

CLEANER GREENER SOUTHERN TIER
REGIONAL SUSTAINABILITY PLAN

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APPENDIX A:
TECHNICAL APPROACH

TECHNICAL APPROACH

Development of the Cleaner Greener Southern Tier Plan has relied on two key components – comprehensive technical analysis, research and synthesis, and a robust public involvement process. Both of these were integrated throughout the Plan’s development and influenced one another:

- Technical Analysis.** The technical analysis covers the research, compilation, synthesis, and analysis of baseline data and potential recommendations across all nine topic areas in the eight Southern Tier counties. This included analyzing relevant existing plans and notable programs, compiling datasets including GIS, exploring best practices and case studies, identifying sustainability indicators and targets, and tailoring this information and baseline assessment to the sustainability goals as they were being developed. It also included conducting a baseline GHG inventory, and analysis of potential GHG reduction benefits of actions in the implementation strategy.
- Public Involvement.** Public outreach has helped shape and ground the research and technical analysis. The public provided input toward identifying community and regional sustainability goals and preferred implementation strategies; identifying best practices and model projects from the region; and outlining what people would like to see implemented in the Southern Tier. The public involvement process included focus group meetings, public meetings, and Consortium meetings during April and October, as well as a project website. In total, 583 people were on the project email list; 138 people participated in the 21 focus groups in April and October; 111 people participated in the 7 public meetings in April and October. There were 1,608 hits to the project website, with 210 of those hits participating in voting activities and/or submitting comments. We also conducted two surveys, one for planners and one for the public which received 101 responses. Consortium meeting attendance included 43 of the 47 Consortium members.

Combined, these two components help to create a community-based plan to craft an implementation strategy that works for the Southern Tier context and communities. The sections below detail the activities and phases of developing the Plan.

Reviewing the Plans

Over 150 Southern Tier plans, codes, and policy documents were reviewed in developing the goals, baselines, and implementation plan. These documents were reviewed to identify existing visions, goals, objectives, and performance measures. Extensive internet search of all relevant plans, reports, and case studies at the watershed, regional, county, city, town, and village levels was completed; a survey was also conducted of local and regional planners to get suggestions on potential best practice examples. The types of plans and other documents reviewed included: Regional and Metropolitan Planning Organization (MPO) plans and policies; County and City Comprehensive Plans and Codes; Village/Town/City Master Plans; Bicycle, Pedestrian, and Multi-Use Trail Plans; Coordinated Public Transportation and Human Services Plans; Corridor and Area Plans and Studies; Sustainability Plans; Comprehensive Economic Development Strategies; Agricultural Development Plans; Climate Change Adaptation Plans and Programs; Water Management Plans; Wastewater and Water Quality Plans; and Solid Waste Management Plans and Compliance Reports.

Every document’s vision, goals, objectives, and indicators or performance measures, where applicable, were captured. The initial plan review and subsequent baseline inventory helped create an understanding of the common themes that are found throughout the Region and where there were differences. Gaps in regional efforts in the nine topic areas were also identified. In addition, significant effort was undertaken to gather and assess baseline information for all the topic areas. One of the main challenges was finding similar levels of information across the topics. Several topics were rich in information for some counties, but then not for others; this was especially true for some of the more rural counties that were not part of the three major urban areas or MPOs. Due to the Regional Economic Development Council (REDC) efforts, economic development was one of

the richest topics. In other cases, there was detailed information but the data were outdated and thus less reliable.

Complementing this research phase, in April 2012, four public meetings, 12 focus groups, an online survey, and an interactive project website were employed to present the project background and facilitate discussions to identify the region's strengths, weaknesses, opportunities, and best practices. During these workshops, participants also provided vision statements or phrases describing their ideal community 20 to 50 years from now. From these meetings, several common themes and priorities emerged:

- Renewable energy production that uses local resources (biomass, solar, wind, hydro) and supports local economic development; more efficient and shared methods of energy and heat production (such as co-generation).
- Energy efficient retrofits and new construction as an energy conservation strategy and an opportunity to create local jobs and support local businesses.
- Focus development in existing communities to revitalize downtowns and villages while protecting rural landscapes. This will use existing infrastructure more efficiently (buildings, pipes, and roads) and encourage the mitigation of environmental hazards on brownfield sites. These efforts should be linked to flood mitigation efforts. Focused development in existing centers supports greater walkability and transit use.
- Multimodal transportation system that is safe for all users and offers increased transportation choices in urban and rural settings.
- Preserve and protect water quality while addressing flood mitigation and storm protection.
- A local economy with unique, local businesses supported by the people and institutions located here; local production and secure jobs.
- Protect working lands and the scenic beauty of the region; bring agriculture into urban areas.
- Develop and support a common vision that sees this region as an innovative place with a high quality of life that people want to stay in, and that embraces a responsible attitude towards resource use.
- More regional collaboration and better enforcement of codes and standards.

Many of these themes were included in the final goals and are foundational to the Plan.

Developing Regional Goals, Indicators and Targets

Using both the plan review and public outreach, the regional sustainability goals and indicators were chosen. The goal development process included excerpting hundreds of example goals from the various plans reviewed. Using the example goals uncovered in the plan review along with input from the public kickoff meetings, a draft list of 21 regional sustainability goals was identified across nine topic areas. The draft goals were then posted on the project website, along with notes from the public meetings. The public and other stakeholders were able to review, rate, and comment on the 21 draft goals via an interactive exercise on the site. The tool also allowed visitors to compare their input with other participants' ratings. A meeting of the Southern Tier Consortium was then held to review input, refine, and adopt the final list of 18 goals.

After the goals were finalized, sustainability indicators were developed to measure the Southern Tier's progress toward its goals. In addition to following NYSEERDA's guidance on developing indicators, two key criteria were used to select the most relevant indicators: whether an indicator aligned with adopted goals, and whether the data needed to track the indicator is available for the entire Southern Tier. The latter is a limiting factor for many potentially useful indicators in a largely rural region. In parallel development of a Tier II GHG emissions inventory for the Region, readily available data was collected that would be required to track any of the proposed indicators. At least one indicator was selected for each topic area.

Specific targets were then developed for a select group of priority indicators to evaluate progress toward GHG reduction and other regional sustainability goals, for both the short term (5 year) and long term (20 year)

periods. Targets for indicators that lack available, region-wide baseline data were not developed, as targets are dependent upon baseline conditions.

Targets were determined based on the following considerations:

1. Current baseline status of the indicator.
2. Existing trends in the region that may affect the ability to meet the targets.
3. Targets identified in similar or comparable regions.
4. Potential to contribute to New York State's goal of reducing the state's greenhouse gas emissions to 80% below 1990 level by 2050.
5. Ease of tracking progress towards the target on an annual basis.

Leveraging Best Practices and Local Innovations

Recognizing that the Southern Tier is a dynamic region - really three central urban centers with significant rural areas - it was important to identify a range of best practices tailored to the Region's sustainability goals. A concurrent research effort identified best practices from within New York State and from around the country, chosen for their relevance to the Southern Tier and alignment with the regional goals. These best practices provided examples of existing policies, programs, and practices that could be replicated and expanded in the Southern Tier. These were used as a basis for developing effective actions for the Southern Tier region to move closer to its sustainability goals. The selected best practices and case studies align with the sustainability goals developed in previous research phases and identify opportunities for successful applications in the Southern Tier area. Over 120 separate best practices examples were identified (from an original list of over 300 best practices) with direct applicability to the Region and potential for replication.

Developing the Implementation Strategy

A multi-faceted approach was used to analyze each topic area and develop a set of related actions. The creation of the implementation strategy relied on the integration of all previous technical analysis and public outreach. The potential actions identified represented the best and most applicable policies, activities, programs and projects to help achieve the region's GHG reduction and other sustainability goals, across each of the nine topic areas. Projects that were particularly well-suited to the Southern Tier and have proven GHG reduction potential were given the highest ranking. For initial public and stakeholder review, a draft long-term implementation plan (with 168 potential actions) and short-term action strategy (64 actions) were developed. The draft strategy included:

- A summary and explanation of the topic area, with an analysis of the strengths, challenges, and opportunities in each topic area.
- One to three regional sustainability goals for each topic area, along with the following components:
 - Discussion of each goal and what it is trying to achieve.
 - Identification of the barriers associated with achieving the goals.
 - A set of long-term strategies that describe how the region will reach its goals and any challenges with implementing these strategies.
 - Short-term actions, which are policies, projects, programs that the region can pursue and implement in the short term to reach its sustainability goals.
 - Information about each action, including relative GHG reduction potential, project opportunities, and potential partners.

Some additional themes were a key part of developing the draft implementation strategy:

- Understanding that the Southern Tier is really three regions working as one with significant differences across the region, in terms of community character, data available, interest in specific topics, and capacity to implement projects.
- Crafting a regional plan that respects and builds on these differences.
- Leveraging the work completed for the Southern Tier Regional Economic Development Council (REDC) Plan.
- Identifying potential opportunities for integrated and regionally significant initiatives and projects.

Refining the Implementation Strategy

In October 2012, seven stakeholder group workshops and three public meetings were held throughout the Southern Tier to present the draft implementation strategy and obtain feedback on priority actions. Both the stakeholders and public provided significant, detailed input to refine and prioritize the top actions that the Southern Tier can take in the next five years to become more sustainable and to reduce greenhouse gas emissions. A similar exercise was provided on the project website, with summary information about each action, so that website visitors could help to prioritize and refine the actions. A Consortium meeting was then held in October 2012 to inform the Consortium on stakeholder and public feedback. The Consortium helped to edit details of each action, confirm whether they should be included in the implementation strategy, and further refine the list to a set of Top 22 priority actions, which are included as priorities in this Plan.

Based on this feedback, the team determined that a shorter more focused implementation strategy would be more powerful and more easily implemented. The most significant, ready-to-go actions were chosen, including those with the greatest GHG reduction potential and others that achieved key non-GHG-related sustainability goals. The final list of 65 actions was further analyzed to determine the GHG reduction potential for each; some were analyzed in groups where the actions were interrelated. Some actions were determined to not have measurable GHG reduction benefits, and others were deemed to support other measurable actions. Additional review and analysis was conducted on job creation potential, other benefits, and potential partners.

Job creation estimates for the energy efficiency measures and renewable energy (except solar) were developed using a rough, back-of-the-envelope approach that employed job multipliers produced by Professor Kammen at UC Berkeley, Renewable and Appropriate Energy Laboratory (RAEL). The team used these multipliers to estimate direct job creation based on the different measure type; energy efficiency, biomass, geothermal and wind. For each measure, the energy savings or generation, captured in kilowatt hours (kWh) was converted into gigawatt hours (gWh). We then applied the technology-specific, national job metric that allowed us to estimate the direct jobs created per gigawatt of energy savings or generation.¹ Jobs estimates for solar PV were extrapolated from the results of NYSERDA's "New York Solar Study" which found 2540 direct PV jobs were created for deploying 5000 MW solar PV New York-wide by 2025. Values were adjusted to include region-appropriate job qualifications which removed jobs associated with manufacturing of parts (60 jobs). Per conversation with NYSERDA staff, extrapolation or JEDIO were acceptable methods of estimation.²

¹ More information on the Kammen multipliers is available at:
http://rael.berkeley.edu/sites/default/files/WeiPatadiaKammen_CleanEnergyJobs_EPolicy2010_0.pdf

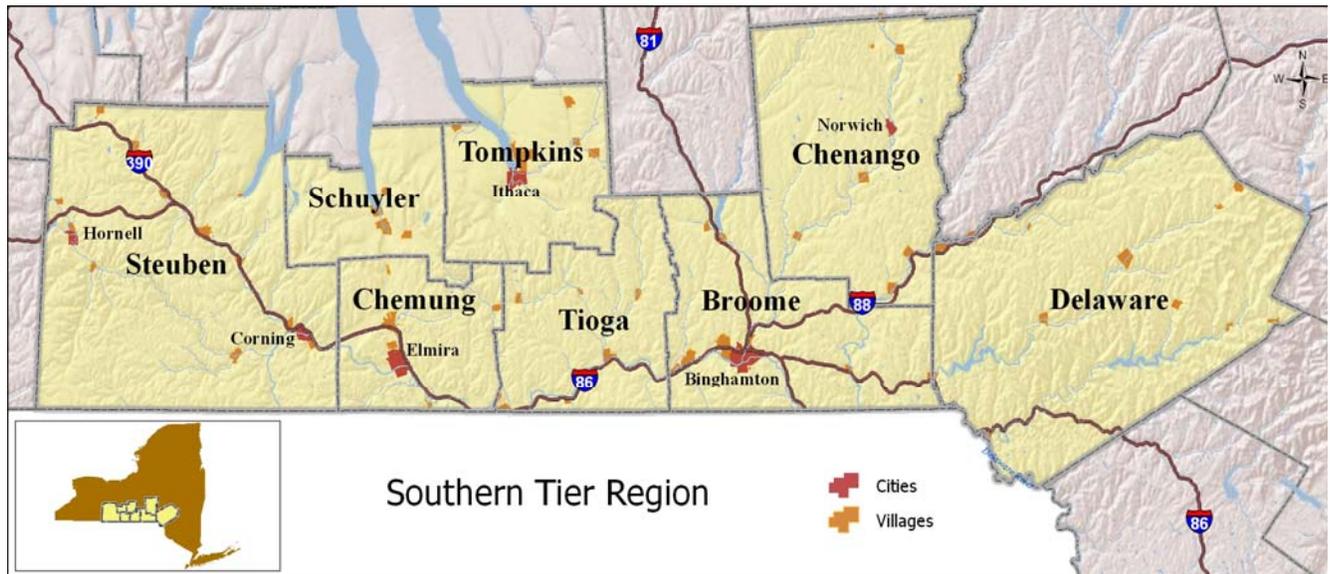
² <http://www.nyserdera.ny.gov/en/Publications/Program-Planning-Status-and-Evaluation-Reports/Solar-Study.aspx>



APPENDIX B: IMPLEMENTATION STRATEGY

Cleaner Greener Southern Tier Final Implementation Strategy

December 28, 2012



The Cleaner Greener Southern Tier Planning Team

Tompkins County
Southern Tier Central Regional Planning and Development Board
Southern Tier East Regional Planning and Development Board
ICF International

INTRODUCTION

The New York Cleaner, Greener Communities Program empowers regions to develop plans to identify regional priorities that will enable them to make progress toward energy and greenhouse gas (GHG) emissions reductions and increase regional sustainability. The Cleaner Greener Southern Tier Plan has engaged with residents, communities, and private experts across a wide range of fields to develop a regional sustainability plan and to identify projects that will significantly improve the economic and environmental health of our region. This effort will guide integrated, sustainable solutions—from statewide investments to regional decision-making on energy and greenhouse gas emissions, transportation, livable communities, economic development, working lands and open space, climate adaptation, water management, waste management, and governance.

Broome, Chemung, Chenango, Delaware, Schuyler, Steuben, Tioga, and Tompkins Counties worked together to develop this Plan. By building on existing plans and programs around the region, the Plan encourages greater regional collaboration and action. This Implementation Strategy presents 65 recommended actions, based on regionally-determined sustainability goals. The critical inputs and outputs of this planning process include:

- A robust public and stakeholder engagement process, coupled with thorough technical analysis.
- A Southern Tier GHG emissions inventory and estimate of GHG reduction benefits from relevant implementation actions.
- A regional assessment of baseline conditions across the nine topic areas.
- A set of indicators and targets to measure progress.

This Implementation Strategy was further refined to a list of the Top 22 priority projects; the 2-page project profiles for each of these are highlighted at the front of the Plan.

Finally, a list of 77 supplemental actions (found in Appendices) was evaluated and determined to be important for future contributions toward long-term greenhouse gas emissions and sustainability goals. Many of the supplemental actions also support the priority actions in this Implementation Strategy. These are presented so that they might be incorporated as municipalities or private entities in the Region move forward.

The Strategy

The Implementation Strategy will help Southern Tier communities achieve regional sustainability goals in nine topic areas: energy and greenhouse gas emissions, transportation, livable communities, economic development, working lands and open space, climate adaptation, water, waste, and governance. Within each topic area, the following sections are included:

- Brief description of current conditions and regional context supporting need for action.
- A list of 65 priority actions, which are policies, projects, and programs that the region can pursue and implement to reach its sustainability goals.
- Analysis of projected GHG reduction benefits of actions (where appropriate), direct and indirect benefits, barriers, potential partners, and projected job creation (where known).
- A narrative explanation of how each of these actions marks progress toward achieving established Southern Tier sustainability targets. (To review the 14 regional sustainability targets and related methodologies, please see the Goals, Indicators, and Targets documents in the Appendix.)

These actions were developed and refined through a comprehensive public process, based on regional stakeholder, resident, and business input; best practices research; model programs review; and technical analysis. Through two intensive weeks of public outreach in April and October 2012, an interactive project website, and a

plan process where over 150 plans were reviewed, more than 190 recommended actions were identified and evaluated. A draft long-term implementation plan with 168 actions, along with a more detailed short-term action strategy with 64 actions, was drafted for presentation to the public and stakeholders in October 2012. The draft actions were evaluated on their GHG reduction potential, direct and indirect benefits, ability to help meet goals and targets, barriers, and potential partners, for inclusion in the final implementation strategy.

Through a series of public workshops, online exercises, topic area expert stakeholder focus groups, and a Consortium meeting in October 2012, further prioritization and refinement of the draft actions resulted in this Final Implementation Strategy.

Linking to the Regional Economic Development Council Plan

In 2011, the Southern Tier Regional Economic Development Council (REDC) undertook an extensive strategic planning process for this region, based on public-private partnerships made up of local experts and stakeholders from business, academia, local government, and non-governmental organizations. The REDC plan, “The Southern Tier’s Approach to Economic Growth: Catalytic, Collaborative, Comprehensive, Competitive” outlines 5 strategies and 14 action items to achieve robust economic development. This plan is important to this effort for several reasons. First, it is the only other comprehensive regional plan that covers the Southern Tier and is the same scope as this implementation strategy. Second, economic development is a critical piece of this strategy, ensuring that it will be sustainable economically, environmentally, and socially. Third, additional funding is available for the implementation of the REDC plan that can also be leveraged to support some of the actions in this strategy. Table 1 below shows where the REDC plan’s 5 strategies and 14 actions influence this implementation strategy. Several additional Supplemental Actions can be found in the Appendix.

TABLE 1 ■ Aligning the Southern Tier REDC with the Implementation Strategy

REDC Strategy	REDC Action Item	CGST Implementation Strategy Topic Area
Strategy 1. The Southern Tier...New York’s Leader in Energy Efficiency and Renewable Energy Technology.	Southern Tier Renewable Energy and Efficiency Initiative: Residential and Small Scale Commercial Retrofit	1. Promote energy efficiency and renewable energy in residential and commercial buildings
	Southern Tier Renewable Energy and Efficiency Initiative: Large Scale Institutional and Commercial Projects.	1. Promote energy efficiency and renewable energy in residential and commercial buildings
	Energy Workforce Development Initiative	28. Implement the Energy Workforce Development Initiative 29. Identify, train, and certify contractors to meet increased demand for energy efficiency 32. Strengthen university-industry connections to improve and promote workforce development
Strategy 2. Southern Tier Transportation Alliance...Building the Next Generation Transportation Technology and Manufacturing	Next Generation Transportation Development Initiatives	Economic Development - Appendix
	Southern Tier Transportation Industry Cluster	Economic Development - Appendix
Strategy 3. Health Care 2020...Integrating Health Care Providers, Higher Education and Cutting Edge Technology	Regional Health Information Exchange and Electronic Medical Record System	Economic Development - Appendix
	Expand Rural Health Care	Livable Communities - Appendix
	Senior Living Communities	Livable Communities - Appendix
	Health Care Workforce Development	Economic Development - Appendix
Strategy 4. Revitalize the Rural Farm- and Forest-based Economy of the Southern Tier	Rural Initiative Venture Fund	35. Support development of processing and distribution facilities (Food Hubs) for local and value-added products 40. Encourage new farm startups and farm transfers to next generation
Strategy 5. Strengthen the Southern Tier’s Economic Development Backbone	Southern Tier Community Revitalization Project	20. Provide gap financing for community revitalization projects
	Shovel Ready Site Development Project	22. Support redevelopment of strategic sites and vacant properties

In each action that has a direct link to a specific REDC Strategy, a text box and link to the specific REDC Strategy has been provided, as shown below.

REDC Strategy 1: Southern Tier Renewable Energy and Efficiency Initiative: Residential and Small Scale Commercial Retrofit. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

Creating integrated projects

A multi-faceted approach was used to analyze each topic area and develop a set of related actions. Each topic area has a set of aligned goals and actions. Since many actions incorporate activities that could be included in multiple topics, the plan makes some general categorizations across topics, such as:

- All general energy related recommendations are in the Energy and GHG section. Some related applications, such as in water facilities or alternative fuel promotion, are in Water and Transportation sections respectively.,
- Regional multi-use, bicycle, and network and trail development are in the Working Lands and Open Space section. Clearly, there is an important multimodal element to these trails, but it seemed appropriate for these to be part of a broader regional strategy on open space connections. Specific streetscape infrastructure and mobility policy recommendations (more common in the cities and villages) are in the Transportation section.
- Health and general social/quality of life considerations are in Livable Communities.
- Any workforce development initiatives are in Economic Development.
- Local farm, forestry, and overall agricultural development are split between Economic Development and Working Lands and Open Space. The marketing and brand development (or creating demand side) of this is in Economic Development, while the sustainable management of these lands (or expanding the supply side) is in Working Lands and Open Space.

Identifying regionally significant initiatives

The categorizations above help to organize groups of actions, but it is also important to continue thinking across the topic areas to create integrated and regionally significant projects in specific places. This Plan identifies the strategies and actions, but as individual communities, organizations, developers, or other project sponsors begin to work on implementing individual actions, they will need to look for place-based connections between actions that could be linked to, or support, actions in other topic areas. Since the topic area structure tends to separate strategies that might actually be integrated more at the project or program level, some initial opportunities for integrated projects are presented below.

- **Plan and develop a strategic redevelopment site as a catalyst for sustainability integration and innovation.** Several areas have been identified for their redevelopment opportunities including the Ithaca Commons, specific areas in Binghamton, and by the Three Rivers Development Corporation in Steuben County. As all of these are identified within major city centers and at critical transportation junctures, they are the perfect building blocks for sustainable project development. An integrated pilot project could incorporate elements from all of the topic areas, including livable communities, such as:
 - Ensuring that energy efficiency, renewable energy, and co-generation or district heat and power technologies are included in the building envelopes and site evaluations.
 - Identifying and integrating with the surrounding multimodal options and networks, including transit, bicycle/pedestrian, and other options; this could also include alternative fuel or recharging stations, and carsharing or bikesharing parking.

- Exploring additional programmatic opportunities and coordinating with relevant public agencies to identify potential health, government office siting, workforce development opportunities, etc. The concept is to use the specific target area and sites to promote as much public good as possible, leveraging and focusing all available public and private investment. Other supporting actions might include local food access, such as farmers markets or community gardens, workforce development, or senior housing.
- Incorporating the best practices in waste and water management in the buildings, sites, and surrounding neighborhoods, such as green infrastructure.
- **Create a “ground to home” life-cycle strategy for local food system development.** This would involve taking a holistic approach to expanding the local food network for both local and regional food and product needs. Based on the Finger Lakes Fresh model that includes product branding and program structure, this would involve creating a Food Hub distribution center and network of local farmers, food providers, distributors, markets, and branding to help increase the supply and the demand for local food products. It would also include taking advantage of additional opportunities in renewable energy, waste and water management, and linking these ideas to rural tourism. All of these elements would take a comprehensive approach and build on each other.
- **Build an energy innovation cluster in a downtown redevelopment location.** By working with universities, hospital and health centers, and local industry and companies, use a place based development concept for clustering and co-locating the education, workforce development, technology transfer and business incubation functions around a targeted sector of the energy development field in a centralized downtown or main street location.
- **Explore a regional lands mapping and programmatic development initiative.** This could involve linking conservation, agricultural protection, open space, and other land preservation efforts into a regional green infrastructure and tourism strategy, potentially developed in parallel with the local food production strategy. It could help to identify the opportunities for better land conservation and preservation across the different types of land uses more effectively. In addition, by creating a mapping component, this can also help to build greater public and policymaker understanding of green networks in the region.

