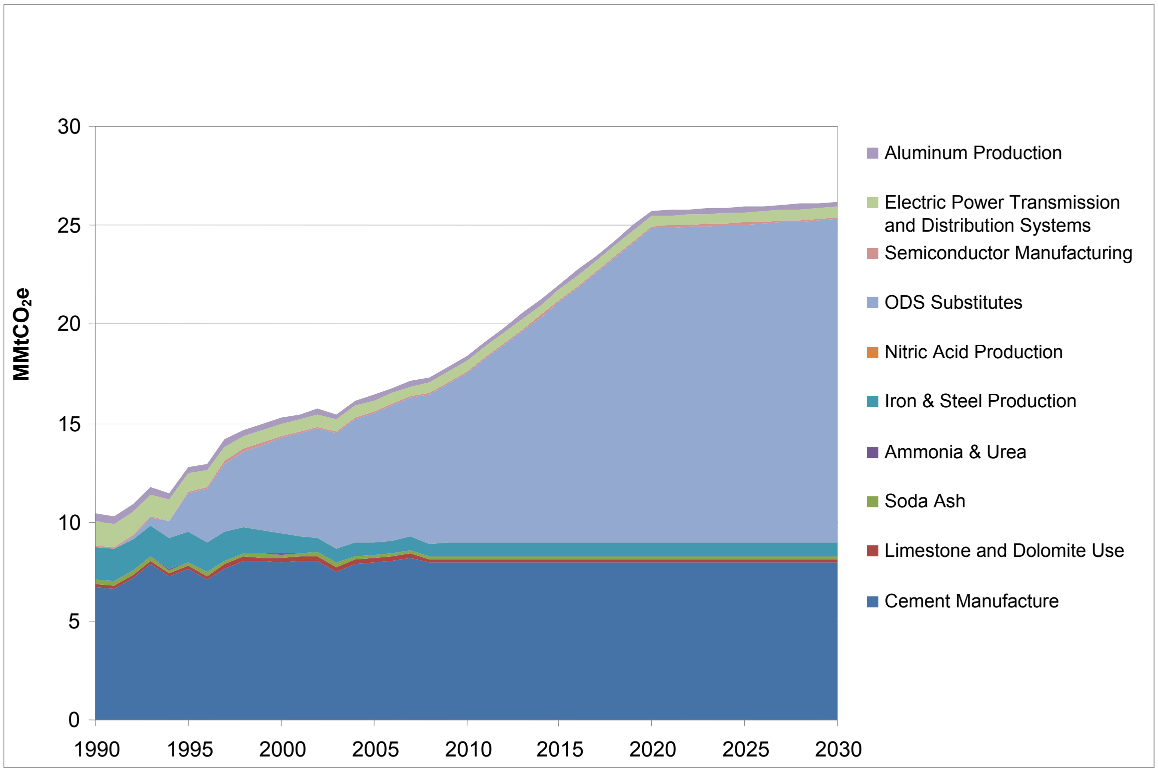

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

**Figure 6-6. Historical and Forecasted Industrial Subsector GHG Emissions by Fuel Type, 1990–2030**



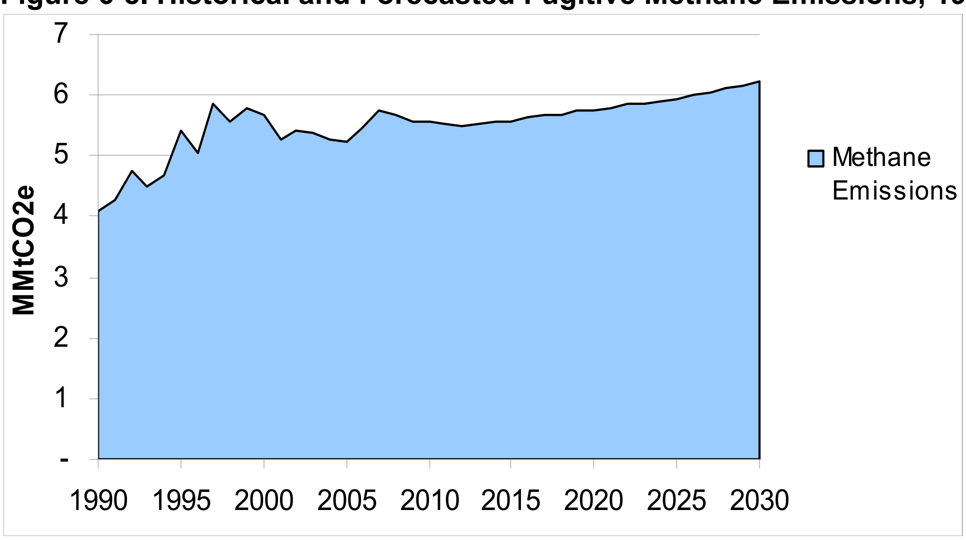

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

**Figure 6-7. Historical and Forecasted Industrial Process GHG Emissions by Source, 1990 –2030**




GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent; ODS = substitutes for ozone-depleting substances.

**Figure 6-8. Historical and Forecasted Fugitive Methane Emissions, 1990–2030**




$MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

## Overview of Policy Options and Estimated Impacts

To achieve mid-century GHG reduction goals in its building stock, New York must implement an integrated, diverse set of policy options. Over the next 40 years, Residential, Commercial/Institutional, and Industrial buildings and processes will need to maximize energy and resource efficiency, minimize fossil fuel inputs, and provide remaining required energy inputs from local low-carbon sources and carbon-neutral imports.

New York has already put policies in place to begin this needed transformation. The 45 by 15 clean energy policy challenges the state to meet 45 percent of its electricity needs by 2015 through increased energy efficiency and renewable energy. The 45 by 15 policy proposes to reduce electricity end-use in 2015 by 15 percent below forecasted levels, while simultaneously meeting 30 percent of the state's electricity supply needs through renewable resources.

Building upon 45 by 15 policies, which focus on increased near-term statewide energy efficiency and renewable energy use, the RCI Technical Work Group has recommended a number of policies to further reduce the GHGs emitted by New York's existing homes, businesses, industries, and new construction. These policies can be organized into three categories: statutory and regulatory policies that reduce carbon emissions in new and existing buildings, voluntary incentive policies that promote energy efficiency and renewable energy improvements in buildings and industrial processes, and supporting policies.

At the core of the RCI policies, the Technical Work Group recommends that the State enact two statutory and regulatory policies: Building Codes, Appliance Standards, and Enforcement (RCI-7) and Building Commissioning, Benchmarking, and Upgrades (RCI-8). RCI-7 encourages New York to aggressively update and enforce the State Energy Code in the near-term, which will lead to long-term emission reductions in code-compliant new and renovated existing buildings. Providing municipalities with the choice of adopting a State-set stretch code, as recommended in the 2009 State Energy Plan, and establishing a flexible code compliance framework will further reduce GHG emissions at the local level. RCI-8 focuses on reducing existing buildings' operating costs and achieving energy savings through regular energy benchmarking, audits and commissioning activities and installing cost-effective energy efficiency measures. Together, these policies will ensure that an increasing percentage of New York's building stock will have significantly lowered GHG emissions and operating costs by 2050.

To encourage additional GHG emission reductions beyond those generated by the mandated policy options, the Technical Work Group recommends three additional voluntary policies to provide incentives for owners of existing buildings to undertake renovations that bring buildings above current code compliance and accelerate the rate of building renovation necessary to achieve the 80 by 50 goals. Energy Efficiency Incentives (RCI-2) uses a whole-building, integrated analysis approach to identify high-performance efficiency measures that could be installed in existing and new buildings. Onsite use of renewable energy would be incentivized through Customer-Sited Renewable Energy Incentives (RCI-3). Improving the state's industrial competitiveness, Industrial Process Incentives (RCI-11) enhances industrial activity and reduces carbon intensity through more efficient, productive and cost-effective operations. Given that most existing buildings will not be subject to code-mandated improvements, encouraging owners to voluntarily implement upgrades is vital to meeting New York's GHG emission reduction goals.