The following 65 actions were determined to be the most important actions for the Region to focus on. The assumptions used to calculate GHG reduction potential, and the expected GHG reduction for each relevant action, are summarized in the tables at the end of each topic area, along with relevant barriers, example projects, and potential partners. Additional detail on assumptions used in calculating the GHG benefits can be found in the “GHG Benefits of the Implementation Strategy” in the Appendix. There is also more detail about the actions marked **TOP 22** at the beginning of the Regional Sustainability Plan.

ENERGY AND GHG EMISSIONS

Reducing energy consumption in buildings has the potential to significantly reduce both energy consumption and GHG emissions in the Southern Tier, since energy consumed in buildings - homes, businesses, and industry - account for nearly half of the region's GHG emissions. A combination of conservation and energy efficiency implementation with expanded use of renewable energy sources can dramatically reduce energy use and related emissions of buildings in the region, while creating local jobs.

Renewable energy sources that are derived from natural, infinite resources such as the sun and wind, or can be grown quickly and managed sustainably, reduce dependence on fossil fuels. Technologies which capture the Southern Tier's abundant natural, renewable resources include wind turbines, solar electric photovoltaic (PV), solar thermal (water and heat), geothermal heat pumps, biogas from agricultural wastes, hydropower, and combined heat and power (CHP) systems. There is great potential to replace a significant portion of fossil fuel in the region with a diverse portfolio of renewable energy resources. As each renewable resource has particular limitations - wind produces more power at night and in the fall and winter, solar produces more power on sunny days, biomass does not lower GHGs as much as wind or solar - a portfolio of renewable resources will be needed to support the energy needs of the region while reducing GHG emissions.

■ **TOP 22 1. Promote energy efficiency and renewable energy in residential and commercial buildings**

Southern Tier residents will benefit from a large-scale, region-wide program that provides education, financing, up-to-date information, and application assistance to homeowners and businesses interested in reducing their energy usage. This "Southern Tier Renewable Energy and Efficiency Initiative," first proposed in the Southern Tier Regional Economic Development Council's Regional Strategic Plan, will be an overarching, coordinated initiative under which a number of targeted efforts will be deployed to help consumers take steps to improve the energy efficiency of their buildings. It will also coordinate education, events, website content, and outreach based on community needs and could support and advertise local efforts to provide basic energy upgrades and weatherization services.

■ **TOP 22 2. Develop a regional energy roadmap**

A regional energy roadmap will establish a detailed plan to achieve the Southern Tier's desired energy portfolio. It will identify potential future energy scenarios and spur action by presenting short- and long-term steps to achieve the desired scenario. The regional energy roadmap will require a proactive strategic planning process which will aim to maximize renewable energy resource development, energy efficient technology and measures deployment, and economic development, and reduced dependence on imported fossil fuels. By identifying clear action steps, the Southern Tier would invest in a process which will likely lead to specific dedication of funds and resources, as well as strategic partnerships to leverage existing initiatives. It would also provide foundational knowledge about renewables in the Region as well as gaps in developing the potential of these energy sources. The roadmap would provide a transparent plan for all community members to see the value of the investment in clean energy and the projected results. It would increase elected officials' and the general public's understanding and awareness about the financial and operational aspects of specific renewable energy and energy efficiency.

■ **TOP 22 3. Explore and create financing options for renewable energy and energy efficiency systems**

One of the most popular actions coming out of the Cleaner Greener Southern Tier Plan public involvement process was to provide additional financing options for energy efficiency and renewable energy projects. Stakeholder and expert panel groups, as well as public meeting and website input, identified the need to empower local government, agencies, and financial institutions to develop financing options to assist businesses and homeowners. Initial investment and long payback periods are often disincentives to retrofitting buildings and installing renewable systems. Innovative financing options can overcome this lack of upfront capital. Providing additional financing will allow home and business owners to invest in energy efficiency measures in buildings and operations and to replace a portion of energy generated by fossil fuels with renewable energy technology. Making these investments offers some of the largest greenhouse gas reductions available to counties in the Southern Tier. The establishment of financing mechanisms, such as a green revolving loan fund, a loan loss reserve to leverage private capital, third-party leasing, energy loan discounts, bond financing, and sales tax abatements and exemptions for energy efficiency projects, will ensure that funding for retrofits and renewable energy systems is available in the future.

The Alternatives Federal Credit Union (AFCU) in Tompkins County offers special discounts on loans for green home renovations, as well as solar panel installations, and hybrid vehicle purchases.

■ **4. Assess energy performance, implement, and monitor energy efficiency upgrades in government facilities**

This action includes performing comprehensive energy audits or inspections of major government buildings including municipal, state, regional, and other agencies such as school districts, water and waste utilities, and airports. It includes identifying and implementing effective cost saving and energy saving strategies; maintaining performance through retro-commissioning; and monitoring these improvements through ongoing inspections and benchmarking. Energy audits identify the potential for basic improvements such as air sealing and lighting upgrades, along with more ambitious measures such as high-efficiency heating systems, building envelope retrofits, and renewable energy. Because systems decrease in performance over time, retro-commissioning is a practice of testing and correcting a building's mechanical systems to ensure that they perform as intended, reducing energy losses over the lifespan of a building. Monitoring energy use through benchmarking building energy use is a popular and free way to quantify energy savings. This enables facility managers to catch spikes in energy use and resolve issues quickly. This type of monitoring may also identify the possibility of moving operations into an off-peak energy demand cycle. Benchmarking building energy use will also provide easy access to data for a greenhouse gas inventory. This initiative would also include auditing and upgrading inefficient outdoor lighting around government and municipal buildings, as well as streetlights.

■ **TOP 22 5. Facilitate deployment of solar photovoltaic and solar thermal systems**

This action focuses on the regional deployment of solar electric photovoltaic (PV) which produces electricity, and solar thermal, which produces heat or hot water, for household, commercial, institutional, and industrial applications using energy from the sun. In 2011, the Region had well over 500 solar installations in place, mostly solar PV. Opportunities for deploying this technology using state tax incentives and subsidy programs are expected to continue; New York State has emphasized solar PV as a main renewable source for expansion under its Renewable Portfolio Standard (RPS), which sets a goal to increase renewable electricity sources to 30 percent by 2015. Solar energy can lower the costs of heating and electricity in homes and businesses, reduce the use of fossil fuels which may rise in cost, and lower greenhouse gas emissions. Deployment of solar PV and solar thermal systems can be enhanced by launching community "solarize" campaigns to aggregate purchase and installation of solar systems, attract leasing companies, and bring down the cost of individual systems. Also, there is potential for increasing local jobs in solar businesses related to installations, potentially 55 jobs over 20 years if deployed aggressively region-wide to expand capacity from the current 4 MW to 110 MW, supplying 2% of regional electricity use at today's consumption rate, within twenty years. This equates to doubling solar capacity approximately every four and a half years.

■ 6. Study and facilitate mid-scale wind projects

This action is to conduct a detailed study of the wind resource to determine micro wind climates that would support mid-scale wind. Mid-scale, or community-scale, wind turbines produce at least 100 kilowatt (kW). The analysis would include information on distinct wind power classes, electricity infrastructure, utility boundaries, and certain physical or population constraints. This would allow for accurate scoping of potential deployment and energy generation. Site-specific feasibility studies will be required to determine exact placement of wind turbines, at any scale, plus funding availability for larger scale projects. This action focuses on mid-scale wind, since large-scale industrial wind farms will generally be feasible as private-sector initiatives if the federal production tax credits are continued. It is proposed that two initial wind turbines be piloted in the Region; one on a farm and one on municipally-owned land so as to demonstrate application differences and similarities. One source of funding that might be available for a farm-based turbine pilot is through USDA renewable energy incentives.

■ 7. Facilitate deployment of demonstration anaerobic digester systems

This action is to encourage the widespread adoption of anaerobic digesters, especially on farms. Anaerobic digestion of animal manure produces biogas, including methane gas, which can be used to fuel an engine generator or turbine to generate electricity and heat. As with mid-scale wind, the pilot deployment of a few digester systems, accompanied by case studies of the projects, could serve as the basis of education and outreach for this program. Additionally, a “community anaerobic digester” could be developed, in which an industrial facility in a rural community takes on some of the cost and operations of the facility, instead of an individual farmer. Nearby farmers could bring waste (manure) to fuel the digester. Chobani Yogurt in Chenango County is in a prime location to take advantage of this opportunity, using both farm waste and dairy manufacturing waste to fuel electricity production for the yogurt plant and the community.

It is estimated that there is the potential for 31 anaerobic digesters in the Southern Tier that could produce between 19,000 MWh and 70,000 MWh of electricity per year, while reducing methane emissions and groundwater pollution.

■ 8. Facilitate deployment of geothermal heat pump systems

This action is to encourage the widespread adoption of geothermal heating systems in the Region. Geothermal heat pump (GHP) systems utilize the constant temperature of the ground to pre-heat or pre-cool fluid (air, liquid, or anti-freeze) to reduce HVAC energy requirements. Geothermal heat pumps require boring holes in the earth for vertical systems, or digging trenches for horizontal systems, and require specialized contractors to design and install. Because geothermal heat pump systems can be deployed almost anywhere, there is potential to decrease heating and cooling energy requirements substantially, especially in new residential and smaller commercial buildings. Increased education about the technology and access to low cost financing can help defray high initial costs. NYSERDA offers financing assistance for geothermal heat pumps through the New Construction Program for commercial/industrial businesses and residential incentive programs. Although not currently cost-competitive with natural gas, geothermal can be a dependable solution for rural residents and business owners to decrease their dependency on oil, propane, or electric systems.

■ 9. Explore transitioning existing power and thermal generation facilities to more sustainable fuel

This action strives to keep existing power plants in the Region viable into the future by exploring transitioning the fuel source to renewable resources. Aging coal-fueled power plants are struggling to maintain operations, with shutdowns occurring and municipalities that rely on those job and tax generators facing potential fiscal challenges. While the transition away from coal power supports sustainability goals for the Region, the loss in economic value from lost employment and lost tax revenues will hurt the Region. Keeping these facilities in production provides a means of local energy generation that may relieve brownout situations and adds a measure of diversity in the power mix while transitioning to renewable sources.

One way to preserve these benefits would be to transition these facilities to more sustainable fuels, beginning with co-firing using biomass or industrial by-products, which are plentiful in the Region. The region could also support efforts in the New York State legislature to provide tax credits and other relief for conversion of these plants.¹ The Region can also support the transition of fossil-based thermal energy facilities toward the use of renewable fuels and more efficient combined heat and power operations. These goals are described in more detail below, under specific actions in support of biomass, district heating, and CHP.

■ **TOP 22 10. Facilitate use of biomass for heating**

Many homes and businesses in the Southern Tier rely on high-cost and high-emissions sources of heat, such as fuel oil, propane, and coal. This is particularly true in the rural areas of the Region that are not served by natural gas. By switching to local biomass – wood and fast-growing renewable crops – residents and businesses could potentially obtain heat at reduced prices, create jobs, and increase income in rural areas. Using locally-sourced biomass for heating fuel builds the rural, agricultural economy and keeps money in the Southern Tier rather than sending it out of the Region to purchase fuels sourced elsewhere. Another benefit of utilizing biomass is that it has tremendous potential to reduce GHG emissions when used in lieu of conventional fossil fuels, as long as the biomass is sourced responsibly. By coordinating the efforts of Cooperative Extension, area nonprofits, equipment dealers, and installation contractors, consumers and facilities managers can be educated about the benefits and savings from installing biomass boilers in residential, commercial and institutional heating.

New England Wood Pellet LLC in Delaware County is the largest biomass wood pellet manufacturing facility in the Northeastern U.S., and produces enough renewable energy pellets annually to heat 25,000 homes and businesses.

■ **TOP 22 11. Study feasibility of combined heat and power in private development projects and public facilities**

Combined heat and power (CHP), also known as co-generation, is an innovative technology which increases energy efficiency at existing electricity generating or steam/hot water facilities which generate energy on site. In these facilities, the “waste” heat from the combustion process to produce electricity is captured and utilized. In this way, electricity and thermal energy are produced from a single fuel source, resulting in significant efficiency improvements, energy savings, and emissions reductions. According to the EPA, a 5 MW natural gas-fired CHP system produces just half the GHG emissions of a separate heat and power system. While CHP systems are often fueled by natural gas, they can also be installed as biomass systems. Combined heat and power is an economical way to reduce the primary energy consumption and GHG impact of existing industrial, commercial, agricultural, and government facilities, while also reducing the impacts from energy demands associated with new development in the Region. According to the DOE, “packaged CHP systems” integrated into commercial buildings can offer up to a 40 percent improvement in building efficiency over conventional heating systems. In addition to the GHG emissions benefits and cost savings, CHP systems can increase power reliability, enhance power quality, and increase operational efficiency.

The Arnot Ogden Hospital in Elmira has integrated CHP technology into its facility, and is serving as a model for Cayuga Medical Center that is currently investigating transitioning its energy plant.

⁴ Sen. George Maziarz, R-Newfane, Niagara County, outlined a series of bills he plans to pursue during the next legislative session, including one that would allow plant operators to take a 12.5 percent tax credit if they upgrade their facility to comply with environmental standards laid out in the state’s new power-plant siting bill. The planned bills also would change the state’s Regional Greenhouse Gas Initiative program, allowing plants to take money they pay for carbon credits and use it to transition to renewable energy or a cleaner fuel. As it stands, that money is earmarked to promote green energy investments in New York.

Local governments and regional agencies could establish a program to evaluate the economic feasibility of adding CHP to facilities that are directly under government control, including identifying target facilities, guidelines for screening facilities, and guidance for evaluating economic feasibility. CHP projects typically require multiple layers of approvals such as electric utility interconnection, natural gas connection and supply, construction and operating approvals, and permit requirements. Local governments can develop model procedures and schedules and facilitate information exchange among all of the economic and regulatory stakeholders. The Southern Tier can also support CHP development by promoting the inclusion of CHP as a covered technology for local option property tax exemption.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
1. Promote energy efficiency and renewable energy in residential and commercial buildings Top 22				
397,000 metric tons of carbon dioxide equivalent (MTCO ₂ e)	<ul style="list-style-type: none"> - Produces an estimated 232 jobs - Supports workforce development in energy industries - Reduces energy use and costs in buildings 	The New York Energy Smart Communities. CCE of Tompkins County's Retrofit Program Marketing Model has now achieved the highest retrofit rate in the state. Binghamton's Green Jobs Revolving Loan Fund provides money for energy efficiency retrofits in local homes.	Sufficient funding and resources for initiative; Needs champion to effectively address needs; High initial investment costs for some energy measures	NYSERDA, CCE, community groups, businesses, neighborhood organizations, job training and economic development organizations, energy contractors and products
<p>The short term target (#1a) associated with this action is to reduce on-site building fuel and electricity consumption by 10 percent in the residential and commercial sectors and 7.5 percent in the industrial sector. The long term target is to reduce on-site building fuel and electricity consumption by 40 percent in the residential and commercial sectors and 30 percent in the industrial sector.</p> <p>Commercial and residential buildings account for 34 percent of the Southern Tier's regional GHG emissions. Supported by other energy efficiency actions, this action's GHG reduction will provide 75 percent progress toward the long term sustainability target of reducing onsite fuel and electricity consumption in residential and commercial buildings by 40%. Assuming that 2 percent of the residential and commercial building stock is retrofitted annually through energy efficiency programs, and these improvements result in a 30 percent reduction in energy consumption, this action will reduce GHG emissions by an estimated 397,000 MTCO₂e, or 12.5 percent of the Plan's estimated GHG reduction benefits. This action is supported by actions 2 and 3, as well as related energy workforce development actions.</p>				
2. Develop a regional energy roadmap Top 22				
This action has high potential for overlap with other measures, so its benefits cannot be quantified separately	<ul style="list-style-type: none"> - Potential energy savings - Analysis to identify feasibility of each renewable energy technology 	Tompkins County's Energy Roadmap is in development and will provide an example of such an analysis from the Region.	Substantial staff time or volunteer efforts; outlay of funds for technical experts to complete analysis and develop the roadmap	NYSERDA, the U.S. Department of Energy, Cornell University, Utility companies
The target associated with this action is #1a; see action 1 above. While no immediate reductions in GHG emissions will be achieved by completing this project, a more detailed understanding of the energy demand and renewable				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>supply potential in the Region is key to determining the most effective and efficient means of meeting the Southern Tier’s long-term energy goals. This action supports the GHG reduction benefits under action 1.</p>				
<p>3. Explore and create financing options for renewable energy and energy efficiency systems Top 22</p>				
<p>This action has high potential for overlap with other measures, so its benefits cannot be quantified separately</p>	<ul style="list-style-type: none"> - Reduce long-term energy costs - Encourage the adoption of energy efficient practices 	<p>Alternatives Federal Credit Union; Finger Lakes Climate Fund; Financing through NY State’s Green Jobs Green NY and On-Bill Financing; Binghamton’s Green Jobs Revolving Loan Fund</p>	<p>Educating government officials on financing issues; building community support for investments which may not result in immediate savings; identifying funding to capitalize a loan program and/or hire experts to advise</p>	<p>Community banks, Southern Tier REDC, county financing authorities, NYSERDA, Community Development Financing Institutions, energy-related businesses, and private foundations</p>
<p>The target associated with this action is #1a; see action 1 above. While no immediate reductions in GHG emissions will be achieved by this action alone, the financing and education programs will support the GHG reduction benefits under action 1 as well as several other renewable energy actions. Increasing access to low-cost capital to encourage homeowners and businesses to invest in increasing efficiency of buildings and offsetting some non-renewable energy use with renewables will lead to reduced GHG emissions. If the financing mechanisms are implemented strategically, where the funding is renewed through revolving loan mechanisms, the funding should be available for the long term.</p>				
<p>4. Assess energy performance, implement, and monitor energy efficiency upgrades in government and municipal facilities</p>				
<p>85,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Produces an estimated 60 jobs - Reduces energy use & GHG in municipal buildings - Reduces energy costs 	<p>Performing comprehensive energy audits of major municipal buildings</p>	<p>Lack of understanding of energy performance contracting and energy auditing of municipal buildings</p>	<p>Local and state governments, and Regional agencies</p>
<p>The targets associated with this action are #1a (see action 1 above) and #18, to increase the number of certified Climate Smart Communities to 25 percent of counties and 12.5 percent of municipalities in the short term and 100 percent of counties and 50 percent of municipalities in the long term. This analysis assumes that governments in the Region will lead the way on energy efficiency, with 80 percent penetration in government facilities over 20 years (either retrofits or new energy efficient construction), 35 percent reduction in energy used in government buildings, and 30 percent reduction in energy used in street lighting. This action will reduce GHG emissions by an estimated 85,000 MTCO₂e, or 2.7 percent of the Plan’s estimated GHG reduction benefits. It will also provide education and help complete the requirements for participating communities to become certified Climate Smart Communities.</p>				
<p>5. Facilitate deployment of solar photovoltaic and solar thermal systems Top 22</p>				
<p>31,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Produces an estimated 439 jobs - Produces energy 	<p>Solarize Madison in Madison County, NY</p>	<p>Initial high cost of solar installation; lack of community</p>	<p>Regional planning and development</p>

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
	<ul style="list-style-type: none"> - Brings down operation costs by producing electricity at peak times (the day) 		awareness of the value of solar systems; difficult to understand purchasing options, economics, technology, and site requirements ; lack of large industries and buildings limit large scale applications of solar PV	boards, Cornell Cooperative Extension, NYSERDA Energy Smart coordinators, non-profits, local governments, universities, and schools.
<p>The target associated with this action is #1a (see action 1 above). Replacing both electricity and heating fuels with solar PV and solar thermal supports this goal of reducing non-renewable energy use. Increasing regional capacity from the current 4 MW to 110 MW-DC within 20 years will represent about two percent of baseline energy consumption in the Region. This is a 27-fold increase over today’s capacity, and is equivalent to doubling capacity every 4.8 years, or adding 5.5 MW-DC of capacity each year, on average. This is equivalent to about 14,600 installations of today’s average size project. The resulting capacity will result in avoided annual GHG emissions of approximately 31,000 MTCO₂e, or 1 percent of the Plan’s estimated GHG reduction benefits.</p>				
<p>6. Study and facilitate mid-scale scale wind projects</p>				
30,000 MTCO ₂ e	<ul style="list-style-type: none"> - Produces an estimated 22 jobs - Adds renewables to the overall energy portfolio - Serves to demonstrate different applications of wind power 	Measure wind speeds in specific target areas. Install pilot rural farm-based wind turbine (using USDA incentives) and community-based wind.	Renewable energy technologies continue to be more expensive than fossil fuel technologies	Local governments, Regional agencies, Farmers
<p>The target associated with this action is #1a; see action 1 above. If 2.5 MW of new wind capacity are added each year (the equivalent of five systems rated at 500 kW each year) over 20 years, the resulting 50 MW of new wind capacity will result in avoided annual GHG emissions of approximately 30,000 MTCO₂e, or <1 percent of the Plan’s estimated GHG reduction benefits.</p>				
<p>7. Facilitate deployment of demonstration anaerobic digester systems</p>				
81,000 MTCO ₂ e	<ul style="list-style-type: none"> - Produces an estimated 5 jobs - Provides a renewable energy source right on the farm 	Potential for 31 feasible digesters (farms w/over 500 cattle or 2,000 swine)	Lack of understanding of the technology; high upfront costs for individual farmer	Farmers, Cooperative Extensions, Local governments
<p>The primary target associated with this action is #1a; see action 1 above. Based on an estimated regional population of 76,000 cattle, about 60 anaerobic digesters installed on the largest farms in the Region could generate between 19,000 and 70,000 MWh of electricity per year, and 7,200 tons of methane can be avoided. Not all systems will be implemented, as it may not be economical at smaller farms. This analysis assumes a midpoint value of 45,000 MWh maximum potential for each farm, and that only 50 percent of the capacity is installed. If half of the Region’s potential is implemented, GHG emissions will be reduced by an estimated 81,000 MTCO₂e, or 2.5 percent of the Plan’s estimated GHG reduction benefits. The benefits will be a result of avoided methane</p>				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>emissions (76,000 MTCO₂e) and electricity generation (5,000 MTCO₂e). By reducing farmers energy costs, this will also help achieve target 9: To increase cash receipts from farm marketings in the short term to \$417 million and in the long term to \$497 million.</p>				
<p>8. Facilitate deployment of geothermal heat pump (GHP) systems</p>				
<p>166,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Produces an estimated 30 jobs - Adds renewables to the overall energy portfolio - Long-term payback is substantial 	<p>NYSERDA New Construction Program (NCP) and others offer financing for GHP for commercial/industrial businesses and residential programs.</p>	<p>High cost of installation, confusion over suitability of resource in the Southern Tier</p>	<p>Local governments, Businesses, Homeowners</p>
<p>The target associated with this action is #1a; see action 1 above. Assuming that GHP systems treating 800,000 square feet of building area are installed annually over 20 years, the total emissions reduced is estimated to be 166,000 MTCO₂e, or 5 percent of the Plan’s estimated GHG reduction benefits. This is equivalent to 200 homes and 50 small commercial projects, and 1 large commercial or institutional project of 100,000 square feet each per year.</p>				
<p>9. Explore transitioning existing power and thermal generation facilities to more sustainable fuel</p>				
<p>46,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Reduces emissions and energy use - Lowers costs - Supports local fuel sources 	<p>Arnot Ogden Hospital in Elmira installed a biomass-fueled heating plant, paid for entirely out of savings. Cayuga Medical Center is investigating a similar system.</p>	<p>Difficult to identify sufficient amounts of consistently available non-fossil fuels to supply needs of large scale generators</p>	<p>Institutions, Businesses, Utility companies, Industry, Counties</p>
<p>The target associated with this action is #1a; see action 1 above. Assuming no overall change in total energy consumption, if 50 percent of current coal consumption was replaced by either combustible waste or biomass, emissions would be reduced by 562,000 MTCO₂e for combustible waste or 992,000 MTCO₂e for biomass. Assuming a mix of both, emission reductions here have been estimated using the average of those two figures, at 777,000 MTCO₂e. These Scope 1 emissions from electricity generation are not included in the Region’s baseline inventory, so these reductions cannot be credited to the Region’s baseline.</p>				
<p>However, because this would reduce overall grid emissions, some part of this benefit can be applied to the emissions associated with the Region’s electricity consumption. This action would reduce emissions from electricity generation in the New York Upstate subregion by about 4 percent, thereby reducing emissions intensity of electricity consumption by 4 percent. In total, actions quantified in this plan would reduce baseline electricity consumption of 6,815 gigawatt-hours (GWh) by 24 percent to 5,187 GWh. Applying this 4 percent reduction to the revised electricity consumption yields 46,000 MTCO₂e of reductions to the Region’s baseline emissions, or 1.5 percent of the Plan’s estimated GHG reduction benefits.</p>				
<p>10. Facilitate use of biomass for heating Top 22</p>				
<p>398,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Job creation due to pellet production - Energy production - Farm and forest harvesting 	<p>New England Wood Pellet LLC in Delaware County is the largest biomass wood pellet manufacturing facility in the Northeastern U.S and</p>	<p>Developing the infrastructure to coordinate forest and crop landowners; building awareness and</p>	<p>Cornell Cooperative Extension, regional planning boards, local governments,</p>

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
		produces enough energy pellets annually to heat 25,000 homes and businesses. They have opened a second plant in Schuyler County.	acceptance of biomass-fueled heating systems to build market demand	NYSERDA, wood pellet manufacturers, major institutions (such as hospitals and schools), farmers, rural landowners
<p>The primary target associated with this action is #1a; see action 1 above. Currently, about 62 percent of the Region’s households use natural gas or electricity for space heating; 31 percent use fuel oil, propane, and coal; and 7 percent use wood. With a regional biomass initiative to encourage the use of locally-sourced biofuels, reaching total market share of 20 percent would require about 33,000 homes in the Southern Tier to switch from oil, propane, or coal to biomass. Combined with similar fuel switching in the commercial and industrial sectors, total regional emissions would be reduced by an estimated 398,000 MTCO₂e, or 12.5 percent of the Plan’s estimated GHG reduction benefits.</p> <p>This will also help achieve target 9: To increase cash receipts from farm marketing in the short term to \$417 million and in the long term to \$497 million, although the specific amount cannot be quantified for this action.</p>				
<p>11. Study feasibility of combined heat and power in private development projects and public facilities</p>				
37,000 MTCO ₂ e	<ul style="list-style-type: none"> - Produces an estimated 79 jobs - Expands CHP opportunities and jobs region wide - Provides more efficient fuel use and more reliable electric production 	Downtown Elmira Revitalization Plan, Ithaca Downtown Commons redevelopment, City and Town of Ithaca Emerson Power Transmission brownfield redevelopment	Not widespread understanding or knowledge of the technology; require significant upfront expenditures; balancing peak heating needs which occur in winter with peak electricity demand in summer can make it difficult to maximize efficiency	Regional agencies, universities, hospitals, industry, government, energy professionals, EPA Combined Heat and Power Partnership, DOE Northeast Clean Energy Activity Center, NYSERDA
<p>The primary target associated with this action is #1a; see action 1 above. There is a potential capacity of 324 MW of new CHP in the Region at over 700 sites, including industrial, commercial, government, and institutional facilities. CHP system benefits can vary widely from site to site, and can even increase net emissions in some scenarios, so care must be taken in site selection and design. Assuming that 50 percent of this potential is realized over the next 20 years, that those systems run 50 percent of the time, and that the observed reduction falls in the mid-point of the general range of benefits (23 percent reduction),² these new installations can reduce regional emissions by 37,000 MTCO₂e, or 1.2 percent of the Plan’s estimated GHG reduction benefits.</p>				

² “Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures,” p. 135. California Air Pollution Control Officers Association (CAPCOA), 2010.” Available online at: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.

TRANSPORTATION

The Southern Tier's transportation system connects extensive rural areas and six small cities. The Region is served by three interstate highways, a strong network of state and local roads, several freight railroads, and a variety of private and non-profit transportation providers. The Region is also served by multimodal options, including bus transit systems in each of its small cities, and a growing network of multi-use trails. These are primarily around the cities of Binghamton, Elmira and Ithaca, where the population densities are the greatest and where the Region's three metropolitan planning organizations (MPOs) are located.

The existing transportation system has the potential to become more dynamic, less energy intensive, and enhance the Region's quality of life. A host of integrated strategies can help achieve this. Rather than just a network of roads transporting people driving alone, this goal envisions a regional transportation network that encourages walking and biking as a primary mode of transportation, and where transit is readily accessible and inviting. This goal seeks to help overcome large demand and reliance on single occupancy vehicle travel and the associated impacts – GHG emissions, household transportation costs, and the public health implications of spending too much time in our cars.

Reducing the energy intensity of vehicles on Southern Tier roads through new vehicle technologies (e.g., hybrid or plug-in electric vehicles), or alternative fuels (e.g., biodiesel or natural gas) is an additional means of reducing energy and greenhouse gas emissions. Improved efficiency can also be achieved with dynamic, real-time information systems that allow travelers to make informed decisions about their routes or modes, as well as other intelligent transportation system innovations like signal timing or dynamic parking pricing. While not under the control of Southern Tier policymakers, increasing fuel costs over time will likely affect driving patterns and mode choice, and reduce GHG emissions.

- **TOP 22 12. Improve connectivity of pedestrian, bike, and transit routes, especially around downtowns, transit stops and schools**

Residents and community leaders throughout the Southern Tier have a strong interest in revitalizing existing downtowns, villages, and hamlets. Creating a well-connected network of bicycle and pedestrian trails and sidewalks will help create an improved downtown walking and biking environment. Providing opportunities for people to travel on foot or by bicycle leads to more vibrant business districts with less surface parking, more cohesive communities, and healthier residents. Increased physical activity can save hundreds of millions of dollars in health care costs³ while improving access to community resources for seniors and youth. Given that sidewalk construction accounts for approximately three percent of the overall cost of rehabilitating or constructing new buildings in downtown areas, and constructing bike lanes accounts for five percent of the overall cost of rebuilding or constructing new roads,⁴ investments in pedestrian and bicycle facilities are relatively small investments that yield significant benefits. A connected network of bicycle and pedestrian facilities can decrease vehicle trips and reduce associated GHG emissions. Through its impacts on community revitalization, this strategy, in combination with other revitalization action items, is likely to create additional jobs in the Region.

NYS DOT is completing preliminary design for the RT434 Greenway between downtown Binghamton and Binghamton University, while linking adjacent neighborhoods with parks, schools, shopping and new student housing. This is an integral connection in the Two Rivers Greenway in Broome County.

³ Bell, Kurt. "Physical Activity and the Intertwine: A Public Health Method of Reducing Obesity and Healthcare Costs," Jan. 21, 2011. Portland Metro.

⁴ Norm Steinman (Charlotte DOT) in a presentation for communities participating in the CDC's Communities Putting Prevention to Work program.

■ **TOP 22 13. Pilot opportunities for intercity bus service, expanded cross-regional transit, and rural on-demand transit**

The existing transportation system in the Southern Tier was not designed to solve 21st century problems such as GHG emissions, high fuel costs, an aging population, and high maintenance costs. Commute patterns are the single most important factor in fuel consumption, and private vehicle travel accounts for most trips taken in the Region. Many of these trips are single-occupancy vehicle (SOV) trips, so making public transportation a real and feasible option for people is needed. While the Region has transit that serves the cities and immediate environs of Binghamton, Elmira-Corning, and Ithaca, bus services between these cities is limited. There is an opportunity to explore and pilot programs to fill these transit gaps for inter-city, cross-regional, and rural on-demand transit trips.

■ **TOP 22 14. Expand Way2Go and other transportation demand management programs**

Transportation Demand Management (TDM) initiatives encourage employees to use public transit, van and carpools, bicycle, walk, or use other alternatives to driving alone to work. Currently 76 percent of workers in the Southern Tier drive alone to work; 19 percent walk, bike, carpool, or take transit. Local governments in the Southern Tier will work with the Way2Go program, other regional TDM initiatives, and 511NY Statewide TDM information system to enhance commute options, thus providing incentives for Southern Tier residents to decrease their daily car use, and particularly their use of single-occupancy vehicle (SOV) trips. Way2Go is a comprehensive information hub that seeks to increase transportation access, choice, equity, and sustainability in Tompkins County. The Way2Go program provides a ride- and information-sharing forum for people wanting to take trips within the county and to destinations beyond the county. By using the website, visitors can learn about and compare different ways to get around. Way2Go also provides transit information by phone or mail, conducts public workshops and events that increase awareness of available transportation options, and shares commuter tips online.

■ **15. Facilitate development and expansion of carsharing programs**

This action promotes the expansion of carsharing, which provides hourly rental of conveniently located cars to members on a reservation basis. The program provides members with self-serve access to a fleet of vehicles. Rate plans are available that fit different usage patterns. Vehicles are typically placed in high visibility areas, near transit and key destinations, and with a variety of car types (vans for families, cars with high MPG, trucks for hauling, etc.). Carsharing members are usually carless households, or families that share one car and occasionally need another one. Research by Philadelphia Carshare showed that each carsharing vehicle replaces approximately 15 private vehicles. Ithaca Carshare is planning a special subsidized plan to members with low-incomes, which will lower the membership costs by more than half. Furthermore, all vehicle locations are next to bus stops, providing compatibility with transit. The Ithaca Carshare program works with local transportation education programs and relevant agencies on outreach, promotion and education surrounding transportation costs and options.

Local options for expansion of successful programs include Ithaca Carshare, which provides members with hourly, 24/7 access to cars parked near neighborhoods and workplaces; Zimride which allows users to post and request rides to places; and VanShare.

■ **16. Update parking policies, codes, management plans, and pricing**

This action proposes that local governments and other institutions with land use authority, or that provide and manage parking, review and update a variety of policies and regulations that influence parking management. This review can assess the extent to which current parking policies may impact such issues as the number of parking spaces offered and utilized in garages, surface parking lots, and on the street; efforts to encourage walkable mixed-use communities; and the ability to achieve community goals to reduce fuel use. Such studies are generally best conducted at a district level. In addition to policy updates, employer subsidy policies such as

“parking cash out,” where commuters are provided cash incentives to take alternative modes of transportation in lieu of parking, can be used to reduce demand for parking.⁵ When free or inexpensive parking is offered, it can lead to overuse; if parking demand exceeds supply, the common phenomenon of “circling,” or looking for spaces, will occur and generate additional air pollution and congestion. Several recent studies show that “parking search” traffic accounts for between 30-45 percent of all traffic in downtown districts. Updating parking management strategies can encourage more efficient use of existing parking facilities, reduce parking demand and shift travel to non-SOV modes.⁶

■ **TOP 22 17. Encourage adoption of green fleet policies for public and private fleets**

Local governments, businesses, and agencies in the Southern Tier can develop policies to better utilize existing fleet vehicles and plan for future acquisitions to increase fuel economy, achieve long-term cost savings, and reduce emissions. These policies will need to be context-specific to ensure that agencies are still able to carry out their missions. For example, in the case of police departments, some patrols may require powerful vehicles, while transport of prisoners may be accomplished with hybrid vehicles. Establishing green fleet policies helps agencies plan for and prioritize their fleet investments over time, analyzing the benefits for each vehicle type and age, and developing incentives and budget allocations to transition to greener fleets as vehicles are replaced. Successful public agency investments in green fleets can test new options, helping commercial owners to understand and track the benefits of green fleet policies that can work in the private sector as well.

■ **TOP 22 18. Create a region-wide electric vehicle and alternative fuel infrastructure deployment plan**

The Southern Tier faces a multitude of challenges and opportunities with regard to transportation and its effects on GHG emissions, costs, and the ability of residents to get to work, services, and other activities. Because established land use patterns and infrastructure are oriented toward automobile use in much of the Region, and the majority of the population lives in low-density rural areas, options are needed to reduce the transportation sector’s impact on both household costs and the environment. This sector is a large consumer of energy and high emitter of GHGs in the Region, since many residents must travel long distances to reach employment, medical and other services, and amenities. Given that individual motorized transportation is the most common way for most Southern Tier travelers to reach their destinations, enhancing the energy efficiency of motorized vehicles is critical to reducing GHG emissions in the Region. Electric and alternative fuel vehicles can significantly reduce the use of fossil fuels and associated GHG emissions, particularly if the energy source is electricity derived from renewable sources. Electric vehicles are gaining some traction across the U.S. – there are currently more than 14,500 electric vehicle charging stations.⁷ The external factors that influence transportation choices, particularly gas prices, which are expected to rise, will likely support this action to expand electric vehicle and alternative fuel infrastructure across the Southern Tier. Even with increased vehicle fuel efficiency for conventional cars, many electric vehicles and alternative fuel vehicles are more efficient than traditional cars.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
12. Improve connectivity of pedestrian, bike, and transit routes, especially around downtowns, transit stops and schools Top 22				
14,000 MTCO ₂ e	- Increase physical activity level - Lower personal	City of Ithaca has new bike lanes and multi-use trails, installed over 100	Construction costs for bicycle and pedestrian facilities,	Municipal transportation planners, MPOs,

⁵ Shoup, Donald. Parking Cash Out, Report 532 (2005), <http://www.planning.org/apastore/Search/Default.aspx?p=2439>

⁶ Seattle Urban Mobility Plan. *Best Practices in Transportation Demand Management* (2008) <http://www.seattle.gov/transportation/docs/ump/07%20SEATTLE%20Best%20Practices%20in%20Transportation%20Demand%20Management.pdf>

⁷ US DOE, “Alternative Fueling Station Counts by State,” http://www.afdc.energy.gov/fuels/stations_counts.html.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
	transportation costs - Reduces emissions - increased mobility and access	bike racks, and is studying creating a network of “Bicycle Boulevards.” The City of Binghamton has completed on-road and off-road bicycle and pedestrian facilities. The Route 434 Greenway is in design to connect downtown Binghamton with Binghamton University and surrounding neighborhoods, schools, parks, and commercial districts.	public works personnel and planners do not always know the specifics of why walkers and bikers do not take certain routes; In parts of the Southern Tier, established land use patterns and infrastructure are oriented toward automobile use, not walking, biking or transit	regional planning agencies, local land use planners, school districts, transit operators, walkers and bikers in a community

The primary target (#3) associated with this action is to increase the percentage of workers commuting via walking, biking, transit, and carpooling to 21 percent in 5 years and 28 percent in 20 years. Enhancing options for commuting to work, combined with an increase in housing units in downtown and priority development areas, will likely result in mode shifts to more sustainable forms of transportation. Based on a 1 percent reduction in vehicle miles traveled (VMT) in the Region’s cities and villages, this measure will reduce regional emissions by 14,000 MTCO_{2e}, or 0.4 percent of the Plan’s estimated GHG reduction benefits

In addition, this action will help achieve the target (#4a) of decreasing estimated annual gasoline sales by 2.5 percent in 5 years and 40 percent in 20 years; and (#5a) increasing the proportion of Southern Tier residents living in existing cities and villages to 40 percent in 5 years and to 45 percent in 20 years. The analysis assumes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the Region’s population will live in cities and villages.

13. Pilot opportunities for intercity bus service, expanded cross-regional transit, and rural on-demand transit Top 22

81,000 MTCO _{2e}	- Increased access to jobs and schools - Expand transit use and efficiency of existing routes; - Improve commuter productivity with amenities (high-speed Wi-Fi, etc.)	Ithaca College allows students to purchase bus passes for a discounted price. Cornell University provides a popular charter bus to New York City that services all members of the community. This service could be replicated by the private sector to provide bus trips to major east coast cities, increasing the demand for bus service. Conduct a regional transportation study to understand how and	Geographic breadth and low density of development makes transit operations expensive; significant funding cuts to MPOs and public transit systems; public perception with many Southern Tier residents having little to no experience with utilizing transit	MPOs, public transit providers, universities, major employers, private regional transportation services, government agencies working to coordinate services for seniors, and environmental groups.
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GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
		where residents travel across the region		
<p>The targets associated with this action are #3, #4a, and #5a, see action 12 above. Based on a 5.9 percent reduction in vehicle miles traveled (VMT) in the Region’s cities and villages, where higher population densities are more likely to utilize expanded transit, this action will reduce regional emissions by 81,000 MTCO₂e, or 2.6 percent of the Plan’s estimated GHG reduction benefits. It also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the Region’s population will live in cities and villages.</p>				
<p>14. Expand Way2Go and other transportation demand management programs Top 22</p>				
22,000 MTCO ₂ e	<ul style="list-style-type: none"> - Support more frequent and regular use of transportation options - Lower personal transportation costs 	<p>Broome-Tioga GreenRide is a free, internet-based rideshare matching service that helps commuters find carpool partners. Ithaca Rideshare is a similar program offered in Tompkins County. The Way2Go program provides a transportation information hub and forum for Tompkins county residents</p>	<p>Communicating effectively about TDM programs and transportation choices with different audiences across a large rural region; getting accurate information to people in ways that are convenient, understandable and lead to action; operational funding for TDM program management and marketing</p> <p>Low congestion levels on area roads are conducive to single occupancy vehicle trips</p>	<p>Region’s three MPOs, Way2Go operators, other TDM programs, NYSDOT, 511NY, rideshare and car share organizations, transit operators, regional planning agencies</p>
<p>The targets associated with this action are #3, #4a, and #5a, see action 12 above. Based on a 3.1 percent reduction in vehicle miles traveled (VMT) associated with commuting, this action will reduce regional emissions by 22,000 MTCO₂e, or 0.7 percent of the Plan’s estimated GHG reduction benefits.</p>				
<p>15. Facilitate development and expansion of carsharing programs</p>				
8,000 MTCO ₂ e	<ul style="list-style-type: none"> - Provides members with hourly, 24/7 access to cars parked near neighborhoods and workplaces - Reduces fuel use 	<p>Zimride which allows users to post and request rides to places; Ithaca Carshare</p>	<p>Insurance can be a difficult issue to overcome, and obtaining dedicated parking spaces near neighborhoods can take time</p>	<p>Local governments, MPOs, Universities, Non-profits</p>
<p>The targets associated with this action are #3, #4a, and #5a, see action 12 above. Based on a 0.55 percent reduction in vehicle miles traveled (VMT) in the Region’s cities and villages, this action will reduce regional emissions by 8,000 MTCO₂e, or 0.01 percent of the Plan’s estimated GHG reduction benefits.</p>				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
16. Update parking policies, codes, management plans, and pricing				
55,000 MTCO ₂ e.	<ul style="list-style-type: none"> - Encourages walkable mixed-use communities - Reduces fuel use 		Creating policies, codes and plans takes time and community will and require resources for implementation and enforcement	Local governments
<p>The targets associated with this action are #3, #4a, and #5a, see action 12 above. Based on a 4 percent reduction in vehicle miles traveled (VMT) in the Region’s cities and villages,⁸ this measure will reduce regional emissions by 55,000 MTCO₂e, or <2 percent of the Plan’s estimated GHG reduction benefits. It also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the Region’s population will live in cities and villages.</p>				
17. Encourage adoption of green fleet policies for public and private fleets Top 22				
262,000 MTCO ₂ e Includes action 18	<ul style="list-style-type: none"> - Reduce fossil fuel consumption - Increase awareness of alternative fuel vehicles 	Tompkins County passed a resolution requiring all County departments with vehicle fleets to adopt a combination of strategies to reduce GHG emissions	Cost, administration, and duplicative fleets across jurisdictions; aligning policies with budget for implementation	Regional agencies, local governments with vehicle fleets, school districts, transit operators, universities, and large employers
<p>The primary target associated with this action (#4a) is to reduce estimated annual gasoline sales by 2.5 percent across the Region in 5 years and by 40 percent in 20 years. Reducing consumption of gasoline by municipal and other fleet vehicles will be a significant contribution to reaching this goal. In addition, this action will help achieve the target (#18) of increasing the percentage of certified Climate Smart Communities to 25 percent of counties and 12.5 percent of municipalities in 5 years and to 100 percent of counties and 50 percent of municipalities in 20 years.</p> <p>If 10 percent of the Region’s vehicle miles traveled (VMT) is shifted from conventional vehicles to electric vehicles over 20 years, this measure will reduce regional emissions by 262,000 MTCO₂e, or 8 percent of the Plan’s estimated GHG reduction benefits. This calculation is based on the mid-point value of performance of electric vehicles currently on the market. The reduction was calculated based on the difference between 10 percent of current on road emissions and the emissions associated with the electricity requirement to meet 10 percent of VMT.</p>				
18. Create a region-wide electric vehicle and alternative fuel infrastructure deployment plan Top 22				
262,000 MTCO ₂ e Calculated with and included in action 17	<ul style="list-style-type: none"> - Reduce fossil fuel consumption - Increase awareness of alternative fuel vehicles 	There are currently three localities in the Southern Tier with electric vehicle charging stations – Horseheads (Elmira),	Lack of regional (and national) infrastructure to support alternative vehicle use	MPOs, regional planning and development boards, county governments,

⁸ Ibid, p. 213.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
		Ithaca, and Vestal (Binghamton). In 2012, NYSERDA provided \$228,000 to the City of Rochester to install 24 charging stations, ⁹ and the New York State Department of transportation has a CNG fueling station in Binghamton that operates 24 hours per day. ¹⁰		NYSDOT, NYSERDA
The targets associated with this action are #4a and #18; see action 17 above. The GHG reduction benefits were calculated in conjunction with action 17.				

⁹ Adams, Thomas, "Rochester Gets Money for Electric Car charging Stations," *Rochester Business Journal*, June 6, 2012, <http://www.rbj.net/article.asp?aID=191489>

¹⁰ FindTheData, "Clean Energy – New York State Department of Transportation in Binghamton, NY – Alternative Fuel Station," <http://alternative-fuel.findthedata.org//4441/Clean-Energy-New-York-State-Department-of-Transportation-Binghamton-NY>.

LAND USE AND LIVABLE COMMUNITIES

Livable communities are compact, walkable, mixed use neighborhoods, with a variety of housing types, commercial and community services, employment opportunities and transportation choices. These areas also enhance economic competitiveness, coordinate and leverage federal policies and investments, and value neighborhoods and the people in them.

Transforming existing historic downtowns into vibrant areas with multiple transportation options through place-making initiatives and mixed-use development will be important for both economic growth and creating livable communities that retain residents and workers. It can also help achieve social, environmental, economic, and fiscal sustainability. The Region has suffered from sprawling development patterns, spurred not from population growth, but from a variety of public policy, planning, zoning, and private investment decisions. By reversing this trend, cities and villages can once again become the centers of economic and social activity.

■ **TOP 22** 19. Encourage development and strategic investment in cities, villages, and hamlets

Many Southern Tier cities, villages, and hamlets were built more than a century ago to meet the needs of a mostly pedestrian population. These communities have downtown and main street areas that were built before automobile travel. The Southern Tier's six cities and 59 villages mostly have historic Main Streets and commercial districts adjacent to compact neighborhoods. These communities have two key ingredients necessary to support a livable community: walkable centers and a mix of land uses. Developing in existing population centers capitalizes on existing public and private investments in water and sewer infrastructure; streets, sidewalks and highways; and houses, businesses, schools, and services.

Revitalization of downtowns and main streets will have a direct impact on expanding economic opportunities. Enhancing core areas helps support new housing and economic opportunities and expanded transit, walking, biking, and carpooling choices. Cost savings are key benefits to developing and investing in cities, villages, and hamlets. Developers may save as the cost of developing housing, on a per unit basis, can be significantly less than in rural and suburban areas. Residents of downtowns and main street areas also spend less than their rural counterparts on transportation. In addition, this strategy will support reduction of public costs to taxpayers, as the cost of maintaining infrastructure in a relatively smaller area is spread over more customers in denser developed areas. Implementing this action may yield jobs, particularly in the construction and transportation sectors.

Binghamton Downtown, Inc surveyed County residents to determine why people visit downtown, what improvements they would like to see, and what currently prevented them from enjoying downtown Binghamton. The survey showed significant interest in walking trails and more outdoor cafes, as well as the draw of events at downtown venues.