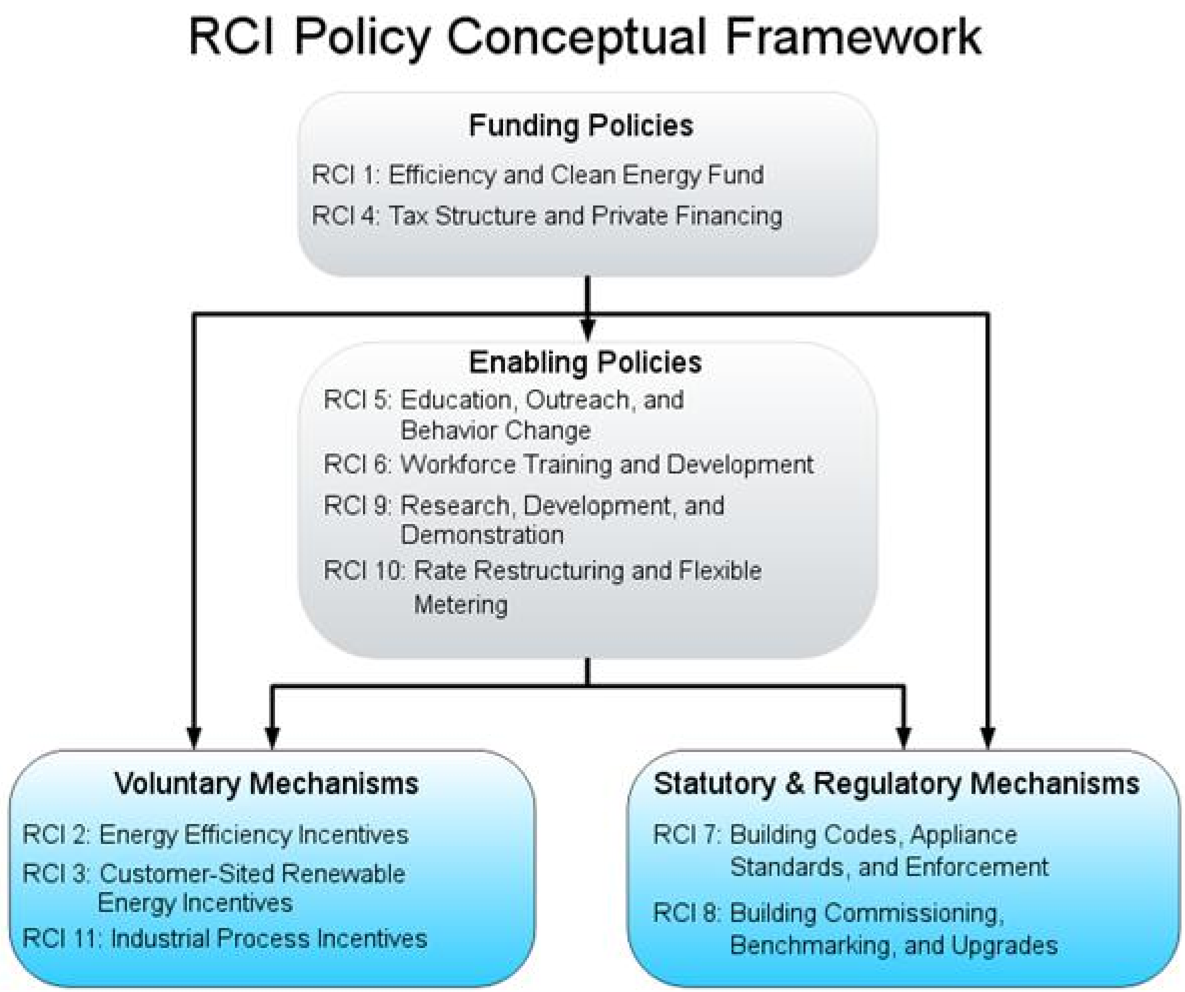
Six additional supporting policies are critical to the successful implementation of the RCI statutory and voluntary policies. Investment and deployment of a trained workforce is a core component of the clean energy economy and will significantly contribute toward achieving the State's climate policy objectives. Workforce Training and Development (RCI-6) recognizes the need for effective development of a skilled workforce equipped with the knowledge, skills, and ability to directly meet the energy service demands of RCI-2, 3, 7, 8 and 11. New technologies, along with a well-trained workforce to support the design, installation and maintenance of those technologies, are integral to successful reduction of GHG emissions in New York. Research, Development, and Demonstration (RCI-9) recommends continued investment—coordinated activity by federal, State and private-sector entities—in the research, development, demonstration, and deployment (RDD&D) of next-generation technologies that will help the State achieve its 80 by 50 goal. These initiatives would accelerate the development and commercialization of new products and technologies that will enhance the State's ability to achieve the 80 by 50 goal at lower cost, while also stimulating a clean energy economy.

Achievement of the State's climate action goals is dependent upon action by consumers to invest in energy efficiency and renewable energy equipment and infrastructure. Building upon the State's progress in this area, Education, Outreach, and Behavior Change (RCI-5) will increase consumer and State employee awareness of the benefits of clean energy, motivating immediate, and long-term action. Rate Restructuring and Flexible Metering (RCI-10) also recognizes the importance of providing real-time energy price signals to electricity customers and increasing the penetration of smart metering. Together, these policies enhance the energy savings information provided to consumers and State employees at the time of purchase or use. This would facilitate informed decisions that may have a long-term effect on energy consumption and bills, and provide a powerful incentive for retailers and manufacturers to provide products that satisfy consumer energy efficiency expectations. RCI-10 further explores electric rate structures that foster energy efficiency and renewable energy activities in RCI-2, 3, and 11, and encourage plug-in electric vehicle use, while promoting rate equity for vulnerable populations. Redesigning electric rates to vary by time of use for all electricity users and providing cost/use information to users on a "real-time" basis would enable customers to make informed decisions about when and how they can reduce their electricity use.

Last, Efficiency and Clean Energy Fund (RCI-1) and Tax Structure and Private Financing (RCI-4) work in unison to leverage public funding and private financing to fund the clean energy activities in RCI-2, 3, 5, 6, 7, 8, 9, and 11. Funds for incentives would be provided by RCI-1 and other sources, such as federal and foundation grants and private co-funding. RCI-4 recommends that the State undertake a comprehensive review of the current tax structure and financing programs and their impact on current and future carbon reduction activities and identify policy options for future shifts to support carbon reduction activities. RCI-1 and 4 recognize that dedicated and continuous funding is essential for the overall success of the RCI statutory, voluntary and supporting policy options and the attainment of long-term carbon reduction goals.

All of the RCI policy options have important co-benefits in terms of reduction of energy demand and the corresponding energy savings, bill reductions, improved occupant comfort, job creation, and clean air.

**Figure 6-9. Residential, Commercial/Institutional, and Industrial Policy Options**



## Policy Scenario Quantification Summary Table

| Policy No. | Policy Option | GHG Reductions ($MMtCO_2e$) | | | Net Present Value: Cost/Savings (Million 2005$) | Net Cost/Savings per Avoided Emissions ($\$/tCO_2e$) |
|---|---|---|---|---|---|---|
| | | 2020 | 2030 | Total 2011–2030 | | |
| RCI-2 | Energy Efficiency Incentives | 3.0 | 17 | 120 | –$29 | –$0.3 |
| | Combined Heat and Power (CHP) Incentives | 0.2 | 1.1 | 7.1 | $14 | $2.0 |
| RCI-3 | Solar Electric Incentives | 0.7 | 3.3 | 22 | $4,400 | $200 |
| | Solar Thermal Incentives | 0.5 | 2.8 | 21 | $2,600 | $130 |
| | Bioenergy Incentives | 5.1 | 5.1 | 84 | –$5,100 | –$61 |
| RCI-7 | Enhanced Building Codes, Appliance Standards, and Enforcement | 1.4 | 6.3 | 43 | –$1,200 | –$27 |
| RCI-8 | Building Commissioning, Benchmarking, and Upgrades | 2.3 | 3.3 | 34 | –$790 | –$23 |
| RCI-11 | Industrial Process Incentives | 1.2 | 2.6 | 26 | –$2,500 | –$95 |

$\$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

The numbering used to denote the above policy recommendations is for reference purposes only; it does not reflect prioritization among these important policy recommendations. The policy numbers that appear in this table are not consecutive because they reflect only those policies for which quantification has been completed and not all policies are amenable to quantification.

**Table 6-1. Summary of Electric and Fuel Savings**

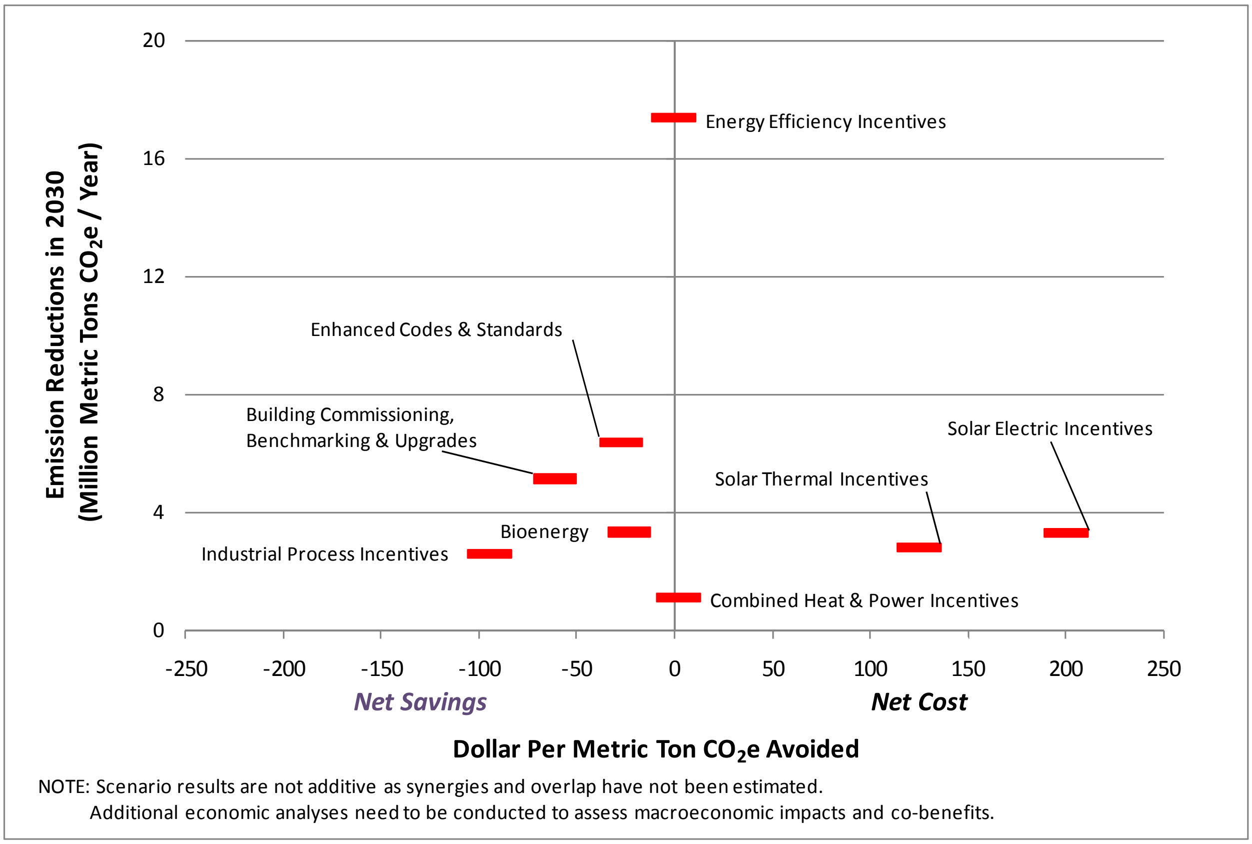
| Policy No. | Policy Option | Annual Electric Energy (GWh) | | Annual Natural Gas (BCF) | | Annual Petroleum Products (Million GGE) | | Annual Other Fuels (BBtu) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| RCI-2 | Energy Efficiency Incentives | 5,300 | 32,000 | 22 | 130 | 58 | 360 | 2,700 | 8,900 |
| RCI-3 | Customer-Sited Renewable Energy Incentives (Scenario #2) | 2,300 | 11,000 | 60 | 83 | 230 | 340 | 0 | 0 |
| RCI-7 | Enhanced Building Codes, Appliance Standards, and Enforcement | 2,000 | 9,500 | 11 | 51 | 36 | 160 | 1,100 | 5,100 |
| RCI-8 | Building Commissioning, Benchmarking, and Upgrades | 3,200 | 4,900 | 16 | 23 | 50 | 68 | 630 | 860 |

| Policy No. | Policy Option | Annual Electric Energy (GWh) | | Annual Natural Gas (BCF) | | Annual Petroleum Products (Million GGE) | | Annual Other Fuels (BBtu) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| RCI-11 | Industrial Process Incentives | 230 | 460 | 7 | 14 | 54 | 120 | 3,900 | 8,700 |

BBtu = billion British thermal units; GWh = gigawatt-hour; BCF = billion cubic feet; GGE = gallons of gasoline equivalent.

Totals may not sum exactly due to rounding. “Other Fuels” estimates do not include increased use of bioenergy feedstock.

**Figure 6-10. Estimate of Cost and GHG Emissions Reductions for RCI Policy Options**




## BUILDING CODES, APPLIANCE STANDARDS AND ENFORCEMENT (RCI-7)

### Policy Summary

New York should aggressively update and consistently enforce the State Energy Conservation Construction Code (SECCC or State Energy Code), and provisions of the Uniform Fire Prevention and Building Code (such as water conservation) that have an energy impact. In addition to the State-mandated base code (SECCC), local municipalities should be given the choice to adopt a State-set stretch code,[6] as recommended in the 2009 State Energy Plan.

The prescriptive SECCC should increasingly become performance-based and include sustainable and whole building design provisions through the adoption of International Energy Conservation Code (IECC), the International Green Construction Code, and the National Green Building Standard (International Code Council [ICC] 700).[7]

To facilitate code compliance, the State should establish a flexible framework by 2015 that allows municipalities, which often lack the necessary resources or expertise, to enforce codes through inter-municipal and county-level agreement or through the services of privately operated, accredited or licensed third-party oversight entities. Third-party certification, training, and project-certification fees could help fund code compliance activities.

Currently, the State Energy Code applies to building renovations that involve replacement of 50 percent or more of a building subsystem ("Fifty Percent Rule"), and the ability to amend the State Energy Code is contingent on obtaining a study to confirm that the cost of compliance with the amended code will be paid back through energy savings in ten years or less ("Ten Year Payback"). Abolishing the Fifty Percent Rule and Ten Year Payback legislative mandates would help the State achieve American Recovery and Reinvestment Act (ARRA)-required rates of code compliance, ensure that each renovation activity that triggers a building permit also triggers an appropriate level of compliance, and enable the timely adoption of new energy conservation measures.

As specified under Article 16 of the Energy Law, the State should also continue to establish and update energy efficiency performance standards for appliances and products that are not federally preempted. For those appliances and products with federal preemption, the State should lobby the federal government to increase those performance standards.

This policy option should be re-evaluated and adjusted in 2020 and 2030 to take into account the future evolution of codes and appliance standards as well as economic development opportunities.

## Quantification

The policy scenario quantified by the Technical Work Group includes the following:

**Transition to performance-based codes**: The State should work with model code development organizations, like the ICC, to develop a performance-based international model energy code by 2021, which New York could adopt by 2023.