The Downtown Ithaca Alliance has created a Downtown 2020 Plan that imagines ways to encourage greater transportation choices and increase housing density

■ 20. Provide gap financing for community revitalization projects

This action will support implementation of the Southern Tier Community Revitalization Project, as identified in the REDC Plan. It will provide "gap financing" for private sector redevelopment of key buildings, infill of new buildings, and development of the Region's downtowns, neighborhoods and rural population centers, which will particularly benefit those communities damaged by recent floods. The project will allow each community to identify its own place-based priorities, and to structure projects to support unique local needs in targeted areas (near transit, schools, historic centers) and places that are supported by local comprehensive plans. Examples include student housing in downtown Binghamton, the Windsor Whip Factory redevelopment, and redevelopment projects in downtown Ithaca. The objective is to use both state and federal public investments

as secondary financing tools for specific downtown and community neighborhood revitalization projects. Projects will need to have a financing strategy and demonstrate the greatest potential to leverage public funds and non-profit resources, attract and sustain both short-term and long-term private capital, and catalyze further development. Revitalization projects will create quality space for commercial development and entrepreneurial enterprises and additional residential housing options, while building on existing infrastructure and housing stock with upgrades and new construction in keeping with the downtown and neighborhood character. While enhancing the tax base overall, the initiative will recapture the value of neighborhoods with underutilized or deteriorated public assets. It will also respond to recent natural disasters that have severely impacted the sustainability of many downtowns.

■ **21. Support development in downtown areas at appropriate densities**

Building density in downtown areas helps build vital communities while providing housing options for an aging population and a younger workforce. Additionally, it is more efficient to develop in areas where infrastructure already exists, so it makes economic sense. Currently, the Tompkins County Industrial Development Agency (IDA) and the City of Ithaca are streamlining the city's downtown density incentive policy. Under the existing policy, the IDA has provided incentives to six downtown projects, which have invested \$71 million and added 477,450 square feet of retail, commercial, office, and residential space. The revised policy will make it easier for companies to take advantage of this incentive and provide economic benefits to the city. Implementing density incentives throughout the Region could improve the local business environment and attract businesses and residents into urban centers.

■ **22. Support redevelopment of strategic sites and vacant properties**

The Southern Tier Community Revitalization Project, discussed above, is intended to fund projects that use coordinated partnerships to provide improved and diverse downtowns with housing, commercial, and retail opportunities, and public spaces to enhance neighborhoods. For vacant and brownfield sites in downtowns, design standards and "development-ready" improvements can enhance properties and decrease the negative impacts they have on the surrounding community. Even temporary site improvements such as fences, signs, landscaping or artistic installations can enhance the appearance of vacant properties while alerting the community that they may be available for development. Cities and villages can also work with developers to address potential contamination and liability issues to incentivize development. The redevelopment of these strategic sites can result in job creation and poverty reduction. Planning for multiple sites in a single neighborhood can have more impact; examples include the City of Binghamton's First Ward neighborhood Brownfield Opportunity Area (BOA) and the North Chenango Corridor BOA.

■ **TOP 22 23. Update local land use regulations and design codes and provide technical assistance to implement projects**

Livable communities are compact and walkable places with mixed-use neighborhoods offering a variety of housing types, commercial and community services, employment opportunities, and transportation choices. Updates to land use and development regulations are critical for focusing future growth in priority development areas to support livable communities. Creating an updated set of codes that is easy to use and

REDC Strategy 5: Shovel Ready Site Development Project. See the REDC Plan for more information:
<http://regionalcouncils.ny.gov/content/southern-tier>

understand and provide clear direction to developers about community needs and desires can reduce concerns about potential impacts of development. Southern Tier villages and hamlets often have limited access to planning and implementation resources to update their codes. There are many successful examples of small communities around the country using updated land use regulations and other programs to support desired development patterns. Form-based codes, smart design standards, and transit-ready street improvements will make the Region's villages and hamlets more walkable, livable, and ultimately sustainable.

Southern Tier governments and agencies can develop a technical assistance program and toolkit of resources that consider and incorporate the unique architectural characteristics, culture, and history of the communities in the Region. With multi-jurisdictional collaboration and pooled resources, the Southern Tier can promote walkable land use patterns in hamlets and villages and enhance economic competitiveness.

■ **24. Assess affordable housing needs and identify target areas for rehabilitation and new construction**

This action would develop a strategic needs assessment for housing rehabilitation and new construction, at either the county or regional level. Mapping existing housing needs and identifying key data, including age of housing stock, household income, occupancy, overcrowding, severe housing conditions, and type of housing, can help identify target areas. Once these elements are mapped, clusters may emerge of low-income communities with substandard housing. These clusters can then be evaluated against planning criteria (e.g., priority city, village, and hamlet development areas, transit service and basic infrastructure) so that investment in these units correspond to the community's overall planning objectives. Calculating the long-term household savings from energy- and location-efficiency may also be important in order to underscore the need for these elements in housing development.

The development of energy-efficient affordable housing at Breckenridge Place in downtown Ithaca exemplifies key livability principles. The development will be LEED-certified, adjacent to transit, and affordable to Ithaca residents with a wide range of incomes.

■ **TOP 22 25. Provide financial and technical assistance to rehabilitate housing for low-to-moderate-income households**

The housing stock in the Southern Tier is aging. Nearly 60 percent of all housing units were built before 1960, which means that they were constructed before building codes that take energy efficiency considerations into account were commonly implemented and enforced. Not surprisingly, many of these units need significant repairs and upgrades to bring them up to code, and even more investment is required to enhance their energy efficiency.

Many low- and moderate-income households lack the funds needed to enhance their homes' energy efficiency, yet would benefit significantly from reduced energy costs that will result from these energy efficiency upgrades. This action focuses on the rehabilitation of small single-family homes, manufactured housing, and 2-4-unit multifamily properties. Subsidy programs for these upgrades should have clearly stated, overarching goals such as reducing energy consumption by a specific percentage or rehabilitating a certain number of units to a specific standard, and should be flexible enough to accommodate a variety of eligible types of housing, rehabilitation activities, and construction materials. These actions will not only alleviate challenges associated with housing and energy cost affordability, but will also help to address regional concerns about vacancy and abandonment of housing units.

The most important part of this action is to invest in technical assistance programs that provide resources to low- to moderate-income households, particularly households living in small homes, manufactured housing, and 2-4 unit multifamily properties. Enhanced building code enforcement for rental properties, which are more likely to be occupied by low-to-moderate-income households, may be necessary to provide an incentive for landlords to ensure that their properties are in compliance and safe for renters.

■ **26. Remove barriers to converting upper floors to residential uses in city and village downtowns**

There are numerous economic, social, and environmental reasons for promoting a mix of uses, like conversion of upper-floor areas to residential uses, in existing downtown buildings. These include supporting local businesses that have suffered the negative effects of flight from downtowns; increasing activity in the downtown during evening hours; expanding housing options for seniors looking to downsize; supporting demand from the Gen Y demographic that prefers well-located units; and promoting transit-oriented land use.

Review of several Southern Tier zoning laws and NY State housing agency reports have confirmed that amendments to current zoning codes will need to be passed in many communities to allow for mixed-use development, including for apartments or live/work units above commercial buildings. Converted upper floors should be available at all price/housing levels, from affordable to luxury. Changes to statewide regulations may also be needed to remove barriers to infill development and allow flexibility in mixed-use development through the amendment and relaxation of outdated codes. Revisions to state building codes in New Jersey and Maryland allowed more flexible interpretation of renovations to historic buildings, which led to increased redevelopment of historic properties in the first year by up to 60 percent. One local example is that existing buildings in Binghamton are exempt from parking requirements if they are being rehabilitated.

■ **TOP 22 27. Provide technical assistance and gap financing for construction and rehabilitation of new energy-efficient affordable housing**

Housing in the Southern Tier is generally considered affordable¹¹ compared to housing in the rest of the State, and slightly more affordable than the national average. Still, nearly half of all renters and over 20 percent of homeowners spend more than 30 percent of their income on housing costs, and thus do not live in housing that is considered affordable. In addition to high housing costs, heating and energy use is also a significant expenditure for many households. This action aims to engage developers and property owners to invest in rehabilitating existing affordable housing to improve energy efficiency and to construct new, energy-efficient affordable housing to meet the Region’s housing needs and energy goals, using technical assistance and financing opportunities. The rehabilitation and development of energy efficient housing will significantly reduce residential households’ energy bills as energy consumption is reduced. In turn, this will reduce the Region’s overall building energy usage. In New York State, 30 percent of all energy consumed is from the residential sector,¹² so any savings in this area will have significant effects. Furthermore, locating housing in priority development areas will improve residents’ accessibility to less energy-intensive forms of transportation (i.e. transit, walking, and biking) and reduce the need for driving trips, which can be very long in some parts of the Southern Tier. Because residents often travel by single-occupancy vehicle, reducing trips can also significantly reduce GHG emissions per capita.

EcoVillage at Ithaca, an EPA Climate Showcase Community, is a successful demonstration project in the process of constructing a new energy-efficient residential neighborhood. EcoVillage uses 40 percent fewer resources than the typical American community. Each of the 72 new housing units is expected to achieve an 80 percent reduction in GHG emissions.

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
19. Encourage development and strategic investment in cities, villages, and hamlets Top 22			
<ul style="list-style-type: none"> - Develop integrated multimodal transportation systems - Encourage walking, biking and transit use - Enhance livability 	Binghamton Downtown, the Livable Communities Alliance in Broome and Tioga Counties, Elmira Downtown Development, Corning’s Gaffer District area, and Downtown Ithaca Alliance all seek to promote the strengthening of downtown and core	Improvements in main streets and downtowns can be costly; land use regulations can discourage development at densities needed to support downtowns; population of downtowns in many Southern Tier areas is	local government officials, businesses, economic development agencies, private and non-profit developers, residents, property owners, DOT, DEC,

¹¹ According to the US Department of Housing and Urban Development, “The generally accepted definition of affordability is for a household to pay no more than 30 percent of its annual income on housing. Families who pay more than 30 percent of their income for housing are considered cost burdened and may have difficulty affording [other] necessities.

¹² US Department of Energy, Energy Information Administration, “New York State Profile and Energy Estimates,” <http://www.eia.gov/beta/state/?sid=NY>.

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
		decreasing	Southern Tier REDC
<p>The targets associated with this action are #3, #4a, and #5a. The primary target (#5a) is to increase the proportion of Southern Tier residents who live in existing cities and villages from 38 percent to 40 percent over the next 5 years and to 45 percent in 20 years. Revitalizing and reinvesting in downtown and main street areas will likely enhance the demand for housing and services in these areas and thereby increase the likelihood that developers will increase the supply of housing in strategic downtown and main street locations. In addition, this action will help achieve the target (#3) of increasing the percentage of workers commuting via walking, biking, transit, and carpooling to 21 percent in 5 years and 28 percent in 20 years; and (#4a) of decreasing annual gasoline sales by 2.5 percent in 5 years and 40 percent in 20 years.</p> <p>Collectively, actions 19 to 23 support the Region’s goal to increase the portion of regional population in cities and villages. Cities and villages have a lower estimated per capita VMT than the less-densely populated portions of the Region, and an increase in population in higher density areas would result in lower total VMT. The actions would collectively reduce regional emissions by an estimated 17,000 MTCO₂e, though this is likely an underestimate due to limitations in the inventory data. This is 0.5 percent of the Plan’s estimated GHG reduction benefits.</p>			
<p>20. Provide gap financing for community revitalization projects</p>			
<ul style="list-style-type: none"> - Improves and diversifies downtowns (commercial/retail) and neighborhoods (housing/public spaces) - Collaborative effort 	<p>Type of funding will vary by community based on needs, damage, and desired redevelopment.</p>	<p>Housing stock in the Region is aging, and much of it is in poor condition</p>	<p>REDC, Local governments, Businesses</p>
<p>The targets associated with this action are #3, # 4a, and #5a. GHG reduction benefits for actions 19, 20, 21, 22, and 23 were calculated together; see action 19 above for targets and GHG benefits details. Providing gap financing for appropriate development in critical target areas can help accelerate the pace of revitalization.</p>			
<p>21. Support development in downtown areas at appropriate densities</p>			
<ul style="list-style-type: none"> - Attracts businesses and workers to urban nodes - - Build compact urban developments - Increases use of walking, biking and transit use - Increases tax revenues 	<p>Tompkins County Industrial Development Agency (IDA) and the City of Ithaca streamlined the city’s downtown density incentive policy, which has provided incentives to six downtown projects totaling \$71 million, adding 477,450 square feet of mixed use space.</p>	<p>Development at this scale is a long-term commitment</p>	<p>Local governments, Finance institutions, Developers, Businesses</p>
<p>The targets associated with this action are #3, #4a, and #5a. GHG reduction benefits for actions 19, 20, 21, 22, and 23 were calculated together; see action 19 above for targets and GHG benefits details.</p> <p>In addition, this action would support target #7a, to increase average weekly wages to 100% of the national average within 20 years.</p>			
<p>22. Support redevelopment of strategic sites and vacant properties</p>			
<ul style="list-style-type: none"> - Redevelops vacant brownfield sites - Returns vacant properties to productive use 	<p>Redevelopment of industrial properties, aging shopping centers, strip commercial and vacant downtown lots. NYS</p>		<p>Local governments, Non-profits, Neighborhood Associations,</p>

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
- Improves neighborhood aesthetics	approved BOA's include Brandywine Corridor, Elmira Waterfront, and Erwin/Painted Post/Riverside BOA		Landowners, Developers
<p>The targets associated with this action are #3, #4a, and #5a. GHG reduction benefits for actions 19, 20, 21, 22, and 23 were calculated together; see action 19 above for targets and GHG benefits details.</p>			
<p>23. Update local land use regulations and design codes and provide technical assistance to implement projects Top 22</p>			
<ul style="list-style-type: none"> - Enhance rural development opportunities - Reform zoning and development regulations 	<p>The Hamlet of Varna, in Tompkins County, involved community residents, business owners, and local government officials to prepare the Varna Community Development Plan. The Collegetown Form-Based Code project developed new building form standards for a mixed-use neighborhood</p>	<p>Some comprehensive plans outdated or fail to provide a broad vision of how priority areas should be developed</p>	<p>local government officials, businesses, residents, property owners, developers, regional and county planning agencies</p>
<p>The targets associated with this action are #3, #4a, and #5a. GHG reduction benefits for actions 19, 20, 21, 22, and 23 were calculated together; see action 19 above for targets and GHG benefits details.</p>			
<p>GHG Reduction Benefits For actions 19 to 23 17,000 MTCO₂e</p>	<p>Collectively, these actions support the Region's goal to increase the portion of regional population in cities and villages. Cities and villages have a lower estimated per capita VMT than the less-densely populated portions of the Region, and an increase in population in higher density areas would result in lower total VMT. The policies would collectively reduce regional emissions by an estimated 17,000 MTCO₂e, though this is likely an underestimate due to limitations in the inventory data. This is 0.5 percent of the Plan's estimated GHG reduction benefits.</p>		
<p>24. Assess affordable housing needs and identify target areas for rehabilitation and new construction programs</p>			
<ul style="list-style-type: none"> - Produces an estimated 34 jobs (between actions 23-26) - Develops framework to guide improvements to affordable housing 		<p>Large portion of Southern Tier residents spend more than 30 percent of their income on housing</p>	<p>Regional planning boards, Local governments, Non-profits, Housing Agencies</p>
<p>The primary target (#6) associated with actions 24 to 27 is to increase the percentage of housing units located within cities and villages that are affordable to low-to-moderate-income households to 38 percent in 5 years and to 42 percent in 20 years. Rehabilitating housing units in the Region will enhance the housing supply, which will provide more options to all residents and will prevent the price of housing from escalating as much as it otherwise would. In addition, reducing long-term energy costs for low-to-moderate-income households will make the combined impact on household budgets of housing and utility costs more manageable. Other targets associated with this action include #5a increasing the percentage of Southern Tier residents living in existing cities and villages to 40 percent in 5 years and to 45 percent in 20 years; and # 1a reducing building energy consumption by 10 percent in the residential sector in 5 years and by 40 percent in the residential sector in 20 years.</p> <p>Collectively, actions 24 to 27 would overlap significantly with the energy efficiency retrofits proposed under action 1. All retrofits were calculated under that measure, so benefits calculated here apply only to new housing units that are more energy efficient than the units they replace. In the context of the new housing units needed in the</p>			

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
cities and villages to accommodate the target growth there, assuming that new units are 50 percent more energy efficient than existing units, these actions will reduce regional emissions by 66,000 MTCO ₂ e, or 2 percent of the Plan's estimated GHG reduction benefits.			
25. Provide financial and technical assistance to rehabilitate housing for low-to-moderate-income households Top 22			
<ul style="list-style-type: none"> - Reduce energy consumption - Decrease household utility costs 	<p>In June 2012, 11 housing rehabilitation and community development projects were funded that will restore and rehabilitate homes for 205 families in Broome, Chenango, Steuben, Schuyler, and Tompkins Counties. The NYS Division of Housing & Community Renewal's Weatherization Assistance Program provides financial assistance to income qualified households</p>	<p>Lack of sufficient funding for rehabilitation, especially of properties that have the greatest need for upgrades; mobile homes are often not eligible for subsidy programs that will help finance energy efficiency improvements</p>	<p>Municipalities, housing agencies, contractors providing energy efficiency services, local financial institutions, foundations</p>
The targets associated with actions 24 to 27 are #5a, #6 and #1a; see action 24 above for a description of the targets and GHG reduction benefits.			
26. Remove barriers to converting upper floors to residential uses in city and village downtowns			
<ul style="list-style-type: none"> - Increases supply of location efficient and energy efficient housing - Increases walking, biking and transit use - Returns thriving downtown areas 	<p>Existing buildings in Binghamton are exempt from parking requirements if they are being rehabilitated. Revisions to state building codes in New Jersey and Maryland allowed more flexible interpretation and increased redevelopment of historic properties in first year up to 60%</p>	<p>Lack of young, urban-centric population</p>	<p>Local governments Housing agencies, Main Street organizations, developers</p>
The targets associated with actions 24 to 27 are #5a, #6 and #1a; see action 24 above for a description of the targets and GHG reduction benefits.			
27. Provide technical assistance and gap financing for construction and rehabilitation of new energy-efficient affordable housing Top 22			
<ul style="list-style-type: none"> - Reduce energy consumption - Decrease household utility costs - Provide new housing 	<p>The partnership of Ithaca Neighborhood Housing Services and PathStone Corporation have begun construction of Breckinridge Place, a 50-unit, LEED-certified energy efficient development;</p>	<p>There are few local financing support mechanisms to assist in these projects; not all funding is aligned to consider energy costs in calculating affordability;</p>	<p>Local governments, non-profit housing developers, NYS Office of Homes and Community Renewal, US Department of</p>

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
	most units will be priced for residents earning less than 60 percent of the regional median income	strong local knowledge in the areas of affordable housing and energy efficiency, yet these areas have not been fully aligned	Housing and Urban Development
GHG Reduction Benefits	Collectively, these actions would overlap significantly with the energy efficiency retrofits proposed under action 1. All retrofits were calculated under that measure, so benefits calculated here apply only to new housing units that are more energy efficient than the units they replace. In the context of the new housing units needed in the cities and villages to accommodate the target growth there, assuming that new units are 50 percent more energy efficient than existing units, these policies will reduce regional emissions by 66,000 MTCO ₂ e, or 2 percent of the Plan’s estimated GHG reduction benefits.		
The targets associated with actions 24 to 27 are #5a, #6 and #1a; see action 24 above for a description of the targets and GHG reduction benefits.			

ECONOMIC DEVELOPMENT

The Southern Tier economy is characterized by historically competitive manufacturing and agriculture industries, as well as new growth in innovation-centered industries, such as advanced manufacturing and renewable energy. There is a strong higher education and innovation sector, with potential for ongoing research and development and technology transfer to high-tech industries. The healthcare sector is also growing.

The Region also faces some challenges, including a declining population, an aging workforce, and job loss in traditional manufacturing, resulting in a mismatch between worker skills and business needs.

However, the Region has opportunities to reverse these trends with forward-thinking policy support. The Southern Tier is well-known for its academic institutions, historic cities and villages; natural beauty of forests, fields, and Finger Lakes; and growing local foods which draw people to visit. The Region also has an economic competitive advantage in areas like advanced manufacturing and new clean energy generation industry. To capitalize on these opportunities, the Region needs to better market its assets and continue to invest in infrastructure and agriculture, as well as its academic institutions and proximity to large markets such as New York City, to drive new industry growth and attract and retain a skilled workforce.

- **TOP 22 28. Implement the Energy Workforce Development Initiative**

The Energy Workforce Development Initiative is an initiative of the Southern Tier Regional Economic Development Council (REDC) to develop a highly qualified and vibrant workforce that is prepared to respond to the opportunities resulting from the emergence of the energy industry in the Southern Tier. This Initiative will provide training and specialized skills to build the workforce needed to perform energy efficiency building retrofits and to install renewable energy systems. The Initiative will also prepare workers for employment opportunities in the management, development, operation, and maintenance of complex energy and industrial processes. The Initiative is geared to build on the strength of the Region's workforce. In general, clean-tech and other green jobs do not require advanced education degrees, yet they pay 20 percent higher than the median wage in the U.S.¹³ Creating a strong, vibrant workforce in the renewable energy and energy efficiency sectors will put the Southern Tier in a strong position to reduce greenhouse gas emissions in the long run. With a growing workforce that is able to respond to new developments in the clean energy sector, the Region can make progress toward reducing energy consumption and related greenhouse gas emissions and increase energy independence while generating jobs and advancement opportunities. According to the REDC, this Initiative, when fully deployed, is anticipated to train 1,000 workers in the Region.

REDC Strategy 1: Energy Workforce Development Initiative. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

- **TOP 22 29. Identify, train, and certify contractors to meet increased demand for energy efficiency**

Ensuring the presence of energy auditors and contractors with the appropriate level of expertise to effectively weatherize existing buildings and construct new energy-efficient structures is critical to reducing overall building energy consumption in the Southern Tier. In New York State, residential buildings accounted for 30 percent of all energy use in 2010, and the

The New York Energy Smart Communities program's mission is to provide access to job training and recruitment opportunities, build networks of organizations and agencies, create local partnerships, and match project needs to NYSERDA funding opportunities and resources.

¹³ See, for example, SFCED, "Green Jobs Paying Off with Greener Salaries," <http://www.sfcged.org/about-sfcged/press/20111/green-jobs-paying-off-with-greener-salaries>.

commercial sector accounted for another 32.8 percent (most of which also comes from building use).¹⁴ Thus, reducing building energy consumption will play a large role in achieving New York State's 2050 target of reducing GHG emissions by 80 percent. Furthermore, weatherization of buildings reduces energy costs by an average of 25 percent.¹⁵ This initiative will prepare the Region's contractors to meet the growing demand for energy efficiency retrofits. Energy auditors and contractors need the proper experience and training to perform energy audits and ratings, weatherization, insulation, and energy efficient construction services. There are two nationally-recognized home performance certification organizations: the Building Performance Institute (BPI) and the Residential Energy Services Network (RESNET). In order for home and business owners to take advantage of financial incentives for energy work offered by the state, they must hire certified contractors.

■ 30. Promote Regional Broadband Communications Projects

Part of the Southern Tier REDC Plan, this action aims to extend broadband service throughout the Region, ranging from sophisticated technology transfer projects between universities and businesses, to rural home-based entrepreneurs. The project has already gained momentum and for the Cleaner Greener Southern Tier Plan the focus is on the strategic economic development to be achieved by extending broadband to the "middle mile" and the "last mile" via fiber and/or wireless service that will benefit small businesses, home-based businesses, and residents in rural areas. This effort is essential for boosting rural and agricultural business opportunities and capturing and retaining youth in the Region. Providing internet access to all residents of the Southern Tier assures equal access and prevents a digital divide from disenfranchising lower income rural populations.