[6] Article 11 of the Energy Law allows municipalities to adopt and enforce a local energy conservation construction code more stringent than the Energy Code. Such programs are referred to as stretch codes.

[7] Performance-based codes provide architects and engineers with the flexibility to meet requirements while attaining higher efficiency.

**New and existing buildings:** The base and stretch codes are a specified percentage more efficient than current code, defined as the IECC 2009 with State Code Council approved modifications:

**Table 6-2. Base and Stretch Codes for New and Existing Buildings**

| Year | Base Code | Stretch Code |
|---|---|---|
| 2020 | 50% | 60% |
| 2030 | 60% | 70% |
| 2050 | 70% | 80% |

Given the available information on future code update trends, New York's base code scenario appears to lead or be on par with federal and other states' code efforts, e.g., Florida and Massachusetts, with the exception of California's goal for net-zero energy buildings by 2030. However, New York's proposed stretch code scenario represents a smaller increase between stretch and base code, compared to states that utilize stretch codes, like Massachusetts.

Existing buildings would be subject to energy efficiency upgrades, and the corresponding code compliance requirements, through the following:

- Building Commissioning, Benchmarking, and Upgrades (RCI-8) mandated benchmarking requirements, which may be triggered at the time of sale of a building or in conjunction with periodic energy audits
- Voluntary building renovation or alterations, which may be triggered when a building owner applies for a building permit

**Code updates and compliance**: The State would accelerate updating its codes to every three years. This would be coordinated with the latest edition of international codes, so that the SECCC and Uniform Fire Prevention and Building Code would be updated within 18 months of international code publication. Further, code compliance is assumed at 90 percent in 2017, as required by the ARRA, increasing to 95 percent in 2030.

**Appliance standards**: The State should review the energy efficiency performance standards for products that are not federally preempted every five years and update them as needed.

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by dollars per metric ton of carbon dioxide equivalent [\$/t $CO_2$e]) for the policy scenario, which did not include Appliance Standards, are presented below.

| GHG Reductions (MMt$CO_2$e) | | Net Present Value: Savings (Million \$) | Savings per Avoided Emissions (\$/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 6.3 | 43 | –\$1,200 | –\$27 |

\$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

### Special Considerations

- The State Energy Code should accommodate all building types and apply energy efficiency performance thresholds that are appropriate to an aggregated building classification framework, e.g., residential, commercial, institutional, versus industrial buildings, and new versus existing buildings. The State should also explore requiring government owned and operated buildings to meet this policy's scenario.

- To avoid discouraging building renovations, the State should consider establishing a regulatory "ability to pay" relief mechanism that adjusts the required level of "incremental" retrofit when owners of existing buildings and affordable housing have demonstrated that they would suffer extreme financial hardship through satisfaction of the required retrofit work.

- Building codes and siting guidelines should include adaptation considerations, such as placing buildings and other facilities away from projected flood zones and favoring designs and materials appropriate for future climate conditions, to help make New York's communities resilient to climate change.

- Workforce Training and Development (RCI-6) will be critical to the successful implementation of this policy. The continued development and demonstration of efficient and renewable energy technologies, as outlined in Research, Development, and Demonstration (RCI-9), will work to help building owners reduce costs to achieve code compliance and maximize co-benefits such as reductions in harmful air pollutants.

- This policy option could have a direct positive effect on jobs through the required code compliance activities and training. In addition, the flexible code compliance framework facilitates municipal compliance activities while reducing home rule concerns. Lastly, under the flexible code compliance framework, third-party certification, training, and project-certification fees should be considered as a potential revenue source for New York State.

## BUILDING COMMISSIONING,[8] BENCHMARKING,[9] and UPGRADES (RCI-8)

### Policy Summary

The State could mandate, through legislation, that all private buildings greater than 50,000 square feet or public buildings greater than 10,000 square feet publicly report their annual energy

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[8] Commissioning is the systematic process of verifying that newly installed building systems perform interactively according to design intent, that they meet the operational needs of the owners and occupants, and that staff responsible for operation and maintenance are sufficiently trained. Retro-commissioning is defined as the same activities as commissioning, but applied to existing building systems.

[9] Benchmarking, which entails the public issuance of a building's energy consumption, indexed against buildings of comparable size and use, would provide information regarding a building's energy use to building owners and managers, prospective tenants and prospective purchasers, thereby increasing the incentive for building owners and managers to reduce energy consumption.

and water benchmarking scores using the ENERGY STAR internet-based benchmarking tool (Portfolio Manager). For the aforementioned-sized "covered" existing buildings, this policy recommends the following:

- Performing an energy audit every ten years by an energy auditor;
- Retro-commissioning and installing all energy efficiency measures identified in the energy audit that have less than a seven-year payback, within five years of completing the energy audit;
- Commissioning of new buildings of the aforementioned size during the design and construction process by a certified commissioning agent.

The State could also mandate, through legislation, the following:

- Every new one- to four-family home should receive a Home Energy Rating System (HERS) rating or an equivalent energy efficiency scoring methodology from a qualified rater. Each new home should obtain a legislatively-established rating to indicate that it meets minimum energy efficiency standards.
- Every existing one- to four-family home sold in the State should receive a HERS rating from a qualified rater and that the rating should be disclosed to all prospective buyers.

## Quantification

The policy scenario quantified by the Technical Work Group includes the following:

- By 2020, 50 percent of all one- to four-family homes sold in the State will receive a HERS rating, increasing to 100 percent by 2030.
- By 2020, 100 percent of covered private buildings and 50 percent of covered public buildings will routinely file benchmarking reports, increasing to 100 percent of covered buildings by 2030.
- By 2020, 50 percent of covered private buildings and 25 percent of covered public buildings will have completed commissioning or retro-commissioning, energy auditing and installation of cost-effective retrofits resulting in an average of 20 percent reduction in total energy use for participating buildings, increasing to 75 percent of covered private buildings and 50 percent of covered public buildings by 2030.

The policy scenario does not include the costs and benefits of the HERS rating on one- to four-family homes.

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by \$/t $CO_2e$) for the policy scenario are presented below.

| GHG Reductions ($MMtCO_2e$) | | Net Present Value: Savings (Million $) | Savings per Avoided Emissions ($/tCO_2e$) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 3.3 | 34 | –$790 | –$23 |

$/tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

## Special Considerations

- There is uncertainty about whether the predicted energy, carbon, and cost savings of this policy will be achieved. Incorporating rigorous evaluation, monitoring, and verification into the policy design from the start would directly address this concern.
- A further uncertainty is the impact of the affected building owners. The policy creates the potential to significantly improve the energy efficiency of buildings occupied by businesses in New York, reduce their operating costs, improve health and safety of work environments, and increase property values. However, the new policy requirements could require capital commitments from building owners, and owners may have concerns with their energy usage information being made public. Coordinated with Education, Outreach, and Behavior Change (RCI-5), effective outreach to educate building owners on the programs and their benefits will be needed to effectively implement this program. Access to funding for studies and capital for the installation of energy efficiency measures are issues that should be coordinated with policies, such as Energy Efficiency Incentives (RCI-2) and Tax Structure and Private Financing (RCI-4).
- The State should consider establishing limited exceptions to the benchmarking requirements for specific building types not currently in Portfolio Manager or if business-sensitive information would be publicly disclosed.
- This policy option could have a direct positive impact on jobs through the required benchmarking and commissioning activities, energy audits, and installation of energy efficiency measures.

# ENERGY EFFICIENCY INCENTIVES (RCI-2)

## Policy Summary

This policy option would provide energy efficiency incentives that address building stock in New York, including existing homes, businesses, and industry, as well as all new construction. The policy and its scenario are both constrained and informed by the current economic potential[10] of energy efficiency. That potential will be re-evaluated every three years with a

[10] Technical potential for efficiency and renewable energy represents the theoretical outer bounds of the resources physically available for exploitation, without any regard for cost or market acceptability. Economic potential for

concomitant re-setting of efficiency scenario and re-examination of energy efficiency program offerings to achieve them.

The role of this policy is to provide incentives for owners of existing buildings to undertake renovations that bring buildings above current code compliance such that the rate of building renovation is accelerated above the norm, and for owners of existing buildings that meet the current State Energy Code to install efficiency measures that provide additional energy savings up to the economic potential. The presumption under this policy is that Building Codes, Appliance Standards, and Enforcement (RCI-7) aggressively ramps up code requirements so that new construction energy savings would be captured under RCI-7's quantified savings.

A whole-building, integrated analysis approach will be used to identify efficiency measures that could be installed in existing buildings to achieve the economic potential, including building envelope, lighting, HVAC (heating, ventilating and air conditioning), insulation, monitoring or control systems, plug-load, and CHP (combined heat and power). Onsite renewables providing a portion of the buildings' electricity load, industrial process efficiency and building commissioning would be incentivized through other RCI policy actions. R&D incentives would accelerate the development and commercialization of new, lower cost, higher performance products and technologies. Supporting policies include Education, Outreach, and Behavior Change (RCI-5), Workforce Training and Development (RCI-6), and Rate Restructuring and Flexible Metering (RCI-10).

The policy incentive structure is in the form of loans and direct payments to buy down the cost of installed efficiency measures. Funds for the incentives will be provided by Efficiency and Clean Energy Fund (RCI-1) and other sources, such as federal and foundation grants, and corporate contributions. Participants in the incentive programs would provide co-funding for their projects.

### Quantification

The policy scenario quantified by the Technical Work Group includes full achievement of the economic potential for energy efficiency in New York's buildings. The following schedule of energy savings was assumed for this scenario; these reductions represent savings available after implementation of '15 by 15,' RCI-7 and RCI-8:

Electric efficiency savings: 5,300 gigawatt-hours (GWh) by 2020 and 32,000 GWh by 2030

Fuel efficiency savings: 32 trillion British thermal units (TBtu) by 2020 and 170 TBtu by 2030

The scenario also assumed that the policy would lead to additional Combined Heat and Power generation capable of producing 890 GWh/year in 2020 and 4,600 GWh/year in 2030.

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/tCO$_2$e) for the policy scenario are presented below.

efficiency and renewable energy is the amount of technical potential available at technology costs below the current projected costs of conventional energy that these resources would avoid.

### Energy Efficiency

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Savings (Million $) | Savings per Avoided Emissions ($/$tCO_2e$) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 17 | 120 | –$29 | –$0.3 |

$/$tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

### Combined Heat and Power

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Cost per Avoided Emissions ($/$tCO_2e$) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 1.1 | 7.1 | $14 | $2.0 |

$/$tCO_2e$ = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; $MMtCO_2e$ = million metric tons of carbon dioxide equivalent.

## Special Considerations

- The policy will define strategies to stimulate owners of existing buildings to make energy efficiency improvements that meet the current code at a minimum. Consistent with RCI-7, this action presumes new construction will meet code-mandated efficiency levels, but given voluntary code triggers for existing building stock, most existing buildings will not be subject to code-mandated improvements. In such an environment, building owners may be content to maintain the status quo unless significant energy savings and short-term paybacks from renovations are possible. In low-income, high-density communities, where problems with basic maintenance and upkeep of residential buildings are not uncommon, it will be even more challenging to ensure that building owners invest in code-mandated improvements. Targeted mechanisms for incentivizing action in these communities may be needed.

- The policy could consider a set of incentives for renovating existing buildings to exceed current code. The incentives for exceeding code are intended to help the State achieve a goal of obtaining all economic potential, which is the “gap” between the then current code (baseline) and the economic potential. Creative incentives are needed to reach the economic potential as some fraction of this potential is not achievable without them. This policy recognizes that as codes become increasingly aggressive, the difference between incentivized and code mandated efficiency levels will correspondingly shrink.

- Consistent with the “ability to pay” relief mechanism outlined in RCI-7, the State could explore establishing tandem scaled incentives for owners of existing buildings and affordable housing that face extreme financial hardship upgrading their buildings.

- As the State designs its incentive structure, it is encouraged to consider the savings to the end-user, the societal benefits of reduced GHG reductions as well as the co-benefits to New York, such as reduced energy demand, offsetting the need to site and build energy infrastructure, and reduced health care costs associated with improved air quality. This policy could have a direct positive co-benefit on jobs based on energy audits and increased installation and maintenance of energy efficiency measures. Properly installed energy efficiency measures, in accordance with a whole building approach, can also help building owners reduce their energy bills and increase occupant comfort.

## CUSTOMER-SITED RENEWABLE ENERGY INCENTIVES (RCI-3)

### Policy Summary

The use of renewable energy resources to meet energy service demands offers a number of benefits including the production of electricity without emissions of GHGs. As outlined in the 2009 State Energy Plan, New York State should continue to support the use of a diverse portfolio of customer-sited renewable energy technologies. However, given the magnitude of the 80 by 50 challenge and the required scale of low-carbon energy production, this policy design focuses on increasing the use of New York's solar and bioenergy resources to meet consumer energy needs.

There are a number of potential policy mechanisms that would further encourage the use of renewable energy systems in New York. These mechanisms can be organized into five broad categories (many of which are currently in use at the state and federal levels): (1) up-front payments, (2) performance payments, (3) tax policies, (4) financing policies, and (5) supporting policies. New York State could expand the use of the existing mix of policy mechanisms, which include up-front and performance payments coupled with tax and financing policies. For solar thermal applications, the existing programs could be expanded to include incentives for displacing fossil fuels currently used for heating space and water. As the installed price of solar technologies continue to decline, policy can transition away from up-front payments and focus on financing policies. While performance-based policies using solar renewable energy credits are not currently in use, New York could explore the potential use of these mechanisms given their wide-spread use in other states and the European Union.

### Quantification

The Technical Work Group explored two scenarios that set different targets for solar energy use and also included use of bioenergy, as provided under AFW-2, to displace heating fuels. The scenarios assumed all bioenergy use would consist of direct combustion of solid biomass, e.g., wood pellets; however, liquid biofuels, e.g., biodiesel, could also provide meaningful carbon emission reductions.

The first policy scenario:

Solar Electric: 1,000 megawatts (MW) by 2020 and 3,000 MW of customer-sited solar electric by 2030. (Additional policy options to support solar electric investments at the utility scale are addressed in Chapter 5 Power Supply and Delivery).

Solar Thermal: 2,000 megawatts, thermal (MWth) by 2020 and 4,000 MWth by 2030

Bioenergy: By 2030 utilize 90 TBtu of sustainable bioenergy resource (See AFW-2 for further discussion).

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/t$CO_2$e reduced) for the first policy scenario quantified by the Technical Work Group are presented below.

**Scenario 1: Solar Electric**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Cost per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 1.0 | 8.1 | $1,800 | $220 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

**Scenario 1: Solar Thermal**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Cost per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 1.0 | 10 | $1,500 | $150 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

**Scenario 1: Bioenergy**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Savings (Million $) | Savings per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 5.1 | 84 | –$5,100 | –$61 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

The second scenario:

Solar Electric: 2,100 MW by 2020 and 9,700 MW by 2030

Solar Thermal: 2,000 MWth by 2020 and 15,000 MWth by 2030

Bioenergy: Same as the first scenario.

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/t$CO_2$e reduced) for the second policy scenario quantified by the Technical Work Group are presented below.

**Scenario 2: Solar Electric**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Costs per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 3.3 | 22 | $4,400 | $200 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

**Scenario 2: Solar Thermal**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Cost per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 2.8 | 21 | $2,600 | $130 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

**Scenario 2: Bioenergy**

| GHG Reductions ($MMtCO_2e$) | | Net Present Value Cost (Million $) | Cost per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011–2030 | | |
| 5.1 | 84 | –$5,100 | –$61 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent.

Negative values represent savings.