■ 31. Grow local businesses through targeted investment

This action introduces a new "economic gardening" approach to economic development, which involves investing in small, local businesses to grow them into big, local businesses. This approach models itself after techniques used by venture capitalists to identify firms with potential and support them in the initial stages of development. The idea is that growing small firms requires an upfront investment but can yield large rewards when the companies become successful. This contrasts with the traditional approach of recruiting large companies from the outside of a Region or municipality by offering long-term tax breaks or other incentives that commit government resources for years to come. This action aims to establish partnerships among industry groups and businesses to identify small, local initiatives that show potential for growth and invest capital in those initiatives in their early development. This approach encourages growth that is true to the character of the local community. Potential opportunities include: advanced transportation technologies, particularly those associated with improved transportation information, software, and applications; local food businesses, especially those that capitalize on regional farm-to-table partnerships and, value-added product development, like Finger Lakes Fresh expansion in cooperation with Challenge Industries; water-based ecotourism ventures, building on planned waterfront revitalization projects such as Watkins Glen's recent and proposed redevelopment work and blueway trail systems like the Cayuga Lake Blueway Trail – a tri-county project; and advanced materials manufacturing startups.

■ 32. Strengthen university-industry connections to improve and promote workforce development

This action would encourage collaboration between institutions of higher education and industry. By developing academic-industry feedback loops, in partnership with workforce investment boards, educational institutions can customize their curriculums to prepare students for the regional business climate in exchange for commitments from local companies to support students through internships or full-time employment upon program completion. Job training and educational courses that are coordinated with business opportunities

¹⁴ US Department of Energy, Energy Information Administration, New York State Profile and Energy Estimates, <http://www.eia.gov/beta/state/?sid=NY#tabs-2>.

¹⁵ See, for example, Wald, Matthew, "Focus on Weatherization is Shift on Energy Costs," *The New York Times*, December 29, 2008, http://www.nytimes.com/2008/12/30/us/30weatherize.html?pagewanted=all&_r=0.

will help ensure that workers develop skills that are relevant to local business needs, increasing their long-term employment options and allowing the Region to maximize economic performance.

■ **33. Expand and promote culinary and agri-tourism opportunities**

This action would build upon the success of existing wine and cheese trails, brewing and distilling facilities, farm-to-table restaurants, and other farm-based activities, such as the planned Tompkins Cortland Community College student farm, culinary lab, and restaurant. This action proposes expanded advertisement of existing tastings and tours at local wineries, breweries, and farms. It could also expand and enhance regional circuits that link sites of interest so that tourists can easily navigate between the Region’s various culinary and agri-tourism offerings; and provide informational materials about the Region’s culinary and agricultural traditions. By inviting visitors to enjoy these aspects of the local culture, the Southern Tier can continue to market itself as a destination for culinary and agri-tourism.

One example of a local culinary tourism attraction is the Finger Lakes Wine Country Restaurant Week. In this weeklong event, local chefs create meals using only ingredients from the Finger Lakes Region. Participating restaurants offer Finger Lakes wine. By sourcing only local food and wine, the restaurant week concept is unique in the United States and could be a larger tourist draw.

■ **34. Coordinate and market educational and green tourism**

Highlighting and marketing the Region’s institutions of higher education as tourist attractions and places of lifelong learning has great potential in the Southern Tier with its excellent colleges and universities. Summer colleges for retirees, business people, and youth offer the gamut of learning and recreational opportunities. In addition, building awareness of the Region’s work to implement sustainability strategies, technologies, and projects can serve as an innovative tourism draw. This action would promote educational courses, workshops, demonstrations, and green building tours to help brand the Region as a destination where visitors can “learn how to do it.” Examples include educational tours at EcoVillage at Ithaca, a co-housing development designed to have minimal ecological impact,¹⁶ and downtown mixed-use projects. The Southern Tier has a host of sustainability developers and organizations that host a variety of education and industry events, such as sustainability conferences, that can be marketed as tourist events.

EcoVillage at Ithaca consists of co-housing neighborhoods designed to have minimal ecological impact. EVI offers tours of its facilities, tailored to the visitors’ particular interests (e.g., energy systems, organic farming).

■ **TOP 22 35. Support development of processing and distribution facilities (Food Hubs) for local and value-added products**

The Southern Tier Regional Economic Development Council Strategic Plan: 2011–2016 highlights opportunities to grow and diversify agriculture, including implementing new technology to extend the growing season, promoting regional products, creating value-added products, and supporting applications in the renewable energy industry. The plan states that agriculture holds great promise as an emerging growth sector, based on the amount and quality of available land, capacity to respond to demand for biomass, and the possibility for adopting technological changes to improve crops. Expanding value-added agricultural products has the potential to greatly enhance the profitability of farms in the Southern Tier. Promoting local food markets and expanding agricultural infrastructure can provide greater access to locally and regionally grown agricultural products to residents within the Region and to nearby urban marketplaces, such as New York City and Rochester. Food hubs are aggregation and value-added production and distribution facilities that collaborate with local farms and producers to expand the markets for their products. Food hubs create efficiencies in

¹⁶ <http://ecovillageithaca.org/evi/>

energy use and producer time by offering cost-effective value-added processes such as freezing, cutting, dehydrating, and packaging that extend shelf life and increase the profitability of local products. They also create infrastructure that facilitates the placement of local foods into regional and state-wide distribution. Establishing and supporting food hubs will bring stability to farmers’ seasonal sales and enable local products, already popular in the Southern Tier, to reach tables in schools, institutions, restaurants, and other stores. It will also support expanded agricultural production, the creation of local jobs, and enhance the financial and environmental sustainability of Southern Tier agriculture.

■ **36. Adopt local food purchasing policies**

This action would further develop existing and create new example policies that could be adopted across the Region to support the purchase of local products by public institutions, particularly school districts, universities and colleges; hospitals; and jails of the Southern Tier.¹⁷ Having a reliable and consistent market allows farmers to increase crop production. School districts often save money when purchasing local products. In order to make the agreement attractive to the growers, prices must be fair, and barriers, restrictions, and requirements must be evaluated and considered in context. There is a significant and growing interest in “buy local” initiatives across New York State including a Buy Local campaign established by Cornell Cooperative Extension in Tompkins and surrounding counties. Program goals are to foster the environmental, economic, and social vitality of the community by increasing the connections between consumers and farmers. Through outreach, marketing, and special initiatives Buy Local seeks to raise individual and institutional awareness about the benefits of buying fresh locally grown and made products and to make local food an integral part of daily life.

Tompkins Cortland Community College is proposing to develop a sustainable produce farm on campus that would train students in sustainable farming and would directly provide food for the campus cafeteria as well as (a culinary lab and training restaurant to be established in downtown Ithaca.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
28. Implement the Energy Workforce Development Initiative Top 22				
This action would help achieve other energy efficiency and renewable energy goals. Its benefits cannot be quantified separately.	<ul style="list-style-type: none"> - Cultivate a thriving energy sector with good paying jobs and opportunities for career growth - Develops and retain skilled workers 		Currently, the projected leaders of this Initiative have limited or no experience working together	REDC; Broome, Corning, and Tompkins Cortland Community Colleges; businesses; industry; workforce development agencies; BOCES, CCE; building trades; service organizations
The primary target (#7a) associated with this action is to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years. This action will also increase the supply of skilled workers in the Region, and attract employers seeking critical masses of workers with these skills. It will also help achieve the target (#1a) of reducing building energy use by 7.5 percent and 10 percent in the industrial and residential sectors, respectively, in 5 years and by 30 percent and 40 percent in these sectors				

¹⁷ Delaware County Department of Economic Development, *Delaware County Agricultural Growth and Sustainability Plan 2010-2015*.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>in 20 years. This action would help achieve other energy efficiency and renewable energy goals, which are measured under other energy actions. The GHG reduction benefits cannot be quantified separately.</p>				
<p>29. Identify, train, and certify contractors to meet increased demand for energy efficiency Top 22</p>				
<p>This action would help achieve other energy efficiency and renewable energy goals. Its benefits cannot be quantified separately.</p>	<ul style="list-style-type: none"> - Cultivate a thriving energy sector with good paying jobs and opportunities for career growth - Develops and retain skilled workers 	<p>Broome Community College’s Center for Energy Efficiency and Building Sciences offers BPI certification trainings and has funding programs to assist colleges and training centers in purchasing and maintaining equipment needed to provide training</p>	<p>Certification programs are expensive and time consuming; rural area hard to attract training programs; contractors may need to pass certification costs on to consumers; contractors may need to assist consumers with paperwork which can be a burden to a small business</p>	<p>Local Workforce Investment Boards, Community Colleges, Cornell Cooperative Extension, energy contractors, energy workers, BPI and RESNET trainers, customers of energy contractors</p>
<p>The target associated with this action is to reduce building energy use by 7.5 percent and 10 percent in the industrial and residential sectors, respectively, in 5 years and by 30 percent and 40 percent in these sectors in 20 years. This action would help achieve other energy efficiency and renewable energy goals, which are measured under other energy actions. The GHG reduction benefits cannot be quantified separately. This action also addresses the target to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years. This action will also increase the supply of skilled workers in the Region, support expansion of small businesses, and attract employers seeking critical masses of workers with these skills.</p>				
<p>30. Promote Regional Broadband Communications Projects</p>				
<p>8,600 MTCO₂e</p>	<ul style="list-style-type: none"> - Improve access to broadband service - Increase opportunity for rural entrepreneurship and teleworking 	<p>Extend and strengthen the last mile to all eight counties in the Southern Tier</p>		<p>Local governments, regional agencies REDC, Utilities</p>
<p>The targets associated with this action are (#7a) to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years, and (#4a) to decrease estimated annual gasoline sales by 2.5 percent in 5 years and 40 percent in 20 years by increasing teleworking and reducing vehicle miles traveled. The combination of middle mile and last mile broadband will support downtown, small town and rural business growth, while allowing employees to efficiently telecommute to increase efficiency and reduce travel.</p> <p>Based on a 1.2 percent reduction in vehicle miles traveled (VMT) associated with commuting, this measure will reduce regional emissions by 8,600 MTCO₂e, or .2 percent of the Plan’s estimated GHG reduction benefits. This is similar to action 14, but this represents voluntary increases in telecommuting due to improved technology as opposed to employer-sponsored transportation demand management programs. This also assumes that an additional 8 percent of employees would convert to a 4-day/40-hour schedule.</p>				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
31. Grow local businesses through targeted investment				
	<ul style="list-style-type: none"> - Grow local businesses - Create good paying jobs - Preserve Region's authentic character - Increase tax revenues 	Examples include advanced transportation technologies and software; local food businesses and product development; river-based ecotourism ventures; advance materials manufacturing	Creating local capital investment groups, such as the new Tompkins LION, where entrepreneurs are looking to invest in sustainable local business	Small businesses, Economic Development Agencies, Local governments, Local Banks and Investors
<p>The primary target associated with this action (#7a) is to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years, as well as (#9) to increase farm marketing from \$338 million to \$417 million in five years and to \$497 million in 20 years. The GHG benefits of this action cannot be quantified. It has the potential to increase regional emissions through increased business activity, or may reduce emissions depending on the type of businesses and workforce that emerges from these investments and partnerships.</p>				
32. Strengthen university-industry connections to improve and promote workforce development				
	<ul style="list-style-type: none"> - Train workers for employment in local growth sectors - Develop and retain skilled, talented workers 	Syracuse Engagement Fellows program; area community college industry-specific certification programs	Forging partnerships between academia and industry can be difficult .Educational attainment and skills mismatch between workforce and growing industries	Local employers, Universities, Community colleges
<p>The target (7a) associated with this action is to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years. The GHG benefits of this action cannot be quantified. It has the potential to increase regional emissions through increased business activity, or may reduce emissions depending on the type of businesses and workforce that emerges from these investments and partnerships.</p>				
33. Expand and promote culinary and agri-tourism opportunities				
	<ul style="list-style-type: none"> - Supports local economic redevelopment and diversification of the economy 	Finger Lakes Wine Country Restaurant Week	Growing new markets and destinations	Local governments, Regional agencies, Restaurants, Businesses, Farms, Cultural Institutions
<p>This action addresses target (#9) is to increase the value of farm marketing from \$338 million to \$417 million in five years and to \$497 million in 20 years. The GHG benefits of this action cannot be quantified. It has the potential to increase regional emissions through increased business activity, or may reduce emissions depending on the type of businesses and workforce that emerges from these investments and partnerships. This action also addressed the target (#7a) to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years.</p>				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
34. Coordinate and market educational and green tourism				
	<ul style="list-style-type: none"> - Increased revenue from tourism - National recognition on sustainability projects 	Susquehanna Sojourn; TechWorks!	Establishing a new tourism niche will require engaging businesses, tourism operators, and chambers of commerce of worth	Local governments, Businesses, Universities, Nonprofits, Tourism boards, Chambers of Commerce
<p>The target (#7a) associated with this action is to increase average wages in the Region to 90 percent of the national average in 5 years and to 100 percent of the national average or higher in 20 years. The GHG benefits of this action cannot be quantified. It has the potential to increase regional emissions through increased business activity, or may reduce emissions depending on the type of businesses and workforce that emerges from these investments and partnerships. Many of the activities may serve to educate and encourage local partners to initiate more sustainable practices that will contribute to multiple goals and targets.</p>				
35. Support development of processing and distribution facilities (food hubs) for local and value-added products Top 22				
	- Increased production of USDA-certified meats, grains, and other food products that require processing	GreenStar Community Projects, in Ithaca, works with groups such as local schools to promote regional food. Many organizations provide local food guides for consumers. Challenge Industries' food hub is a great example of a specialized type of food facility	Costs more for local and smaller-scale agricultural producers to process their products in a cost-effective way; difficult to compete with industrial-scale producers, and to access mainstream markets	Cornell Cooperative Extension, Challenge Industries, farmers markets, the Farm Bureau, USDA, NYS Department of Agriculture and Markets, farmers, distributors, grocers, food transporters
<p>The target (#9) associated with this action is to increase cash receipts from farm marketing to \$417 million in 5 years and to \$497 million in 20 years. This will increase the share of fresh, local products as a proportion of all goods consumed in the Region and provide additional economic value to the Region's producers. It may also contribute to higher regional wages (#7a), although these are not quantifiable.</p>				
<p>While there are potential GHG benefits of increasing local food purchasing, estimating these benefits on a regional scale is extremely challenging. Transportation emissions account for a small part of food life-cycle emissions, and of that, personal transportation to and from stores and restaurants is greater than upstream supply chain emissions. Growing practices are a larger driver of emissions. Also, any GHG reductions would not be applicable to the Region's baseline, as they would mostly impact transportation and agricultural emissions outside of the Region. Intensified development of food production, processing, and distribution within the Region could potentially increase the Region's GHG emissions. Given these complex issues, GHG benefits of local food purchasing and distribution policies cannot be credibly estimated.</p>				
36. Adopt local food purchasing policies				
	- Increase local farm production	Buy Local campaigns seek to raise individual and	Many of the public institutions	Local governments, Institutions,

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
	<ul style="list-style-type: none"> - Preserve working farmland - Create jobs in food production - Improve access to fresh, healthy foods; save money 	institutional awareness about the benefits of buying fresh locally grown food	projected to be leaders of this action must meet various state and Federal food and purchasing requirements	schools, hospitals, Universities, Farmers
See action 35 above.				

WORKING LANDS AND OPEN SPACE

There are many existing programs and resources in the Southern Tier, such as County Soil and Water Conservation Divisions, NYSDEC, and local farm agencies available to help landowners and farmers identify and implement best practices in forest and farm management. However, there is insufficient funding to implement many of these programs. Coordination and increased funding of these programs using can help ensure that Southern Tier farms and forests are managed to maximize the value of products grown and produced, while protecting water quality and wildlife habitat, and maximizing the potential for carbon sequestration.

■ **TOP 22** 37. Develop a regional program to promote sustainable forestry and wood products

The Southern Tier has a wealth of forest resources that can be used to develop local building materials, but they are underutilized. Most hardwoods in the Southern Tier are harvested and milled locally but are then shipped to China and other international destinations for their furniture making industries. Local forest products – both raw and value-added – suffer from a lack of strong local markets. Developing a regional program to promote sustainable forestry and wood products will support the creation of a sustainable materials market. By conducting broader outreach and branding of locally grown and sustainably managed woods and wood products, additional revenue can be generated in the rural portions of the economy, benefitting rural landowners and farmers. Encouraging participation in sustainable forest certification programs is one way to promote sustainable management and production of forest resources. If either a certified or sustainably managed local wood product market is developed, the number of jobs in this area will likely be expanded, though the extent of this impact is difficult to predict.

■ 38. Develop a regional biomass consortium

This action would establish a network of regional growers, harvesters, processors, and distributors to develop and expand regional biomass markets, with assistance from natural resources, conservation, and agricultural experts. Given the availability of marginal farmland and extensive forests in the Southern Tier, there is significant potential to grow a market for biomass for home, farm, and commercial/institutional heating. Because biomass production and distribution can be labor-intensive, it is a good market for small landowners and small businesses. Creating reliable supply chains and marketing could be linked to the Southern Tier Bioenergy Partnership.

The Danby Land Bank Cooperative, a biomass cooperative of crop growers, harvesters, and rural landowners, serves as a biomass supplier. It is working with its member producers to create a marketing and distribution network. Establishing a regionally-based entity similar to this cooperative, may offer opportunities for other value-added forest and agricultural opportunities.

■ 39. Promote adoption and funding of BMPs on farms

A number of organizations promote Best Management Practices (BMPs) on Southern Tier farms, including County Soil and Water Conservation Districts, Southern Tier regional planning and development boards, the Upper Susquehanna Coalition, and NYC Department of Environmental Protection (in Delaware County only). These BMPs focus primarily on protecting water quality, with especially stringent regulations for portions of the Region that are situated in the Chesapeake Bay and New York City multi-regional watersheds. Currently, Agricultural Environmental Management (AEM) programs provide effective systems for tracking and monitoring best practices on farms across the Southern Tier, and participation in the AEM program is required for eligibility for other Federal and state conservation programs and the associated cost share.

Development of a land management plan is a key step in identifying the most effective BMPs for specific areas; these can include deer and pest management and emerald ash borer and other invasive species management. BMPs can also be established for agro forestry in wooded pastures, such as mushrooms, nuts, and other permaculture crops. USDA Natural Resources Conservation Service Non-Point Source Priority Area and the 2012 Chesapeake Bay Watershed Initiative Priority Areas provide financial and technical assistance to eligible

producers to install practices to meet program goals. These can include energy, water and air quality, forestry, and organic farming projects. This action would promote outreach to farmers about implementing BMPs to maintain water quality and best agricultural management practices. This outreach can also serve as an opportunity to discuss enhanced supply chain, marketing, and product development to improve economic prospects for Southern Tier farms. Increasing both the amount of available funding and technical assistance for putting together projects and funding applications will increase the implementation of BMPs and have a positive effect on soils conservation and water quality of the Region.

■ **40. Encourage new farm startups and farm transfers to next generation**

REDC Strategy 4: Rural Initiative Venture Fund. See the REDC plan for more information:
<http://regionalcouncils.ny.gov/content/southern-tier>

Retaining existing family farms (through next-of-kin or non-family business partners) and encouraging new farm startups is key to growing the agricultural sector of the Southern Tier, while ensuring long-term sustainability of the Region's agricultural industry. While improved markets and financial returns are critical, providing programs to educate new farmers about business operations, sustainable farming practices, and financing for farm acquisition and upgrades are also needed. The Rural Initiative Venture Fund is a regional program designed to reduce financial risk and increase sustainability of agriculture and forestry ventures through product development and promotion, business infrastructure development and utilization of new technology. The Fund will provide startup and expansion capital through a revolving loan fund and grants, and leverage existing programs such as the Farmer's Market Initiative to create new wholesale and marketing businesses and new processing facilities.

■ **41. Maximize farm-based renewable energy production opportunities**

This action would harness the land resources of agricultural properties to promote farm-based renewable energy production opportunities, including harvesting marginal brushland for sustainable timber, growing biomass or biodiesel crops, and installing renewable technologies, such as anaerobic digesters to produce methane from manure. This would encourage farmers to convert marginal lands to perennial biomass production for on-farm energy production and to retrofit fossil-fuel dependent systems in farm buildings, residences, and industrial facilities with renewable energy sources. Farmers benefit by adding value in the case of biomass production and/or reducing on farm energy costs with renewable installations that would augment current livelihoods.

■ **42. Coordinate planning and implementation for priority conservation and agricultural protection areas**

Many of the Southern Tier counties have both agricultural protection and conservation/open space plans in place. This action would take a regional perspective, identifying both preservation and conservation opportunities to yield a comprehensive view of the most critical lands needing protection and support. It can also develop regional conservation and agricultural protection priorities that might create more fundable projects, due to cross municipal collaboration and expanded local leveraging possibilities. Strategies for permanent protection can include conservation easements, acquisition, purchase of development rights, and zoning restrictions. Conservation easements are an excellent and cost effective strategy to permanently protect the natural resources and forests of the Southern Tier. This action would also create and implement a funded program (or increase funding for existing programs) to pursue the easement and/or property acquisition priorities identified in protection plans. For agricultural lands, the USDA Natural Resources Conservation Service (NRCS) offers a variety of easement programs such as the Farm and Ranch Lands Protection Program, Grassland Reserve Program, and Wetlands Reserve Programs. The NRCS also offers small, limited and beginning farmer assistance, conservation innovation grants, and wildlife habitat incentive

programs.¹⁸ Purchase of development rights is also a possibility for interested farmers wishing to permanently conserve their lands in agricultural use. These actions will support efforts to permanently protect, strategically expand, and systematically connect the Region’s network of forests, farms, natural areas, rivers and streams. This includes trails, parks, and open spaces; resource conservation, green infrastructure, and stream buffers; and lake and river access. It also includes planning and education, along with access to natural resources, to build public awareness and support.

■ **43. Identify and develop priority trail segments to connect key destinations**

MPOs, counties, and towns in the Southern Tier have all expressed interest in promoting the development and use of trails, and existing plans include multimodal trails in Tompkins County, along the Susquehanna River in Broome and Tioga Counties, and along abandoned railroads in Delaware County. This action would identify and develop priority trail segments to connect regional trail systems and support recreation opportunities in natural areas. While efforts have been made to think regionally during the preparation of many of these studies, the Southern Tier, as defined for this plan, has never been systematically studied for regional trails. Identifying and developing priority trail segments to connect key development and employment destinations would help prioritize one or more trail projects in each MPO area or rural county and plan for the implementation of at least one regional trail connector. A number of trails are currently planned or under construction, such as the Susquehanna Headwaters River Trail, the Utica MainLine Rail Restoration Project, the Broome County Greenways, and the Black Diamond and Cayuga Waterfront Trails in Tompkins County. Completing planned trails will be a key step towards building a regional network. The plan could also identify potential links that might be built by developers as part of their project infrastructure and amenities. Requiring developers to build trail segments through their properties can be accomplished via local government land use authority, either through Amenity Zoning or use of the Official Map. If a trail is included on a municipality’s official map, then proposed development must incorporate that trail into development plans. This program could also identify funding for preparing feasibility studies, concept designs, and cost estimates to advance key greenway and blueway trail projects that require additional study.