## Special Considerations

- As compared to the generation of electricity and the provision of heat using fossil fuels, most renewable energy technologies avoid the production of harmful air pollutants (such as oxides of nitrogen, particulate matter, and hydrocarbons), increase system security of energy supplies by reducing energy imports, and reduce energy price volatility in the long-term. Customer-sited distributed generation increases reliability by lowering peak demand and relieving transmission and distribution bottlenecks in the electricity generation system, and use of in-state renewable resources also creates jobs, income, and economic development opportunities for New York State. Finally, early investment in emerging technologies will contribute to lowering the price of such technologies so that they can be more competitive in the future.

- Distributed renewable energy technologies are available in the marketplace and can be deployed without overcoming some of the significant siting barriers that slow the installation of large-scale low-carbon technologies such as wind turbine farms and nuclear power plants.

- The cost of solar energy technologies is forecasted to decrease over time. As this cost changes, incentive levels will need to be adjusted to maximize the use of public funds. Future analysis should be conducted to evaluate the cost and benefits of solar electricity generation under a real-time (time-of-use) pricing regime.

- There is considerable uncertainty surrounding carbon-accounting of bioenergy pathways given differing methods for modeling and measuring the release of carbon during land conversion processes and the rate of carbon uptake as new biomass is grown. As new methods and findings are published by organizations such as the U.S. EPA, the benefits associated with bioenergy use will need to be reevaluated.

- This policy depends on funding and financing policies as outlined in Efficiency and Clean Energy Fund (RCI-1) and Tax Structure and Private Financing (RCI-4). Eventually, codes may require the use of distributed renewable energy depending on the transition to a performance based system, as discussed in Building Codes, Appliance Standards, and Enforcement (RCI-7). Workforce Training and Development (RCI-6) and Education, Outreach, and Behavior Change (RCI-5) will be critical to the successful implementation of this policy. The continued development and demonstration of clean and efficient renewable energy technologies as outlined in Research, Development, and Demonstration (RCI-9) will work to both reduce costs and maximize co-benefits such as reductions in harmful air pollutants.

## INDUSTRIAL PROCESS INCENTIVES (RCI-11)

### Policy Summary

Voluntary incentive programs would be established to reduce the carbon intensity of industrial operations within the state, while fostering increased industrial activity through programs that result in more efficient, productive and cost effective operations. These programs would be available to both existing facilities and new facilities and processes, particularly those new industrial facilities involved in the clean energy economy. These programs would complement the Cap and Invest Program (PSD-6) if industrial sources are included in that program.

The policy option would establish a voluntary program, similar to existing energy efficiency programs, which provides technical assistance and financial incentives. Similar to Leadership in Energy and Environmental Design (LEED), the voluntary program would also provide recognition to industrial facilities that have met defined targets for reduction of their carbon intensity on a per-facility basis. The programs would include, but are not limited, to:

- Efficiency measures, including building energy efficiency, process optimization, water usage minimization, minimization of waste generation, e.g., solid wastes and wastewater;

- Adoption of advanced process technologies, including electro-technologies, which result in an immediate net reduction in carbon intensity;
- Installation of CHP systems;
- Waste heat capture and reuse, either onsite, including the production of electricity from waste heat (bottoming cycles), or shared with neighbors through district energy systems;
- Application of renewable energy systems, including the use of renewable fuels.

### Quantification

The policy scenario quantified by the Technical Work Group includes a reduction in statewide carbon intensity, defined as carbon dioxide-equivalent ($CO_2e$) per industrial Gross State Product, of 15 percent by 2020 and 30 percent by 2030.

The GHG reduction potential, total cost or savings (as measured by net present value), and cost effectiveness (as measured by $/t$CO_2e$) for the policy scenario are presented below. This is one of the more cost-effective policy options considered for this sector.

| GHG Reductions (MMt$CO_2$e) | | Net Present Value Savings (Million $) | Savings per Avoided Emissions ($/t$CO_2$e) |
|---|---|---|---|
| 2030 | Total 2011-2030 | | |
| 2.6 | 26 | -$2,500 | -$95 |

$/t$CO_2$e = dollars per metric ton of carbon dioxide equivalent; GHG = greenhouse gas; MMt$CO_2$e = million metric tons of carbon dioxide equivalent; N/A =not applicable; R&D = research and development.

Negative values represent savings.

### Special Considerations

- If not properly designed and absent other economic development programs, state-level GHG reduction mandates applied to energy-intensive industries that are subject to interstate or international competition, could be a factor in industry decisions to relocate to other locations, which could lead to the loss of employment in the state with no reduction in global GHG emissions. If well-designed cap-and-invest and other mandatory programs are implemented, complementary incentive programs can provide an effective stimulus for plant improvements that increase efficiency and reduce emissions. Similarly, if national policies are put in place that limit industrial GHG emissions either through emission controls or cap and trade mechanisms, state-level incentive programs will still be needed to ensure that investments in new and upgraded facilities are made in New York instead of other locations.
- Improved efficiency of an industrial facility tends to result in improved economic viability and job growth/retention. The incentives offered by the programs will only cover a portion of the total cost of the GHG reduction measures. The industrial facilities will need to provide the remaining capital requirements.
- Commencing in 2011, federal new source review requirements will apply to GHG emissions from new or modified industrial sources. Those requirements are likely to

require new or modified sources to utilize highly efficient processes and incorporate energy efficiency measures into their design.

- The make-up and size of industry in New York State in the future are difficult to predict, as are the products that those industrial facilities will produce, and the processes that will be employed.

## WORKFORCE TRAINING AND DEVELOPMENT (RCI-6)

### Policy Summary

The effective development of a skilled workforce equipped with the knowledge, skills, and ability to directly meet energy service demands is an enabling policy effort. Workforce training and development is primarily intended to improve productivity (quality of production output) by improving the knowledge, skills, and abilities of the workforce.

Workforce training and development is primarily intended to improve productivity (quality of production output) by improving the knowledge, skills and abilities of the workforce. This bundle will examine the following current workforce development strategies and programs: energy efficiency; customer-based clean and renewable energy resources; power supply and demand; smart grid; codes and standards; agriculture, forestry, and waste; transportation; manufacturing; and other related areas. Opportunities to prepare and expand upon current workforce training, continuing education, credentialing, licensing, on-the-job training, recruitment, and job placement efforts will be identified. The following initiatives will be the focus: midstream decision makers and building professionals in the residential, multifamily, and commercial/institutional building sectors; industrial, power systems, and manufacturing engineers and skilled technicians; bio-refinery, upstream, or feedstock production training related to biomass energy, as well as downstream training for conversion facility personnel; integrated farm management processes and systems; forest management focusing on upstream workers and; waste reduction, recycling, and composting.

Workforce training and development implementation mechanisms require a coordinated effort across State agencies, such as the work of the State Energy Technology Partnership to define the characteristics of the future workforce based on demographics (languages spoken, age, educational level, location), expectations for displaced workforce due to shrinking job sectors, and expectations regarding communities in need. New York State Department of Labor (NYSDOL) actions include identifying those industries critical to meeting the 80 by 50 goal, determining the areas that currently lack or will soon lack sufficient numbers of adequately skilled workers, and defining the training needs to move that workforce into green energy career pathways.

The Technical Work Group has established a policy scenario to further encourage a stronger workforce responsive to needs of the clean energy economy: (1) quantify the training needs in terms of the number of individuals to be trained and dollars to be spent on workforce development activities; (2) establish a process for early identification of these new needs, defining the training and education needs, developing training curriculum and certifications, and delivery of the same; (3) define the characteristics of the future workforce based on demographics, expectations for displaced and underemployed workers as well as others who have faced barriers to equal employment opportunities due to shrinking job sectors, and expectations regarding communities in need, and define the training needs to move that workforce into the green energy career pathway; (4) better define the career ladders and training needed to advance the clean energy economy; (5) identify the education and training needs for green professionals; (6) ensure the educational system supports the development of green career training; (7) make workforce training and development investments to address skill shortages in the energy efficiency labor market that will significantly contribute toward achieving the 80 by 50 goals and maximize the use of public resources; and (8) commit to train building professionals involved in the clean energy field to reach 35 percent of these participants by 2020, and 70 percent by 2030.