The Delaware County Trail Initiative, which mapped abandoned rail/trolley lines to connect population centers, is a good example of how trail segments could form a regional network. This could also include recreational blueways.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
37. Develop a regional program to promote sustainable forestry and wood products Top 22				
630,000 MTCO ₂ e	<ul style="list-style-type: none"> - Increase forest acreage managed sustainably - Protect forests for carbon sequestration - Local industry 	The Local Building Materials Initiative is sponsored by Cornell Cooperative Extension of Tompkins County and the Ithaca Green Building Alliance. The initiative is designed to promote the use of local lumber and other building materials	Forest Stewardship Council certification of forests is costly; there are no FSC-Certified lumber mills and no programs to market local certified wood products	CCE, regional agencies, colleges and universities with robust forestry programs, forest owners, sawmill operators, lumber consumers
The primary target associated with this action (#10) is to increase the number of acres of land that is either under the Agricultural Environmental Management Program or is Certified Managed Forestland by 25,000 acres in 5				

¹⁸ <http://www.ny.nrcs.usda.gov/programs/>

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>years and 100,000 acres in 20 years. The 5,000 acres per year goal will require concerted efforts in outreach, education, and funding, but the benefits can be significant. Sustainable forestry management practices have the potential to increase forest carbon storage depending on the management scenario; e.g. working timberland or forests that are not being harvested.</p> <p>The NY Climate Action Plan Interim Report estimated sequestration benefits for all forests in NYS; benefits from this action were calculated based on the Region's share of all forests in the State (public and private). The state has estimated that treating under-stocked forest stands will reap annual sequestration benefits of 4.7 million MTCO₂e by 2030.¹⁹ Since the Region contains 13.4 percent of the state's forested land,²⁰ increased sequestration in the Region can be estimated as 630,000 MTCO₂e, or 20 percent of the Plan's estimated GHG reduction benefits.</p> <p>With increased local harvesting, milling, and wood products, there would also likely be some increase in the farm marketing (#9) and increased wages (#7a) measures.</p>				
38. Develop a regional biomass consortium				
This action would help achieve the benefits of action 10	<ul style="list-style-type: none"> - Increase supply and demand for biomass - Reduce energy consumption 	Danby Land Bank Cooperative's marketing and distribution network (under development)	Forest Stewardship Council certification of forests is costly	Small businesses, Non-profits, Biomass Suppliers
<p>The primary target associated with this action (#10) is to increase the number of acres of land that is either under the Agricultural Environmental Management Program or is Certified Managed Forestland by 25,000 acres in 5 years and 100,000 acres in 20 years. The GHG benefits are included in the calculations for action 37 above; it would also support the benefits of action #10, to increase use of biomass for heating.</p>				
39. Promote adoption and funding of BMPs on farms				
74,000 MTCO ₂ e	<ul style="list-style-type: none"> - Enhance supply chain, marketing, and product development - Improve economic prospects 	County Soil and Water Conservation Districts		Farmers, CCE, non-profits.
<p>The primary target associated with this action (#10) is to increase the number of acres of land that is either under the Agricultural Environmental Management Program or is Certified Managed Forestland by 25,000 acres in 5 years and 100,000 acres in 20 years. No-till practices can reduce emissions by reducing N₂O emitted from agricultural soils, increasing carbon storage, and reducing the need of diesel fuel for tilling. Adopting such best management practices on 50 percent of the Region's cropland would reduce regional GHG emissions by about 74,000 MTCO₂e, or 2.3 percent of the Plan's estimated GHG reduction benefits.</p>				
40. Encourage new farm startups and farm transfers to next generation				
The GHG benefits of this action cannot be quantified.	<ul style="list-style-type: none"> - Ensure longevity of working farms - Attract and retain agricultural talent 	Hudson Valley AgriBusiness Development Corporation		Farmers, Community Colleges, Universities, Non-profits

¹⁹ "Climate Action Plan Interim Report." New York Climate Action Council (NYCAC), 2010. Available online at: <http://www.dec.ny.gov/energy/80930.html>.

²⁰ "Forest Inventory Data Online." U.S. Forest Service, 2012. Available online at: <http://apps.fs.fed.us/fido/>.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>The target associated with this action (#9) is to increase cash receipts from farm marketing to \$417 million in 5 years and to \$497 million in 20 years. This will increase the share of fresh, local products as a proportion of all goods consumed in the Region and provide additional economic value to the Region's producers. It may also contribute to higher regional wages (#7a), although these are not quantifiable. The GHG benefits of this action cannot be quantified.</p>				
<p>41. Maximize farm-based renewable energy production opportunities</p>				
<p>This action would help achieve the benefits of the other renewable energy-based actions.</p>	<ul style="list-style-type: none"> - Increase supply of renewable energy - Enhance livelihood of local farmers 	<p>Ronnybrook Dairy Farms, Ancramdale NY Solar Water Heating Project</p>		<p>Farmers, Biomass Suppliers</p>
<p>This action would support meeting the targets under several renewable energy actions, including #1a, and help achieve the GHG benefits of other renewable energy-based actions; GHG reduction benefits are calculated in those actions. This action would also support the target (#10) to increase the number of acres of land that is either under the Agricultural Environmental Management Program or is Certified Managed Forestland by 25,000 acres in 5 years and 100,000 acres in 20 years; the related GHG benefits are quantified under action 37.</p>				
<p>42. Coordinate planning and implementation for Southern Tier priority conservation and agricultural protection areas</p>				
<p>219,000 MTCO₂e</p>	<ul style="list-style-type: none"> - Create a comprehensive plan for the Region - Enhance regional collaboration 	<p>Conservation Focus Areas of the Upper Susquehanna Watershed; Chemung Action Plan; Finger Lakes Trail in Emerald Necklace</p>	<p>Shale gas development in Pennsylvania is now causing increased development pressure</p>	<p>Local governments, MPOs, Non-profits</p>
<p>One target associated with this action (#10) is to increase the number of acres of land that is either under the Agricultural Environmental Management Program or is Certified Managed Forestland by 25,000 acres in 5 years and 100,000 acres in 20 years. Another target (#11) is to increase acres protected through NYS DEC and other public, non-profit and private protected lands, by 7,500 acres in five years and 30,000 acres in 20 years. If each year, 800 acres of currently vacant land are protected and converted to forest, an estimated 219,000 MTCO₂e will eventually be sequestered, or 7 percent of the Plan's estimated GHG reduction benefits. In addition to this action, achieving this level of forest conversion will be supported by actions 46 through 49, which will encourage the reforestation of stream banks and buffers. It would take many years to achieve this level of sequestration, but permanent protection would present a clear net reduction in GHG emissions.</p>				
<p>43. Identify and develop priority trail segments to connect key destinations</p>				
<p>This action would help achieve the benefits of the increased accessibility action 12.</p>	<ul style="list-style-type: none"> - Improved connectivity of bicycle/pedestrian infrastructure - Communities connected to Region's natural amenities via the trail network 	<p>The Delaware County Trail Initiative; Binghamton Metropolitan Greenways Study</p>		<p>Local governments, MPOs, Non-profits</p>

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>One target (#3) associated with this action is to increase the percentage of workers commuting via walking, biking, transit, and carpooling to 21 percent in 5 years and 28 percent in 20 years. In addition, this action will help achieve target #4a of decreasing estimated annual gasoline sales by 2.5 percent in 5 years and 40 percent in 20 years. It will also support target #11 to increase acres protected through NYS DEC and other public, non-profit and private protected lands, by 7,500 acres in five years and 30,000 acres in 20 years. This action would help achieve the benefits of action 12 for increased accessibility. Both the GHG benefits and the acres protected would be calculated under other actions.</p>				

CLIMATE CHANGE AND ADAPTATION

The strategies and actions that follow will help guide the Southern Tier Consortium and regional governing bodies through a process of integrating climate change projections into regional planning documents. The actions support three overarching strategies: identifying the best available climate projections, promoting success through collaboration, and integrating climate change into long range planning. Adaptation strategies are also incorporated into other goals.

Flooding actions are also identified specifically, as many communities in the Southern Tier are located along waterways where the hazard of flooding is a fact of life. Recently, there have been two 100-year flood events in a five-year period. This frequent and intense flooding caused millions in damaged property within or adjacent to historic floodplains, endangered the lives of residents in the Region, and caused major transportation and economic disruptions across the Region. As the local climate continues to change, it is anticipated that precipitation and runoff patterns will shift, increasing the uncertainty for water supply and quality, flood management, and ecosystem functions. Southern Tier communities can be better prepared to minimize damages during future storms by collecting data on local flooding events, reducing the vulnerability of development, and preserving buffers.

- **TOP 22 44. Incorporate anticipated climate projections, impacts and proposed mitigation strategies into Hazard Mitigation Plan updates**

ClimAID, a 2011 NYSERDA-commissioned report on anticipated climate projections for New York State, highlights the need for the Southern Tier to prepare for climate change related impacts, including heavy downpours and increased flooding, heat waves, summer droughts, and major changes to ecosystems and crops. Southern Tier counties and municipalities, many of which are prone to flooding, already have Hazard Mitigation Plans (HMPs), which consider natural and manmade hazards that affect the Region. In order to be eligible for various Federal Emergency Management Agency (FEMA) mitigation funds, jurisdictions are required to develop and update plans every five years according to standards prescribed by FEMA. These updates provide an opportunity to consider the role climate change plays in relation to a community's hazards. Incorporating climate change into these plans is both prudent and an efficient use of resources. Including an analysis of historic disaster events and the likelihood that the climate will change in the future allows planners to anticipate potential disaster events and plan for their mitigation. Evaluating the community risk, and the range of potential measures to mitigate this risk, will allow municipalities to identify the most appropriate and efficient ways to reduce risk and allow them to proactively prepare projects to leverage funding opportunities as they arise. In addition, including projects that reduce impacts from climate change into HMP updates allows those projects to be eligible for federal and state funding for disaster mitigation efforts.

- **45. Assess the viability of current and potential future crops**

A regional group, such as the climate change working group proposed as a supplemental action, could work with local agricultural producers to evaluate the potential for the continued success of crops that are currently grown in the Region, as well as identify current damages and dangers. They could help bring together experts to recognize crops that may be more productive under future climatic conditions and techniques to help mitigate the impacts of extended dry periods and intense rain events. By identifying specific hazards that are likely to occur over time, these experts could help meet the changing needs of the agricultural community.

■ **46. Update Flood Insurance Rate Maps, map additional flood-related hazards, and manage development in high risk areas**

Existing floodplain maps are based on historical observations and flood probability estimates. While this practice may have been adequate in the past, the changes in precipitation patterns combined with an increase in construction and impervious surfaces make these maps imperfect and in need of updating. Floodplain maps should accurately represent current flood hazards, with advisory information about future potential conditions, so that they are effective tools for reducing flood losses. FEMA has released updated floodplain maps for several communities, but some have not yet been adopted by local governments. Recognizing that map development and adoption is a time consuming process, this initiative should focus on areas where the FEMA maps have not yet been updated and on information that supplements that provided on regulatory floodplain maps. Counties, cities, villages, and agencies in the Southern Tier should work with FEMA to update Flood Insurance Rate Maps and also develop additional advisory information. These efforts should include the impact of: existing and planned land development; flood mitigation improvements (including levees); past floods; recurring flooding; shifts in riverine ecosystems (e.g., the loss of riparian forests or wetlands); changes in precipitation patterns; erosion hazard areas; and residual risks behind flood control levees. In order to use this information effectively, municipalities should receive technical assistance to enforce minimum floodplain development standards, enact higher standards, integrate flood risks into comprehensive plans, and address flood hazards in other land use regulations.

In response to devastating floods in 2006, Broome County activated a Flood Task Force that advocated for updated floodplain maps to better document flood hazards and manage development in flood-prone areas.

■ **47. Prioritize high risk floodplains for conservation through acquisition and easement**

Buildings are frequently constructed in the 100-year floodplain and other flood-prone areas. Reducing the vulnerability of existing development can minimize property loss/damage, but generally does not protect or restore ecosystem functions in the floodplains. Regulatory restrictions can be used to manage development on flood-prone parcels. However, existing floodplain development standards generally do not prohibit development or preserve natural floodplain functions. Floodplain easements are a potentially more effective method for limiting development in priority flood-prone locations. Floodplain easements are permanent conservation easements that provide the Natural Resources Conservation Service (NRCS) with the full authority to restore and enhance the floodplain's functions and values.²¹ At particularly critical locations, government acquisition authority can be used in order to limit flood damages and to protect the flood-carrying capacity of the riparian corridor. This action can be applied to areas outside the NRCS program, by land trusts and other organizations who can purchase and manage easements and property. FEMA buyouts can also be used to implement this action in flood-impacted areas that are currently developed.

■ **48. Establish and promote undeveloped buffers for streams and wetlands**

Counties, cities, and villages in the Southern Tier can use buffers as a cost-effective measure to preserve riparian forests, wetlands, and floodplains by preventing development within a minimum distance of a stream or wetland. A buffer is an area of permanent vegetation that may consist of grasses, shrubs, and trees that provide valuable benefits to streams, creeks, and rivers. Buffers also reduce flood damage by directing development to safer locations with less risk of flooding and erosion. Buffer protection strategies should also address

The Town of Dryden recommends a buffer be maintained, to the maximum extent possible, between land development activities (including the placement of silt fences) and streams and wetlands.

²¹ "Emergency Watershed Protection Program – Floodplain Easements," USDA Natural Resources Conservation Service, Website, Available Online: <http://www.wi.nrcs.usda.gov/programs/ewp/fpe.html>

fencing to keep livestock away from streambeds. Communities in the Southern Tier can establish a minimum buffer width, such as 100 ft. or 300 ft., from rivers, streams, lake shores, and wetlands. Criteria used in determining adequate buffer sizes should include stream size, value of ecosystem services around the stream, intensity of adjacent land use, and specific buffer functions required.²² The Tompkins County Stream Buffer Protection Program developed tools to properly protect and restore stream buffers, including a stream buffer planting guide, which identifies how and what to plant in the stream buffer. Additional assistance, sample language, and educational resources can enhance the ability of municipalities to implement buffer regulations and educate property owners about management of buffer areas.

■ **49. Develop incentives to encourage property owners to protect streams and buffers**

Incentives can help motivate landowners and municipalities to take proactive steps to reduce property loss, protect water quality, and build greater resilience to future flood damages. Incentive programs can pay landowners to adopt conservation practices on private property. The Maryland State Buffer Incentive Program pays landowners to plant and maintain trees along streams and shorelines.²³ An example from agriculture practice that could be applied to stream buffers is the Conservation Reserve Enhancement Program that offers agricultural landowners technical support and financial incentives to install forested buffers and other conservation practices on eligible land.²⁴ A habitat bank is a market-based solution that allows developers to purchase credits to fund habitat creation, restoration, or enhancement on another parcel to offset anticipated adverse impacts to similar nearby ecosystems.²⁵ County and regional agencies should continue to support existing incentive programs for agricultural land and investigate alternatives for improved management of streams and riparian corridors on non-agricultural land.

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
GHG Reduction Benefits	The GHG benefits of all of the actions below cannot be quantified		
44. Incorporate anticipated climate projections, impacts, and proposed mitigation strategies into Hazard Mitigation Plan updates Top 22			
- Prepared to manage more frequent and severe weather emergencies	Tioga County Hazard Mitigation Plan 2012 Update and the Delaware County Hazard Mitigation Plan 2012 Update incorporated the projections from ClimAID to assess the role of climate change on the future probability of floods, severe storms, extreme heat, and drought.	It can be difficult to convince emergency service providers and municipal officials of the diverse impacts of climate change and its likely impacts on the frequency and severity of community hazards; uncertain degree of impacts of climate projections	Local planners and emergency service providers; climate change scientists; schools; hospitals; Red Cross; NYS Homeland Security and Emergency Services; FEMA

²² Castelle, A.J., A.W. Johnson and C. Conolly. "Wetland and Stream Buffer Size Requirements – A Review." *Journal of Environmental Quality*, 1994. Available online: http://www.nj.gov/drbc/library/documents/Flood_Website/FRES/WendelgassBuffer_publications.pdf

²³ Lynch Lori. "Riparian Buffer Financial Assistance Opportunities," Maryland Cooperative Extension, 2002. Available online: <http://www.riparianbuffers.umd.edu/fact/FS769.html>

²⁴ "Conservation Programs," USDA Farm Service Agency, Website. Available online: <http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep>

²⁵ "Habitat Banking FAQs," The Environment Bank LTD. Available Online: <http://www.environmentbank.com/docs/Habitat-Banking-FAQs.pdf>

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>The target (#12) associated with this action is to increase the degree to which climate change and adaptation are discussed within required Hazard Mitigation Plans (HMPs) and 5-year updates to those plans. Specifically, attainment of this target will require inclusion of climate risks in the HMPs and associated strategies to reduce vulnerability to these risks, based on a tiering system. In addition, the process of updating HMPs can also help provide climate impact information and potential mitigation strategies for inclusion in other long-range plan updates for local and regional transportation, land use, housing, environmental, and economic development plans. This will, in turn, help the Region prepare for climate-related impacts, and identify cost-effective mitigation strategies that can be incorporated into regular capital and maintenance projects. The GHG reduction benefits of this action cannot be quantified.</p>			
<p>45. Assess the viability of current and potential future crops</p>			
<ul style="list-style-type: none"> - Mitigate the impacts of extended dry periods and intense rain events 	Identify projects and crops that could help meet the changing needs of the agricultural community	Lack of understanding about projected long-term impacts and lack of funding	Cooperative Extension, Counties, Farmers
<p>The primary target (#9) for this action is to increase the value of farm marketing from \$338 million to \$417 million in five years and to \$497 million in 20 years. It should provide farmers with information for their long-term crop planning. It can also be a supporting action to action 44 and the HMP target #12 above, to incorporate agricultural and crops planning into the Hazard Mitigation Plans. The GHG reduction benefits of this action cannot be quantified.</p>			
<p>46. Update and adopt local floodplain maps to improve accuracy of flood hazard information</p>			
<ul style="list-style-type: none"> - Limits development on land with high risk for flooding - Protects buildings and other development from flood damage 	Updated Flood Insurance Rate Maps for priority areas; mapping of additional flood hazards; resources for improved land use management	Constrained budgets; technical limitations for anticipating future flood hazards	FEMA, Non-Profits, Local governments, regional and State Agencies
<p>The target associated with this action (#13) is increased participation in the Community Rating System (CRS) program of the National Flood Insurance Program, based on a tiered percentage for municipalities with over 50 or over 100 policies. All of actions 46 to 49 would support this target. The GHG benefits of actions 46 to 49 are quantified in action 42. The GHG benefits of the above actions cannot be quantified separately from action 42, so were incorporated into that emissions reduction figure. These measures are likely to result in reforestation of some stream banks, and will help achieve the 800 acres per year assumed in action 42. In addition, there are likely to be benefits from the avoided energy and materials needed to rebuild after floods, though the energy and emissions cost of events has not been quantified and would rely in large part on life-cycle emissions that may occur upstream from the Region's baseline.</p>			
<p>47. Prioritize high risk floodplains for conservation through acquisition and easement</p>			
<ul style="list-style-type: none"> - Limits development on land with high risk for flooding - Protects people and buildings from flooding - Restores beneficial floodplain functions 	Easements purchased on floodplain property by the Natural Resources Conservation Service and land trusts; property acquisition and floodplain restoration by local governments through FEMA buyout programs	Constrained budgets; opportunities to purchase flood-damaged property are often lost due to the slow processing time and other difficulties with federal buyout programs	Landowners, Non-Profits, Local governments, County Emergency Management Offices, State Agencies, federal agencies
<p>See action 46 above.</p>			

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
48. Establish and promote minimum buffer widths for streams and wetlands			
<ul style="list-style-type: none"> - Lessens flood damage - Protects water quality in rivers, streams, wetlands, and lakes - Restores hydrologic and ecological functions of floodplains 	The Tompkins County Stream Buffer Protection Program; municipal buffer setback requirements	Limited developable land makes buffer areas desirable locations for many uses	County Planning Departments, Local governments, Landowners, Non-profits, State and regional Agencies
This action supports the target (#15) to reduce the number of impaired water bodies by 66 percent in the long term and 11 percent in the short term. For most of the impaired water bodies, the pollutants that contribute to the impairment are at least partially related to stormwater runoff directly into the impaired water body or indirectly into the rivers and streams that are tributary to the impaired water body. Establishing stream buffers helps to reduce the amount of pollutants in stormwater runoff. Also, see action 46 above.			
49. Develop incentives to encourage property owners to protect streams and buffers			
<ul style="list-style-type: none"> - Reduces flood-related damage to private property - Protects water quality of rivers and streams - Provides habitat for fish and wildlife - Restores floodplain functions of storing and slowing high flows 	Regional Flood Mitigation Assistance Program Serving the Southern Tier Central Region; Implement a regional flood education program	Lack of funding; existing programs do not provide incentives for non-agricultural buffers	Local governments, Landowners, Non-profits, Soil and Water Conservation Districts, State and regional Agencies
This action supports the target (#15) to reduce the number of impaired water bodies by 66 percent in the long term and 11 percent in the short term. For most of the impaired water bodies, the pollutants that contribute to the impairment are at least partially related to stormwater runoff directly into the impaired water body or indirectly into the rivers and streams that are tributary to the impaired water body. Establishing stream buffers helps to reduce the amount of pollutants in stormwater runoff. Also, see action 46 above.			

WATER MANAGEMENT

Treating and transporting water and wastewater is an energy-intensive process. Nationally, the energy used to treat water and wastewater can account for up to 35 percent of a municipality's energy budget. Energy efficiency in water and wastewater plants, along with leak prevention in water transmission, reduces both energy consumed and greenhouse gas emissions. Consumers on public water and sewer have a role, too, as water conservation conserves the water resource and reduces the demand, diminishing the energy required to process and distribute water. In the Southern Tier, there are approximately 40 water supply and 50 wastewater treatment plants, most of which are prime for energy improvements.

The Southern Tier's water resources are perhaps its most bountiful and critical assets. Lakes, rivers, and streams support tourism, agriculture, drinking water, and industrial and commercial uses, as well as serving important ecological and habitat functions. While most water in the Region is of good quality, some improvement efforts and protections for maintaining this resource are needed. Major water quality issues in bodies of water in the Southern Tier originate from agricultural runoff, point and other non-point sources, combined sewer overflows, discharges from onsite septic and rural wastewater treatment systems, and flooding, as well as motivations to protect major drinking sources.

- **50. Incorporate energy efficiency, renewables, and advanced controls into policies for new equipment, new plants, and plant upgrades**

Most water and wastewater treatment plants have evaluation criteria that they must follow when purchasing new equipment and performing retrofits. Policies should be established that require consideration of energy efficiency, renewable energy, and long-term operating costs of equipment in these criteria, so that advanced controls, energy system and process upgrades, and control monitoring equipment can be promoted for energy and cost savings. This may also require board member education to support getting policies passed and budgets established for improvements.

Similar improvements are being made to the Town of Chenango water and wastewater plants, to improve energy efficiency, operational savings and increase water/sewer revenues through performance contract with Wendel Engineering.

- **TOP 22 51. Perform energy audits and install retrofits at major water and wastewater facilities**

Water and wastewater treatment processes use large amounts of energy. Nationally, the energy used to treat water and wastewater can account for up to 30-35 percent of a municipality's energy budget.²⁶ According to the U.S. EPA, potential energy savings at these facilities of 15-30 percent are "readily achievable" and have payback periods of between a few months and a few years.²⁷ Targeting the least efficient plants and implementing energy efficiency retrofits reduces both energy consumed and GHGs emitted. Given that these facilities are typically older and require periodic improvements, communities can plan for those upgrades and significantly reduce their energy bills when improvements are made. Opportunities for reducing energy use in water and wastewater facilities include sealing building exterior areas to reduce energy losses, upgrading lighting, replacing equipment, incorporating renewables, and improving operations. Two specific processes that lend themselves to energy upgrades in water and wastewater facilities are aeration and pumping systems. Aeration is the procedure that introduces oxygen into treated water and is one of the most energy-intensive parts of water treatment processes. Installing control equipment that monitors dissolved oxygen and turns on

²⁶ US Environmental Protection Agency, "Energy Efficiency: On the Road to Net Zero Energy," <http://www.epa.gov/reg3wapd/infrastructure/EnergyEfficiency/Lampman, Gregory, Kathleen O'Connor and Amy Santos, 'NYSERDA and Strategic Energy Management at Municipal Wastewater Treatment Facilities,'> <http://www.nywea.org/clearwaters/08-1-spring/04-NYSERDA.pdf>.

²⁷ US Environmental Protection Agency, "Energy Efficiency for Water and Wastewater Utilities," <http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm>.

the aeration pumps only as needed can reduce energy use significantly. Pumping systems also require a lot of energy. Upgrades can be made to the pumping system to minimize water distribution during peak times, improve the efficiency of the pumps, motors, and other processing equipment, and automatically regulate the pumping and other processes in a plant. Installing more efficient pumping systems and sensors can produce energy savings of 20 percent or more.

■ **52. Develop new distribution system repair, replacement, and expansion policies that prioritize repair/replacement rather than expansion of service areas**

Modeling and analyses have been conducted around the country to analyze the financial impacts of sprawling vs. compact development, and the cost savings are significant. The cost to serve compact development close to a centrally located water/wastewater plant is about half that of distribution for highly dispersed development located far from the water service center.²⁸ This action calls on municipalities to review current policies to be sure that they encourage compact development and growth in areas where the distribution system already exists, in order to avoid the costs associated with far-flung, costly infrastructure. This analysis is also required for any state-funded projects under the 2010 Smart Growth Public Infrastructure Priority Act, which directs New York State agencies to make infrastructure spending decisions in accordance with smart growth principles. To encourage growth in already-developed service areas, municipalities can provide funding for the upgrades to water systems that maintain their current boundaries.²⁹ Updated policies should also address INI (inflow and infiltration) and the importance of collection and distribution systems to INI mitigation, as well as improvements to metering and sub-metering systems.

■ **53. Expand education, outreach and pilot projects for green infrastructure and Low-Impact Development practices**

Several Southern Tier organizations promote community education and outreach and encourage local governments to become involved in water quality efforts. However, more education, training, and staff are needed to support and enforce current stormwater permit requirements (for construction activities and “urban area” municipalities), local water quality objectives, and Chesapeake Bay restoration. Funding is also needed to implement retrofit projects that address drainage problems associated with existing development. Counties could seek funding to foster a citizen based watershed ethic and promote water quality protection programs with local governments, such as provided by the Chesapeake Bay program. Broome County is working toward installing pervious pavement in the parking lot and the Garden of Ideas at the TechWorks! Museum of Invention and Upstate Industry, which will help the public see firsthand the benefits of replacing traditional asphalt parking lots. Binghamton has a sustainable development planner and is updating land use regulations and codes to promote sustainable practices. Tompkins County has taken steps towards completing aquifer studies county-wide and establishing a Community Science Institute volunteer water quality monitoring program and a floating classroom on Cayuga Lake.³⁰

■ **54. Develop program and guidelines to improve stormwater drainage design and maintenance for rural roadways**

Water quality could be improved if best practices were instituted for the construction and maintenance of rural roadways in the Southern Tier that run along streams. These projects often result in narrower floodplains and the need to harden stream banks to protect the road, which can contribute to further destabilization of the stream via erosion and sedimentation. County Soil and Water Conservation Districts and Cooperative Extension can work with roadway maintenance agencies to develop improved construction and maintenance

²⁸ Spier, Cameron and Kurt Stephenson, 2002. “Does Sprawl Cost Us All? Isolating the Effects of Housing Patterns on Public Water and Sewer Costs.” *Journal of the American Planning Association* 68(1): 59-70.

²⁹ “Growing Toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies.” EPA, 2006, Available online: http://www.epa.gov/dced/pdf/growing_water_use_efficiency.pdf

³⁰ Cayuga Lake Floating Classroom, Website, Available online: <http://www.floatingclassroom.net/who>

standards. While roadway construction projects typically require compliance with general NYSDEC SPDES stormwater permits for linear projects, additional design and management measures can further enhance water quality protection. Pennsylvania’s Dirt and Gravel Road Program addresses roadway drainage issues through research, technical bulletins, assessment of current conditions, technical assistance by Conservation Districts, training of highway department staff, and grant funding for priority problem sites. The program could also promote the increased use of vegetative buffers along roadways to enhance natural drainage and filtration of contaminants, along with hydroseeding of roadside ditches after they are cleaned (several counties have hydroseeding programs for this purpose). Road maintenance activities in more developed areas could also prioritize the collection and removal of road debris on a periodic basis through street sweeping as well as curb and storm drain debris removal. Limitations on the amount of road salts applied to rural roadways and the storage of salts for snow removal during the winter season could also be implemented.

■ **55. Support regular updates and implementation of local and county water quality strategies and plans**

Most Southern Tier counties have active Water Quality Coordinating Committees that have developed and implemented strategies for protecting and improving water quality. In addition, municipalities in the Binghamton, Elmira, and Ithaca areas have established stormwater programs in compliance with Municipal Separate Storm Sewer System (MS4) permits. Chemung, Schuyler, and Steuben Counties have also established the Rural Stormwater Coalition to promote improved stormwater management. Implementation funding and regular updates of these various strategies can promote a variety of local water quality improvement activities. Technical support is provided by County Soil and Water Conservation Districts, Southern Tier Central Regional Planning and Development Board, and others. Counties without active Water Quality Committees or existing stormwater programs could develop local plans and ordinances that address specific water quality issues, such as high nutrient loads from agricultural activities, sediment loads from new development, and urban runoff from towns and roadways. A good example to work from is Syracuse’s successful “Save the Rain” program.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
50. Incorporate energy efficiency, renewables, and advanced controls into policies for new equipment, new plants, and plant upgrades				
See green box below for benefits	<ul style="list-style-type: none"> - Produces an estimated 14 jobs (between actions 50 and 51) - Reduce energy consumption and emissions - Reduce operating costs of wastewater and water treatment systems 	Install supervisory control and data acquisition (SCADA) systems	Water infrastructure is outdated and requires upgrades	Water and wastewater utility boards, Local governments
See action 51 below for combined targets and GHG reduction benefits for actions 50 and 51.				
51. Perform energy audits and install retrofits at major water and wastewater facilities Top 22				
See green box below for benefits	<ul style="list-style-type: none"> - Reduce energy consumption - Reduce operating costs of wastewater and water treatment systems 	The Ithaca Wastewater Treatment Plant is reducing its net energy use by 70-75 percent through installation of multiple energy efficient plant and equipment	<ul style="list-style-type: none"> Improvements to facilities can be expensive Use of decentralized water treatment systems poses a challenge for 	Regional planning boards; councils of government; municipalities; energy professionals;

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
		upgrades. Lowell, MA installed motion sensors for lighting and energy efficient pump motors	implementing energy efficiency strategies	businesses
GHG Reduction Benefits	7,000 MTCO₂e. This action would affect about 210 of the water systems and 33 of the wastewater systems.			
<p>The target (#1a) associated with this action is to reduce on-site building natural gas and electricity consumption per end use by 7.5 percent in the industrial sector in 5 years and by 30 percent in the industrial sector in 20 years.</p>				
<p>The Ithaca Wastewater Treatment Plant is reducing net energy use by 70-75% through a variety of investments in energy efficiency and renewable energy. If two-thirds of the Region’s water and wastewater treatment plants make similar upgrades, the Region’s emissions can be reduced by about 7,000 MTCO₂e, or 0.2 percent of the Plan’s estimated GHG reduction benefits. There are about 320 community water systems serving about 478,000 people (though individual districts within the same system are often counted separately) and about 50 wastewater systems in the Region. This action would affect about 210 of the water systems and 33 of the wastewater systems.</p>				
<p>52. Develop new distribution system repair, replacement, and expansion policies that prioritize repair/replacement rather than expansion of service areas</p>				
This action would help achieve benefits of land use and location efficiency.	<ul style="list-style-type: none"> - Reduce energy consumption - Reduce operating costs of wastewater and water treatment systems 			Local governments, Utilities
<p>This action would help achieve the benefits of land use and location efficiency discussed above, as well as supporting the energy reduction and GHG reduction quantified in action 51.</p>				
<p>53. Expand education, outreach and pilot projects for green infrastructure and Low-Impact Development practices</p>				
	<ul style="list-style-type: none"> - Reduce runoff and flooding, and increase aquifer recharge - Save money by protecting water quality and avoiding the need for clean-up 	Bioretention systems and/or rain gardens; Pervious pavement. Can be applied to new development, redevelopment, or as retrofits to existing developments.	Lack of education on the impacts of citizens’ actions on water quality; high cost of stormwater retrofit projects	Local governments. Utilities, Developers, stormwater coalitions, County Water Quality Coordinating Committees
<p>The target (#15) associated with actions 53 to 55 are to reduce the Total Number of Impaired Waters by 11 percent in 5 years and by 66 percent in 20 years. The GHG benefits of the actions 53 to 55 cannot be quantified. They would likely improve water quality and reduce the intensity of water treatment, but the net effect of these policies is difficult to quantify at this time.</p>				
<p>54. Develop program and guidelines to improve stormwater drainage design and maintenance for rural roadways</p>				

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
	<ul style="list-style-type: none"> - Keeping water clean and safe - Reducing road maintenance costs 	Pennsylvania DOT Dirt and Gravel Road Program	Lack of funding for additional technical assistance and project grants	Local governments, County Highway Departments, SWCDs, MPOs, Regional agencies, NYSDOT, Cornell Local Roads Program
See action 53.				
55. Support regular updates to County-based water quality strategy plans				
	<ul style="list-style-type: none"> - Keeping water clean and safe - Maintaining established policies for water protection - Local information sharing and coordination for reducing non-point pollution 	The Southern Tier Central Regional Water Resource Program provides technical support for improved management of stormwater runoff, avoiding increased flood risks, and protection of water quality.	Non-point source pollution originates from diverse sources across the landscape, including construction, road maintenance, and agriculture	WQCCs, stormwater coalitions, Local governments, County and Regional Agencies, Nonprofits, lake associations and watershed organizations
See action 53.				

WASTE MANAGEMENT

In the Southern Tier, the average resident disposes of about four pounds of waste daily. Additional effort is required to increase waste prevention, encourage material reuse, improve collection and processing of recyclables, and maximize energy recovery from the methane generated by waste. Reinforcing actions taken by informed and engaged households, businesses, industries, governments, and waste collection managers are essential to achieving this goal.

■ **TOP 22** 56. Expand Pay-As-You-Throw trash collection

Pay-as-you-throw (PAYT) programs charge residents for the collection of their household trash, based on the amount they throw away. This provides a strong incentive to reduce waste production, and increases recycling and reuse of materials. PAYT advances the principal of the Four R's of Waste: reduce, reuse, recycle, and rebuy, and also encourages composting. Traditional waste collection systems are paid for through fixed fees, regardless of a resident's level of usage. Pay-as-you-throw and other unit-based pricing systems require residents and businesses to purchase trash tags that cover the per-unit cost of waste in order to dispose of it. In doing so, they ensure that consumers of waste collection services only pay for the collection of the waste they produce. Various studies have presented the immediate and direct benefits associated with this program, including findings that the recycling rates can increase by nearly 100 percent³¹ as a result of implementing a PAYT system. According to the EPA, PAYT can also reduce overall waste disposal by an average of 14 to 27 percent; various other studies have estimated a 30 to 40 percent reduction in the amount of waste deposited in landfills, directly reducing the environmental impacts and methane emissions from waste.³²

■ 57. Introduce innovative reuse strategies to reduce the waste stream

This action promotes finding ways to reuse hard-to-recycle waste streams, such as food waste, construction and demolition materials, and office and industrial waste. This can also have positive social and economic benefits. Excess food that is suitable for redistribution to food banks can promote healthy community initiatives. Food waste may also be repurposed for animal feed. In the Southern Tier, construction and demolition materials are being repurposed by such entities as Finger Lakes ReUse. This business model could be promoted across the Region to develop a "reuse network" of similar facilities.

Reuse centers, such as Finger Lakes ReUse or Habitat for Humanity's ReStore facilities, focus specifically on construction and demolition material reuse, as well as office supplies, housewares, and electronics. These community-oriented facilities provide environmental benefits through the recovery of usable materials through deconstruction of buildings, as well as social benefits from the training of employees in specialized skills in the construction trades in addition to basic competencies.

■ 58. Expand and improve access to recycling

This action aims to expand recycling systems to include additional drop-off sites or through specialized recycling events such as for electronics or hazardous products, offered with operating hours that are convenient for working people. Expanding curbside collection to more municipalities would facilitate easier recycling for residents, especially if applied to multi-family residences. A complementary concept is to place freestanding recycling dumpster stations in community hubs, school parking lots, or other locations that are accessible to residents at all times. Also, establishing new resource recovery parks, similar to the Finger Lakes ReUse Center, would provide a convenient central location for residents to engage in a variety of waste management activities, such as dropping off recyclables and waste electronics while purchasing compost and reused goods.

³¹ See, for example, Connecticut Department of Energy and Environmental Protection, "SMART Programs in Connecticut," <http://www.ct.gov/dep/cwp/view.asp?A=2714&Q=324920>.

³² See, for example, US EPA, Pay-As-You-Throw: Lessons Learned about Unit Pricing, <http://www.epa.gov/osw/conserves/tools/payt/pdf/payasyou.pdf>.

■ **59. Expand and improve access to composting services**

This action calls for increasing composting through municipal curbside pickup for organic waste, especially food waste. There is potential for establishing centralized public composting stations in rural areas where curbside pick-up is not economically feasible, such as at community gardens, co-locating with Resource Recovery Parks, or on other publicly owned property, such as school grounds. Public-private partnerships between municipalities responsible for collection and composters may be an effective model for facilitating larger-scale composting.

Composting in the Southern Tier

- Tioga County has successful public yard waste composting events for rural residents.
- Delaware County operates a centralized mixed-waste composting system.
- Cayuga Compost is a commercial business that partners with Tompkins County Division to compost about 3,400 tons of community-generated waste annually.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
56. Expand Pay-As-You-Throw trash collection Top 22				
72,000 MTCO ₂ e	- Reduce trash collection service costs - Reduce waste generation - Increase reuse, recycling and composting	Tioga and Tompkins Counties and the City of Binghamton: Pay As You Throw (PAYT) programs	Can be difficult to convince residents and businesses that are used to a fixed-fee system that PAYT is a beneficial alternative	Counties, solid waste managers, private waste collection and disposal firms, managers of recycling and reuse facilities
<p>The target (16a) associated with this action is to reduce per capita waste disposal rates (measured in pounds per capita per day) by 12.5 percent in 5 years and by 50 percent in 20 years. Given research from other areas that has shown over 100 percent increases in recycling rates as a result of PAYT implementation, 12.5 percent in five years seems practical. Combining this action with improvements to recycling infrastructure and implementation of materials reuse strategies will make the long-term target achievable as well.</p> <p>Using the EPA SMART BET tool,³³ it is estimated that implementing Pay As You Throw (PAYT) policies at the Region’s trash collection centers would reduce emissions by about 72,000 MTCO₂e, or 2.3 percent of the Plan’s estimated GHG reduction benefits. This is based on conservative assumptions about policy design, and PAYT policies could be leveraged to realize greater reductions.</p>				
57. Introduce innovative reuse strategies to reduce the waste stream				
See green box below for benefits	- Reduce GHG emissions -Reduce waste generated - Support sustainable agriculture and food systems efforts	Finger Lakes ReUse; Humanity’s Re-Store facilities	Limited data on waste managed in the private sector inhibits resource recovery	Local governments, waste haulers Institutions, Non-profits

³³ Available online at: <http://www.epa.gov/osw/conservation/tools/payt/tools/smart-bet/>.

GHG Reduction Benefits	Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
<p>Actions 57 to 59 address the same target (16a) as action 56 above, using the EPA WaRM tool³⁴ to estimate an alternative waste scenario that includes source reduction, increased recycling, and increased composting. Assuming that the regional landfilling rate of 4 lbs/person/day is reduced to 2 lbs/person/day through source reduction, recycling, and composting, GHG emissions can be reduced by 427,000 MTCO₂e. Because PAYT programs discussed in action 56 above help achieve the same goal, only the incremental benefits of this action should be counted here: 427,000 MTCO₂e minus 72,000 MTCO₂e, yields 355,000 MTCO₂e. Of this, 328,000 MTCO₂e of reductions result from recycling and source reduction, and 27,000 MTCO₂e result from composting. These benefits include some upstream lifecycle emissions not include in the Region’s baseline, but for the purposes of this analysis they have been included here. 355,000 MTCO₂e is 11 percent of the Plan’s estimated GHG reduction benefits.</p>				
<p>58. Expand and improve access to recycling</p>				
<p>See green box below for benefits</p>	<ul style="list-style-type: none"> - Reduce GHG emissions - Increase recycling rates and variety of materials recycled - Raise awareness about waste reduction and management 	<p>Increase collection of recyclables through single-stream recycling collection and other methods and incentives</p>	<p>Due to low population density, the Region faces high costs for Municipal Solid Waste collection</p>	<p>Local governments, waste haulers Institutions, Non-profits</p>
<p>See action 57 above</p>				
<p>59. Expand and improve access to composting services</p>				
<p>See green box below for benefits</p>	<ul style="list-style-type: none"> - Reduce trash collection costs - Reduce waste generation - Support agriculture activities 	<p>Centralized composting, which provide the opportunity to divert large quantities of organic materials from the waste stream</p>	<p>Limited opportunities for increased landfill gas to energy recovery</p>	<p>Local governments, waste haulers Farms, Businesses Institutions, Non-profits</p>
<p>GHG Reduction Benefits</p>	<p>355,000 MTCO₂e. Of this, 328,000 MTCO₂e of reductions result from recycling and source reduction, and 27,000 MTCO₂e result from composting.</p>			
<p>See action 57 above</p>				

³⁴ Available online at: http://www.epa.gov/climatechange/waste/calculators/Warm_home.html.

GOVERNANCE

Building and strengthening long-term partnerships will be critical to tackle planning, development, infrastructure, and energy/GHG emissions issues. Working together on strategies, policies, codes, efficiencies, best practices and new technology integration into systems will be needed to take action and implement this plan. By continuing to work together as the Southern Tier Regional Consortium, each member government, regional agency, institution, or business can focus on developing innovative solutions that can be shared with other regional partners.

Many actions that are proposed in this Plan are inherently cost-effective, whether through low initial costs, or by one investment meeting multiple goals. Others are more expensive, but provide significant annual savings in operating costs that can help pay off the investment over time, while producing ongoing environmental and health benefits. Given limited funding availability and a long list of potential projects, coordinating projects across agencies and municipalities will help maximize the effectiveness of each investment.

Smart growth planning that is integrated across land use, transportation, housing, water and sewer, schools, parks, and other facilities can reduce infrastructure and operating costs. Designating growth areas and focusing development in and around existing communities can increase the efficiency and effectiveness of every system – from water and sewer, roads and transit to shared parking and multi-use facilities. Coordinating a variety of initiatives with other municipalities, such as green fleet programs, energy codes, waste reduction programs, energy conservation, renewables deployment, cooperative purchasing agreements offers great potential for fiscal savings and good government.

■ 60. Strengthen the Southern Tier Regional Consortium

The Southern Tier Regional Consortium (Consortium) consists of representatives from all counties, cities, and Climate Smart Communities in the Southern Tier; Southern Tier Regional Economic Development Council (REDC) members; and other regional stakeholders, such as cooperative extension staff, local economic development agencies, metropolitan planning organizations (MPOs), colleges and universities, and agricultural agencies. The Consortium was established to involve municipal planning representatives and a cross section of Southern Tier leaders and topic area experts in this planning process. Consortium members have reviewed, discussed, and helped to refine draft elements of the Cleaner Greener Southern Tier Plan. The Consortium, the Regional Economic Development Council, and the Southern Tier Central and Southern Tier East Regional Planning and Development Boards will be the primary regional entities working to coordinate implementation of this plan. STC and STE already have strong working relationships with each other and with their member localities, and can take a lead or supporting role on many of the projects identified in this plan (although many actions will require additional funding or staff). Members can continue supporting and strengthening the Consortium by encouraging other municipal leaders, organizations, University sustainability leaders, municipal service providers, and others to join the Consortium. The Consortium will be important in ensuring that the goals of this Plan continue to be considered and met as municipalities move forward with planning and implementing sustainability initiatives. The Consortium could also provide opportunities for its members to collaborate in smaller topic-area work groups (or Communities of Practice) to share knowledge and strategies across the Region.

■ 61. Develop regional coordinated planning and policy guidance documents

Based on further review of existing planning documents and codes, a set of templates can be developed that could be re-used and customized for all municipalities across the Region. These documents would be developed in partnership with local governments working collaboratively, serving as pilot projects that represent a range of community types, sizes, geographic differences, and specific planning and development issues. A toolkit of regional guidance documents could make it easier for local governments to coordinate and collaborate on plans and project-level implementation. This action is linked to several other actions in other topic areas that describe specific plans, codes, policies, and other documents or projects that might benefit from coordinated development. Topics to be addressed initially would reflect the Region's 65 priority

implementation actions and would likely evolve over time. Since climate change and disaster planning are not yet fully understood by residents and elected officials, a draft chapter that outlines the issues and suggested actions could be prepared for use in comprehensive plan updates, and adapted as needed for different municipalities. The U.S. EPA recently developed guides for reviewing and updating both urban and rural planning and development policies and codes.³⁵ The Town of Ithaca recently created a Conservation Zone along the west shore of Cayuga Lake to ensure the protection of wooded and steep slopes. Using these and other local code examples as models, interested municipalities can explore similar applications in other areas throughout the Southern Tier.

■ 62. Hold regular conferences and training for planning boards, agency staff, and community stakeholders

Implementing the Cleaner Greener Southern Tier goals should include ongoing public outreach and project-level work with communities. Municipal staff and elected officials will want to learn more about what the Plan means to their community, and how they can access tools and planning resources to develop their own project implementation strategies. The short time frame of the Cleaner Greener Initiative does not allow the partners to fully develop the training, understanding, and buy-in needed for the Region to take action on the recommendations. Ongoing interaction among regional and local elected officials, planning boards and staff, operating agencies, and community volunteers and activists can help the local governments and Consortium members to implement the Plan and track its progress. It will also help regional agencies and local planning boards to coordinate planning efforts. A series of presentations at local community colleges or hosted by regional agencies could provide training on sustainability principles, transportation strategies, policies, and code changes that could be considered for implementing the Cleaner Greener actions in each municipality. Training sessions can also be incorporated into ongoing planning processes and project development. Staff could work with the towns, villages, and counties; the regional planning boards could develop sample language and draft chapters on the many topics covered by the plan, all to be made part of the communities' comprehensive plans. Southern Tier East's partnership with the Tioga REAP Stronger Economies Together Program, which focuses on rural economic and civic development, could be used as a model for similar efforts in other counties.³⁶

The Southern Tier Central RPDB holds an annual municipal training institute for planning and elected officials, including continuing education credit.

The Southern Tier East RPDB conducts municipal training for compact development across the STE region.

Many of the agencies, organizations, and staff likely to be involved in implementing this plan already meet regularly on a variety of issues. These include transportation planners, local planners, economic development groups, environmental organizations, and others, though most do not meet with all of the regional players involved on any one issue. In some cases, progress can be made by simply adding plan implementation as an agenda item in these regular meetings. Since some of these meetings are in organizations that do not cover the entire Region (STC, STE, or the three MPOs), there will need to be regular coordination across these 'sub-regional' agencies to make sure that information learned from each pilot project is shared across the Region.

■ 63. Coordinate regional working groups focused on key implementation actions

In other topic areas, there may not be an existing agency or organization that covers the Region and gathers all parties interested in a particular topic or action, such as water and wastewater system operators. Given the high GHG reduction potential of energy efficiency improvements at these plants – and the limited time available for staff at each plant to explore sustainability solutions – a working group could be formed to

³⁵ "Essential Smart Growth Fixes for Rural Planning, Zoning, and Development Codes", 2011, U.S. EPA. "Essential Smart Growth Fixes for Urban and Suburban Zoning Codes". 2010, U.S. EPA. http://www.epa.gov/smartgrowth/essential_fixes.htm

³⁶ <http://www.tiogareap.org/>

coordinate efforts. Sometimes called ‘communities of practice’, working groups can be informal, not require board votes to establish or join, and only last as long as needed to accomplish specific goals.

In coordination with the Consortium, each working group can focus on specific actions in their topic area, determining what project types and locations would be most effective as demonstration projects and which localities or agencies are interested in sponsoring or hosting projects or events. The working groups can also explore how best to gather and share work products from each project – whether it is a new zoning ordinance template, a checklist for how to plan and select a farm-based anaerobic digester or windmill, or an example green purchasing policy. The MPOs and other transportation agencies could also work with transit providers to develop or enhance inter-city and inter-county transit and rideshare programs. Development of this strategy could involve shared research into overall codes and policies, complete street policies and design guidelines, shared development, parking, and transportation demand management (TDM) policies that could be incorporated into county codes, as well as planning for intra-regional transit service.