## Quantification

This policy was not quantified; however, studies have shown quantifiable energy and emissions reductions benefits from training participants directly involved in efficiency work.

## Special Considerations

- An unskilled workforce poses a significant potential risk of compromising the State's ability to achieve carbon reduction goals. If one assumes that about 20 percent of the performance of measures is attributable to the ability of the workforce to properly analyze, design, install, and maintain systems, then the absence of a trained workforce could reduce the potential environmental benefits by a similar amount. This policy, along with policy mechanisms outlined in Education, Outreach, and Behavior Change (RCI-5) will be critical to the successful implementation of most policy initiatives under the New York State Climate Action Plan.

Environmental justice (EJ) stakeholders have strongly endorsed the following principles with respect to "green jobs" workforce development initiatives:

They should include strong Minority and Women-owned Business Enterprise contracting and hiring standards.

Whenever possible and feasible, they should incorporate 1) a community-based delivery system that establishes and funds local groups as hubs for the program to generate homeowner interest and develop training-to-jobs networks, and 2) local environmental and community-development goals whenever feasible.

- The future workforce will be different from today's workforce in many ways. Data from the U.S. Department of Labor's Bureau of Labor Statistics (BLS) and the U.S. Census implies that the workforce will suffer a shortage in well-educated, highly skilled workers due to the retirement of the baby boomers; the projections from this data extend to the year 2018. However, many factors, such as potential changes in immigration and education policy, make it difficult to confidently predict the demographics and training needs of the workforce in the long term. In the short term, NYSDOL receives continuous updates on the state of the workforce through projections from BLS and the Census, unemployment insurance data, layoff notices, and services through the One-Stop Career Centers. These projections and updates can inform future initiatives.

- A skilled workforce will have a positive impact on the State's industrial competitiveness and promote economic development activities.

## EDUCATION, OUTREACH AND BEHAVIOR CHANGE (RCI-5)

### Policy Summary

The State would conduct a thorough review and evaluation of existing academic and market research and engage the academic community to better understand New Yorkers' attitudes and behaviors as they relate to energy decision making. Building on this research, which will drive program design and implementation both at the onset and duration of this policy, the State would create market-based and educational approaches that inform end-users and encourage reduction of energy use, energy efficiency, and renewable energy. The State would also ensure that the outreach, education, and marketing efforts reflect best practices in terms of design and delivery, and are properly integrated, coordinated, and evaluated. Incorporating state-of-the art behavioral change tools and principles, the State would pilot test these market-based and educational approaches and establish evaluation methods to analyze the success of these pilots before programs are rolled out on a regional or statewide basis. Regular evaluation would also occur through the program's duration to gauge the policy's effectiveness.

This policy option would develop methods and incentives to increase consumer awareness and understanding of the benefits of reduced energy use, and to 1) motivate people to take immediate energy efficiency action, and 2) bring about fundamental change in attitudes that will result in long-term behavior change related to energy efficiency and renewable energy. This policy recommends focusing efforts on several key areas:

- Changes in retail sales and stocking preferences in New York State through a statewide training program to educate and train all retailers on how to effectively sell energy-efficient and renewable energy products and plug-in electric vehicles. The training could include introduction to new product standards and specifications; understanding product life cycle costs and efficiency measurements; and other topics related to selling energy-efficient and renewable energy products and plug-in electric vehicles.
- Changes in education and testing through 1) a New York school district educational initiative that would facilitate the full integration of energy efficiency and GHG emission information into current curriculum and testing at all levels, and 2) a State employee Lead-by-Example educational initiative that would require all State employees to complete energy efficiency and sustainability training as a condition of employment.
- Expansion of education of energy consumers with outreach programs and provision of tools that provide more detailed and frequent information and feedback on energy use to help consumers make more efficient and effective use of energy resources, and encouraging plug-in electric vehicles. New York could explore expanding the scope and

funding for statewide consumer education programs and electronically accessible energy efficiency tools and resources for all fuels.

A multimedia approach could include TV, print, radio, web, and collateral materials as well as community-based outreach to reach diverse audiences across the state, including low-income, senior, and environmental justice communities.

The Technical Work Group identified the following targets as appropriate given the magnitude of the 80 by 50 challenge:

**Retail**
**Retail workforce training:** The percentage of New York retail stores where management will have implemented employee training: 80 percent by 2020; 100 percent by 2030.

**Sales and stocking**: The percentage of energy-efficient products sold and stocked by New York retailers above national baseline: 7 percent by 2020; 12 percent by 2030.

**Education**
**School district**: The percentage of New York school districts (K–12) reached with integrated education programs about energy efficiency and broader sustainability issues: 70 percent of public school districts by 2020; 100 percent of public school districts by 2030; 100 percent of private and at-home school systems by 2030.

**State employee training (lead-by-example)**: The percentage of New York employees receiving energy efficiency and sustainability training with a refresher course every two years: 50 percent by 2012; 100 percent by 2015.

**Behavior**
Implement clearinghouse of tools by 2012, expanding upon existing clearinghouses. Update and revise statewide education programs to reflect state-of-the art best practices, including behavioral changes approaches, every three years.

## Quantification

This policy option has not been quantified.

## Special Considerations

- Several key uncertainties include measuring the impacts of behavior change programs and tools motivating end-users to change their procurement habits, particularly in unreached communities; fully integrating climate and energy information into evolving school curriculums; temporal changes in energy consumption and use patterns; and the duration and magnitude of the current fiscal crisis and its impact in program budgets, retail establishments, and end-user finances.
- In EJ communities, in particular, stakeholders maintain that lasting behavior change emerges from sustained local dialogue and assistance provided by respected opinion leaders. Setting standards and programmatic guidelines that promote or integrate community-led capacity-building may be critical to the success of the proposed behavior change programs. These kinds of approaches could help ensure that the proposed energy

efficiency programming reaches the scale needed to address climate impacts while simultaneously promoting community centered job development.

- This policy option could help end-users save on energy bills, and, correspondingly, New York employees reduce state operational costs, which, in turn, may facilitate economic growth.

## RESEARCH, DEVELOPMENT, AND DEMONSTRATION NEEDS FOR THE RESIDENTIAL, COMMERCIAL/INSTITUTIONAL, AND INDUSTRIAL SECTOR (RCI-9)

See Chapter 10 for a complete presentation of Research, Development and Demonstration needs for this sector.

## RATE RESTRUCTURING AND FLEXIBLE METERING (RCI-10)

### Policy Summary

Building upon current initiatives, this policy option would focus on expanding use of more effective, dynamic price signals and providing in-home displays that show detailed electricity usage information to electricity customers as well as home automation, increasing customer engagement and intelligent vehicle charging. The desired result is an overall reduction in monthly electrical usage, shifting electrical usage to off peak periods, and encourage demand response activities.

The policy option recognizes that rate structures must evolve as conditions change. For example, alternative metering and pricing regimes may be needed in the near term to provide a clear regulatory and pricing environment to encourage the widespread market penetration of electric vehicles. This policy would be implemented through the following mechanisms:

**Legislation and Regulations**
**Time-of-use pricing**: After full implementation of the current policy of mandatory day-ahead hourly pricing for large commercial customers, explore expansion to small commercial and enact legislation that permits the Public Service Commission to implement mandatory time-of-use pricing for residential customers upon finding that it is beneficial and in the public interest to do so. Absent legislation, the State could explore voluntary residential real-time pricing options.

**Net metering**: Improve and evolve net metering regulations to facilitate installation of renewable distributed generation and CHP resources that provide carbon reduction benefits.

**Smart Meters**

**Consumption information:** Install smart meters and feedback tools; e.g., in-home displays, to convey price and consumption data, and implement rate structures, potentially including critical peak pricing or peak-time rebate programs, that encourage reductions in peak usage and shifting of usage to off-peak hours, along with public education and outreach programs in RCI-5 and energy efficiency activities in RCI-2.

**Assessments and Surveys**

**Smart grid, smart metering, and plug-in electric vehicles pilot program design**: Conduct a survey and assessment of smart grid and smart metering pilot programs, including rates and metering for plug-in electric vehicles, to determine the need for further in-state pilots, and to determine best practices and programs suitable for adoption in New York. Based on findings and analysis, the State could develop and implement New York-specific pilots or targeted programs.

**Smart meter cost-benefit analysis**: Perform a sector-based benefit-cost analysis of implementing smart meters and initiate an assessment of available consumption and feedback options; e.g., commercial and industrial meter data dashboards and in-home displays. Based on findings and assessment, the State will determine the extent to which smart meters could be deployed within New York.

**Submetering best practice**: Conduct a sector-based survey of regional and national best practices for submetering to assess applicability and opportunities for the State. Investigate extent to which such best practices can help support other subgroup policies, such as Energy Efficiency Incentives (RCI-2), which address barriers to energy efficiency, e.g., landlord-tenant split incentives, benchmarking, and monitoring based commissioning.

**Carbon impacts and demand response**: Conduct a survey and assessment of carbon impacts associated with various rate options and demand response that encourage reductions in peak usage and shifting of usage to off-peak hours.

## Quantification

This policy was not quantified.

## Special Considerations

- Some key uncertainties that could significantly affect the implementation of this policy include: (1) the timing and likelihood of mechanisms to incorporate the price of GHG emissions into energy prices and the energy sources to which such mechanisms will apply; (2) the timing of broad market adoption of electric vehicles and electric building heating systems; (3) the development of new low- or zero-carbon sources of electricity production and the associated costs; (4) whether the recommended legislation and regulations would be enacted; and (5) uncertainty with regard to the degree to which consumers will alter their consumption in response to prices. The State could study the relationship of carbon impacts on consumption patterns; e.g., reduced on-peak and increased off-peak demand.

- Increased use of time-of-use pricing, and other rate and demand response options, could lower critical peak usage in New York City, which is expected to reduce the hours that higher emitting, electric peaking generating units run.
- The State could explore residential rate designs and rate mechanisms that foster energy efficiency, promote rate equity for vulnerable residential populations, such as low-income households, and encourage plug-in electric vehicle use.

## EFFICIENCY AND CLEAN ENERGY FUND (RCI-1)

### Policy Summary

This policy option would create a Efficiency and Clean Energy Fund to further the State's long-term efforts toward its 80 by 50 goal, building upon the State's current near-term efforts to implement 45 by 15. The purpose of the Fund is to facilitate investment in electricity, natural gas, propane, fuel oil, thermal energy, and district heating energy efficiency and onsite renewable energy options using a "whole-building" approach. A whole-building approach involves implementing fuel-neutral, integrated steps to meet energy requirements. In addition, adaptation of building energy capabilities for new technologies and uses, such as electric transportation, may also be considered in developing the fund.

Through legislation, the State could possibly establish a Efficiency and Clean Energy Fund by 2015 that consolidates current funding streams (e.g., the Systems Benefit Charge [SBC], Energy Efficiency Portfolio Standard [EEPS], Renewable Portfolio Standard [RPS], Regional Greenhouse Gas Initiative [RGGI], weatherization) and be combined with new revenue sources such as oil and propane public-benefit surcharges and code-based user charges. The legislation would recognize that dedicated and continuous funding is essential for the overall success of the individual programs and the attainment of long-term carbon mitigation strategies. The Fund could be designed to support the entire spectrum of energy efficiency and clean energy product and service development: from research and analysis through technology development and demonstration through business and market development through market commercialization and adoption to standardized practice.

A governing structure, headed by a Coordinating Council, would be established to provide common administration and funding distribution of the State's energy efficiency, renewable energy, and low-carbon programs. Comprised of State agencies and authorities, this Coordinating Council would have the flexibility to modify funding distributions, as needed, to take advantage of evolving technological advances or programmatic needs. As revenue streams are identified and implementation mechanisms developed, broad criteria for program participation will be considered, including those that would apply for public and private participation. An advisory group, including private advisers, would also be established to advise the Coordinating Council during its decision making processes.

The outflow of the funding can be guided by proportional distribution based on the inflow of revenue streams per source (fuel or, in the case of RGGI or another emission cap-and-invest program, pollutant), but would not be wholly constricted by such revenue inflow, and may consider the existent needs and opportunities as recognized by the Climate Action Plan, State Energy Plan, or other State activities or studies and as deemed appropriate by the Coordinating Council. Continuing the practices of current funding streams, private recipients will be eligible to receive incentives.

Until the Efficiency and Clean Energy Fund is established, the current collection methods of the existing 45 by 15 funding streams would continue as currently designed. The State should draft a transition plan from 2011 to 2015 outlining how the current funding streams would be transitioned to the Efficiency and Clean Energy Fund. The Fund will also recognize any restrictions on non-state funding streams, such as federal weatherization funding, and will accordingly continue to dedicate funding to the desired end-users; e.g., low income recipients of weatherization funding.

### Quantification

This policy was not quantified. However, it provides funding for Energy Efficiency Incentives (RCI-2); Customer-Sited Renewable Energy Incentives (RCI-3); Building Codes, Appliance Standards, and Enforcement (RCI-7); Building Commissioning, Benchmarking, and Upgrades (RCI-8); and Industrial Process Incentives (RCI-11), which are quantified.

### Special Considerations

A legislative mandate establishing this Fund will be necessary given the various regulatory jurisdictions that apply to energy supplies. Such legislation can best identify the appropriate revenue resource opportunities to support the Fund's various program activities, including whether to assess new user charges.

## TAX STRUCTURE AND PRIVATE FINANCING (RCI-4)

### Policy Summary

This policy option recommends that the State undertake a comprehensive review of the current tax structure and financing programs and their impact on current and future carbon reduction activities. As part of its review, the State would also identify gaps in the current tax structure and financing programs and identify policy options for future shifts to support carbon reduction activities.

Based on this analysis, New York could establish a two-phase comprehensive financing and tax policy that supports the reduction of GHG emissions and encourages investment into clean energy options. The first phase, to be implemented incrementally annually from 2011 to 2015, includes suggested near-term modifications to existing programs that New York could evaluate as part of its comprehensive financial and tax policy framework, implementing those options that it deems viable. During this phase, the State is encouraged to advance PACE and on-bill financing by 2011, and advocate for any necessary policy changes at the federal level as needed. Given the complexity of the State's tax policy, the modifications and new policies would be incrementally rolled out in the second phase: modifications to existing programs to be completed by 2015 and new policies to be fully rolled out by 2020, with pilot programs as appropriate from 2015 to 2020.

## Quantification

This policy option was not quantified. However, it provides funding for Energy Efficiency Incentives (RCI-2); Customer-Sited Renewable Energy Incentives (RCI-3); Building Codes, Appliance Standards, and Enforcement (RCI-7); Building Commissioning, Benchmarking, and Upgrades (RCI-8); and Industrial Process Incentives (RCI-11), which are quantified.

## Special Considerations

- Access to capital and favorable economic considerations underpin the success and rate of implementation of this policy. Complementary or competing programs, policies, and laws on the federal level, such as PACE, will impact the success of the implementation and/or need for modification of State proposals. Tolerance for modification of existing financial mechanisms and creation of new such mechanisms will provide additional venues to fund energy efficiency and renewables.
- Financing mechanisms are demand-driven. The pace that the other RCI policies are implemented will affect the timing and demand of the financial and tax recommendations contained in this policy.
- As the State evaluates the viability of the financing policy options, it will need to take into account the limitations on State entities' ability to provide financing, including their statutory authorization, their covenants with bondholders, the overall capacity of their balance sheet to provide large capital investments, and their ability to collaborate with other agencies.