These approaches are already working in the Southern Tier. The Regional Transportation Study is a planning project developed by the Regional Transportation Planning Coalition, a group of community leaders representing county governments, higher education, transit, human services, and planning interests, to study transportation in a seven-county area, including the counties of Cayuga, Cortland, Tioga, Chemung, Schuyler, Seneca, and Tompkins (Cayuga and Cortland are not in the Southern Tier project area). Another example of existing interagency collaboration is the I-86 Coalition, led by the Southern Tier East and Southern Tier Central RPDBs.

While the Region’s three major airports are in competition with each other for travelers, they are also competing nationally with other regions. In addition to operational coordination to test sustainability strategies like Binghamton’s heated runways project, a coordinated ‘customer-facing’ green marketing strategy could be linked to other regional sustainable tourism marketing initiatives, and linked to coordinated ground transport options, so that tourists could seamlessly fly into one of the Region’s airports and out of another. Building on the Southern Tier East’s existing Aviation Consortium could be a good way to expand this initiative throughout the Region.

Increased collaboration among area educational institutions could help the Region capture and build upon sustainability initiatives and advanced technology being developed at local universities and colleges. While institutions may compete somewhat for students and faculty, they are also likely to specialize in different fields and research topics that might complement each other. At the academic level, educational institutions could collaborate to align their research efforts and training programs to address any of the sustainability initiatives in this plan. At the administrative level, sustainable purchasing, facilities management, transportation, and management strategies can be shared and replicated across campuses. The same approach could be used for public and private K through 12 school districts.

■ **64. Identify and share examples of existing efficient practices**

The Consortium, regional planning boards, and the REDC can establish a fiscal efficiency working group to research and evaluate the most cost-effective sustainability actions to be undertaken in this Region, building from the Cleaner Greener Southern Tier Plan priority actions. The working group would be composed of Consortium member administrators, budget analysts, purchasing agents, and sustainability planning staff. It would also be helpful to partner with area universities to help track and evaluate ongoing projects through case studies in student research and class projects.

■ **65. Encourage participation and certification in the Climate Smart Communities program**

The Climate Smart Communities program is a partnership between New York State and local communities to reduce GHG emissions and save taxpayer dollars through climate smart actions that also promote community goals of health and safety, affordability, economic vitality and quality of life. It is administered by a partnership of five state agencies, including NYSERDA. Currently there are 5 Climate Smart Communities in the Southern Tier, including cities, towns, and counties. Any town, city, village or county can join Climate Smart Communities

by adopting the CSC Pledge; becoming certified requires developing a climate action plan and taking steps to implement it. This action has been selected as an indicator for tracking progress on this regional sustainability plan.

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
GHG Reduction Benefits	The GHG benefits of the actions below cannot be quantified. Collectively, they help support other actions.		
60. Strengthen the Southern Tier Regional Consortium			
-Continued Regional Planning and coordination - Cleaner Greener Southern Tier plan monitoring		Consortium does not have a sponsor, dedicated staff, or funding beyond this planning process	Local and Regional planning departments, economic development entities, universities and colleges, and topic experts
See action 65 below.			
61. Develop regional coordinated planning and policy guidance documents			
-Make it easier for local governments to coordinate and collaborate on plans and project-level implementation	Schuyler County is updating the County-Wide Comprehensive Plan which all of the municipalities can utilize	Decision-making authority is in the hands of each local community making it difficult to develop coordinated strategies	Consortium, Regional agencies, Local governments
See action 65 below.			
62. Hold regular conferences and training for planning boards, agency staff, and community stakeholders			
	The Southern Tier East RPDB conducts municipal training for compact development across the STE region	Limited local budgets and staff time to address the need for updates	Regional agencies, Local governments, community colleges
See action 65 below.			
63. Coordinate regional working groups focused on key implementation actions			
	The Regional Transportation Study is a planning project developed by the Ithaca-Tompkins County Transportation Council, covering much of the Southern Tier	Difficult to apply integrated sustainability concepts across the entire Region	Consortium, Local governments, regional agencies , MPOs
See action 65 below.			

Other Benefits	Potential Projects or Southern Tier Examples	Barriers	Potential Partners
64. Identify and share examples of existing efficient practices			
			Local governments. Consortium
See action 65 below.			
65. Encourage participation and certification in the Climate Smart Communities program			
<ul style="list-style-type: none"> - Build community capacity - Lower energy costs and emissions - Adds potential for funding 	Current Climate Smart Communities in the Southern Tier: Town of Caroline, Town of Ithaca, City of Binghamton, City of Ithaca, Tompkins County		Local governments, Regional and State agencies
<p>The target (#18) associated with actions 60 to 65 is the number of Climate Smart Communities within Region and the number of certified Climate Smart Communities; with 25 percent of counties and 12.5 percent of municipalities in 5 years and 100 percent of counties and 50 percent of municipalities as the target in 20 years. All of the governance actions support the other actions throughout the plan, and contribute to overall GHG reduction and other sustainability goals.</p>			

COMPLETE LIST OF IMPLEMENTATION STRATEGY ACTIONS

The following list includes all 65 actions in the Final Implementation Strategy. There are another 77 supplemental actions in the Appendix that also support the goals and these priority actions.

1. Promote energy efficiency and renewable energy in residential and commercial buildings **TOP 22**
2. Develop a regional energy roadmap **TOP 22**
3. Explore and create financing options for renewable energy and energy efficiency systems **TOP 22**
4. Assess energy performance, implement, and monitor energy efficiency upgrades in government facilities
5. Facilitate deployment of solar photovoltaic and solar thermal systems **TOP 22**
6. Study and facilitate mid-scale wind projects
7. Facilitate deployment of demonstration anaerobic digester systems
8. Facilitate deployment of geothermal heat pump (GHP) systems
9. Explore transitioning existing power and thermal generation facilities to more sustainable fuel
10. Facilitate use of biomass for heating **TOP 22**
11. Study feasibility of combined heat and power in private development projects and public facilities **TOP 22**
12. Improve connectivity of pedestrian, bike, and transit routes, especially around downtowns, transit stops and schools **TOP 22**
13. Pilot opportunities for intercity bus service, expanded cross-regional transit, and rural on-demand transit **TOP 22**
14. Expand Way2Go and other transportation demand management programs **TOP 22**
15. Facilitate development and expansion of carsharing programs
16. Update parking policies, codes, management plans, and pricing
17. Encourage adoption of green fleet policies for public and private fleets **TOP 22**
18. Create a region-wide electric vehicle and alternative fuel infrastructure deployment plan **TOP 22**
19. Encourage development and strategic investment in cities, villages, and hamlets **TOP 22**
20. Provide gap financing for community revitalization projects
21. Support development in downtown areas at appropriate densities
22. Support redevelopment of strategic sites and vacant properties
23. Update local land use regulations & design codes and provide technical assistance to implement projects **TOP 22**
24. Assess affordable housing needs and identify target areas for rehabilitation and new construction
25. Provide financial & technical assistance to rehabilitate housing for low-to-moderate-income households **TOP 22**
26. Remove barriers to converting upper floors to residential uses in city and village downtowns
27. Provide technical assistance and gap financing for construction and rehabilitation of new energy-efficient affordable housing **TOP 22**
28. Implement the Energy Workforce Development Initiative **TOP 22**
29. Identify, train, and certify contractors to meet increased demand for energy efficiency **TOP 22**
30. Promote Regional Broadband Communications Projects
31. Grow local businesses through targeted investment
32. Strengthen university-industry connections to improve and promote workforce development
33. Expand and promote culinary and agri-tourism opportunities
34. Coordinate and market educational and green tourism

35. Support development of processing & distribution facilities (Food Hubs) for local & value-added products **TOP 22**
36. Adopt local food purchasing policies
37. Develop a regional program to promote sustainable forestry and wood products **TOP 22**
38. Develop a regional biomass consortium
39. Promote adoption and funding of BMPs on farms
40. Encourage new farm startups and farm transfers to next generation
41. Maximize farm-based renewable energy production opportunities
42. Coordinate planning and implementation for priority conservation and agricultural protection areas
43. Identify and develop priority trail segments to connect key destinations
44. Incorporate anticipated climate projections, impacts and proposed mitigation strategies into Hazard Mitigation Plan updates **TOP 22**
45. Assess the viability of current and potential future crops
46. Update Flood Insurance Rate Maps, map additional flood-related hazards, and manage development in high risk areas
47. Prioritize high risk floodplains for conservation through acquisition and easement
48. Establish and promote undeveloped buffers for streams and wetlands
49. Develop incentives to encourage property owners to protect streams and buffers
50. Incorporate energy efficiency, renewables, and advanced controls into policies for new equipment, new plants, and plant upgrades
51. Perform energy audits and install retrofits at major water and wastewater facilities **TOP 22**
52. Develop new distribution system repair, replacement, and expansion policies that prioritize repair/replacement rather than expansion of service areas
53. Expand education, outreach and pilot projects for green infrastructure and Low-Impact Development practices
54. Develop program and guidelines to improve stormwater drainage design and maintenance for rural roadways
55. Support regular updates and implementation of local and county water quality strategies and plans
56. Expand Pay-As-You-Throw trash collection **TOP 22**
57. Introduce innovative reuse strategies to reduce the waste stream
58. Expand and improve access to recycling
59. Expand and improve access to composting services
60. Strengthen the Southern Tier Regional Consortium
61. Develop regional coordinated planning and policy guidance documents
62. Hold regular conferences and training for planning boards, agency staff, and community stakeholders
63. Coordinate regional working groups focused on key implementation actions
64. Identify and share examples of existing efficient practices
65. Encourage participation and certification in the Climate Smart Communities program



APPENDIX C:
**GHG BENEFITS OF THE IMPLEMENTATION
STRATEGY**

GHG BENEFITS OF THE IMPLEMENTATION STRATEGY

The purpose of this document is to present the estimated GHG emission benefits of the actions proposed in the Cleaner Greener Southern Tier Implementation Strategy. Estimating the GHG benefits of actions in the Implementation Strategy is a necessary step toward demonstrating the extent to which the Strategy contributes to New York State's GHG emission reductions. Due to the nature of the Implementation Strategy, rigorous quantification of GHG benefits is not possible; however, broad estimates of GHG reductions can be made. Monitoring and verification activities will be required in order to achieve highly accurate accounts of the actual emission reductions accomplished through implementation of these actions.

The sections below present the calculated emission reduction potential of the actions identified in the Implementation Strategy. In all cases, the potential identified is calculated based on aggressive assumptions in order to provide an estimate of the impacts of these actions. Achieving these reductions will require the application of significant resources, both in time and money, and will require the Southern Tier to work together as a region in new ways not yet seen. The challenges are significant, however, the emissions reductions calculated could be accomplished if the region is able to coordinate activities, share models of success, and attract project funding. While these action estimates are aggressive, there is still room for more to be done, and greater reductions can be achieved through even more aggressive adoption of these actions, as well as additional efforts to implement the supplementary actions in the Plan's Appendix.

Conclusion

The official New York State goal is to reduce GHG emissions to 80 percent below 1990 levels by 2050, with an interim goal of 40 percent below 1990 levels by 2030. A 1990 baseline has not been developed for the Southern Tier region, but New York State emissions were nearly unchanged between 1990 and 2008: 247 million MTCO₂e in 1990, rising to a high of 280 million MTCO₂e in 2005, down to 254 million MTCO₂e in 2008.¹ Assuming a relatively similar pattern in the Southern Tier Region, the 2010 Southern Tier inventory value can serve as a reasonable proxy for the 1990 emissions baseline, from the context of the state goal. It is likely that the Southern Tier's GHG emissions are already below 1990 levels due to declining population and the declining GHG emissions intensity of grid electricity in the region.

Between the quantifiable actions in the region's Implementation Strategy and the Federal CAFE standards, Southern Tier emissions can be reduced by approximately 3.2 million MTCO₂e, or about 32 percent of 2010 emissions, by 2032. While this is less than the 40% by 2030 goal for NYS, this Plan lays out a clear path for the region to make significant strides in achieving GHG emissions reductions in support of state goals.

Background

Emission reductions are calculated in a similar manner as GHG emissions, but there are distinct differences and challenges in projecting the reductions anticipated to be achieved as a result of activities. Specifically:

- Broadly speaking, GHG *emissions* are estimated as the result of a measurable activity times an emission factor, which is expressed in emissions per unit of activity. Energy consumption is the most important activity from a GHG perspective, and estimates included in the Southern Tier's Regional GHG Inventory are calculated as the consumption of various fuels multiplied by the appropriate emission factor for that fuel.
- Emission *reductions*, on the other hand, are estimated based on either a change in the amount of an underlying activity or a change in the emission factor. For example, emissions from electricity consumption can be reduced by increasing efficiency and consuming less electricity (reducing the level of the activity)

¹ "Climate Action Plan Interim Report," Tables 3-1 and 3-2. New York Climate Action Council (NYCAC), 2010. Available online at: <http://www.dec.ny.gov/energy/80930.html>.

and/or by changing the technologies used to generate the electricity to emit fewer GHGs per unit of electricity (reducing the emission factor).

The challenges of estimating the benefits of the actions in the Implementation Strategy fall into the following key categories:

- **Level of Detail.** The quality of a GHG emission reduction estimate is a function of the level of detail available. Whenever possible, this analysis used existing, credible methods for quantifying reductions, such as those developed by the California Air Pollution Control Officers Association (CAPCOA) in their guide, “Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures.” These methods require a certain level of detail, yet many of the actions are construed rather broadly, to “promote” and “facilitate.” To account for this, benefits in this memo are quantified based on the measured performance of related actions and assumptions about the extent of the action.
- **Overlap between Actions.** Many of the actions listed below address the same ultimate goal. For example, Transportation and Livable Communities actions often have the ultimate goal of reducing vehicle miles traveled (VMT) through changes in land use and behavior. While studies quantify the benefits of one policy or another, these benefits are not necessarily additive. In fact, actions such as increasing density, improving public transit, and implementing car sharing programs may collectively reinforce each other, making it difficult to identify the benefits associated with any one specific action. Therefore, in this memo, many actions have been grouped, and a shared set of assumptions is proposed.
- **Boundary Considerations.** There are a variety of boundary considerations to keep in mind in calculating the GHG reductions associated with actions. First, an action may have emissions benefits that were not included in the baseline inventory. For example, increasing recycling will usually result in upstream benefits that occur outside of the region. This is noted when applicable. Second, the Southern Tier inventory provided electricity emission estimates for both Scope 1 (direct emissions from electricity generation) and Scope 2 (indirect emissions from electricity consumption), but only Scope 2 emissions were included in the regional total. Actions in the Implementation Strategy address both Scopes: increasing electricity generation from renewable sources affects Scope 1 emissions, while increasing energy efficiency affects Scope 2 emissions. Further complicating the matter is the fact that Scope 2 emissions are driven by the grid mix of fuels used for electricity generation, and the grid extends outside of the Southern Tier region. Fully accounting for these effects is extremely challenging on the community level, and is more easily addressed on the state or national level. Therefore, this issue should be noted or accounted for when summing benefits across actions.

Another boundary consideration to keep in mind is future development. It was assumed in this analysis that there will be no net change in regional population, and that future economic development will offset projected decline in regional population over the next few decades.

- **External Forces.** Some of the largest factors driving future emissions are beyond the control of the Southern Tier region. Motor vehicle fuel efficiency and alternative fuel availability will be likely shaped in large part by the Federal government and car companies, while the grid mix for electricity generation will likely be shaped by State policy. We have adopted a Business-As-Usual (BAU) approach here, holding such key factors constant based on currently adopted laws and policies. Another reason to hold emissions constant over the 20-year time horizon of this plan is that total population in the region has been declining over the past several decades, though it is anticipated that growth in the region’s metropolitan areas will offset that ongoing trend, leaving total regional population unchanged between 2010 and 2032. As a result, the 2032 BAU emissions are projected to be approximately equal to 2010 baseline emissions, or 9.9 million metric tons of carbon dioxide equivalent (MTCO_{2e}).
- **Unquantifiable Actions.** Several actions are considered unquantifiable. In some cases, actions are likely to help support GHG reductions from other actions, but the relationship cannot be quantified. The actions are marked as “supporting actions.” In other cases, the actions have no tangible GHG benefits or the potential outcomes are too uncertain to quantify benefits at this time. These are also indicated below.

Methods and Results

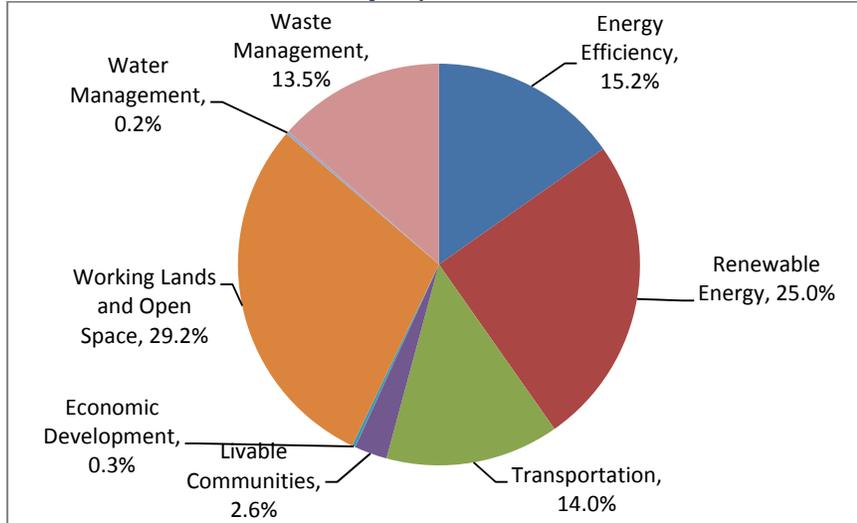
The Implementation Strategy is the result of an extensive process to identify the most effective implementation actions to help the Southern Tier meet its sustainability goals across the nine topic areas. It was developed over the course of several months, based on extensive community involvement and significant technical analysis.

Over 160 potential actions – policies, programs, or projects – were developed for review by the public and several technical stakeholder groups; a sub-set of over 60 priority actions were included in a Short-Term Action Strategy. After working sessions with the Planning Team and a weeklong set of public and stakeholder workshops in October 2012, a set of 65 priority actions were chosen for inclusion in the Implementation Strategy; many of the original actions were combined and strengthened. The 65 priority actions were found to be technically feasible, realistic from a policy perspective, and would contribute significantly toward meeting the Region’s sustainability goals. Another 77 remaining potential actions were identified as less important to focus on in the near term, but would support the project goals and contribute to other actions in the Implementation Strategy. These supplementary actions are found in the Appendix, and are not included in this emissions reduction analysis.

This analysis did not look at what emission reductions were needed, then work backward to identify how aggressively and what specific actions would need to be implemented. Rather, this analysis quantified the GHG impacts of reasonably implementing these actions over 20 years. The results of this analysis are presented in Table 1 below, showing only those actions which will result in quantifiable GHG reductions. The table also shows the total amount of carbon dioxide equivalent that will be reduced by 2032, the planning horizon for this report. As noted above, 2032 BAU emissions were projected to be equal to 2010 emissions, or approximately 9.9 million MTCO₂e. Among the measures quantified, total reductions are estimated to be approximately 3.2 million MTCO₂e, a reduction of approximately 32 percent. Figure 1 below shows the relative contribution to overall reductions by topic area.

TABLE 1 ■ Estimated GHG Reductions by Action

	Action	Metric Tons CO ₂ Equivalent Reduced
1	Residential/commercial energy efficiency	397,000
4	Government building energy efficiency	85,000
5	Solar PV	31,000
6	Mid-scale wind	30,000
7	Anaerobic digesters	81,000
8	Geothermal heat pumps	166,000
9	Power plant fuel switching	46,000
10	Biomass for heating	398,000
11	Combined heat and power	37,000
12	Pedestrian/bicycle connectivity	14,000
13	Transit access	81,000
14	Commuter TDM	22,000
15	Car sharing	8,000
16	Parking programs	55,000
17-18	Alternative fuel vehicles and infrastructure	262,000
19-23	Infill growth, VMT benefits	17,000
24-27	New EE units	66,000
30	Broadband (telecommuting)	8,600
37	Sustainable forest management	630,000
39	Agricultural BMPs	74,000
42	Conservation areas	219,000
50-51	Water and wastewater treatment energy efficiency	7,000
56	Pay as you throw	72,000
57-58	Increased recycling and source reduction	328,000
59	Increased composting	27,000
	Total Reductions	3,161,600

FIGURE 1 ■ GHG Reductions by Topic Area

Many of these actions address emissions included in the regional baseline, but others do not. For example, action 9, Power Plant Fuel Switching, would reduce emissions at power plants sited in the region by nearly 800,000 MTCO_{2e}, but because the NYS Inventory Protocol has elected to count electricity from the consumption side and not the production side, these emissions were not included in the Southern Tier Inventory baseline. However, such an action would nevertheless reduce statewide GHG emissions, and this table does include the portion of those reductions that would affect the indirect emissions from electricity consumption in the region. Similarly, increased recycling (action 58) would reduce upstream GHG emissions due to decreasing the need for energy-intensive virgin materials. Nevertheless, it is important to acknowledge the GHG benefits of the above actions, regardless of where they occur with respect to the region's boundaries.

External Policies that will Impact Regional Emission Projections

Two major policies have the potential to affect the region's future emissions: the New York State Renewable Portfolio Standard (RPS) and Federal Corporate Average Fuel Economy (CAFE) standards. The New York State RPS goal is for the state to generate 30 percent of its electricity from renewable sources by 2015. Based on existing policy, no changes were included for the New York RPS because the New York Upstate sub-region already meets this standard: in 2009, 34.7 percent of electricity was generated by renewable resources, 34.7 percent was generation by fossil fuels, and 30.6 percent was generated by nuclear power. Therefore, there is no additional state policy driver at this time forcing an increase in renewables. As a result, emission reductions from any additional renewables adopted as a result of this Implementation Strategy will reduce GHG emissions beyond BAU.

In the case of Federal CAFE standards, average fuel economy in new passenger cars and light trucks will increase from 27.5 MPG in 2010 to 54.5 MPG by 2025. The average MPG for vehicles in this category in the region in 2010 was 23.5 MPG. Assuming these vehicles fully penetrate the market in 20 years and VMT stays constant, regional emissions will be decreased by an additional 545,000 MTCO_{2e}. However, actions 12 to 16, actions 19 to 23, and action 30 will reduce passenger car VMT by about 15 percent, thereby reducing the potential benefit of the CAFE standards by 15 percent. Additionally, the benefits of actions 17 and 18 (Green Fleets and Alternative Fuel Vehicle Infrastructure) will overlap with the benefits of the CAFE standards since Alternative Fuel Vehicles will be used to help meet the CAFE standards. Therefore, the benefits of actions 17 and 18 have been subtracted from the benefits of the CAFE standards. As a result, only 240,000 MTCO_{2e} of the estimated 545,000 MTCO_{2e} reduction from the CAFE standards is counted here as an additional reduction from the Federal policy.

Beyond state and Federal policies that will impact GHG emissions in the region, some actions are anticipated to occur that are not quantified in the discussion of actions below. These include the development of utility-scale wind and large solar projects in the region. These are not explicitly addressed, though solar projects may help

meet the goals of action 5 below. While utility-scale electricity generation will not directly impact GHG emissions calculations in the Region, as it is a Scope 1 item for power generation, it will impact NYS GHG emissions reduction goals, and can affect Scope 2 emissions.

Calculation of Benefits by Action

The sections below provide details on the methods and assumptions used to estimate GHG reductions for each action.

1. Promote energy efficiency and renewable energy in residential and commercial buildings

Estimated Benefit: Assuming that 2 percent of the residential and commercial building stock is retrofitted annually through energy efficiency programs, and that these improvements result in a 30 percent reduction in energy consumption, this action will reduce GHG emissions by an estimated 397,000 metric tons of carbon dioxide equivalent (MTCO₂e). Additional benefits from renewable energy deployment are estimated under other measures.

Detailed Assumptions: Reductions from this measure will depend on the overall penetration of retrofits throughout the commercial and residential building stock and magnitude of the improvements. Programs in the U.S. have demonstrated penetration rates of 0.75% to 1.75% annually, with reductions of 25-35% of heating, cooling, and hot water energy use in programs in New York, New Jersey, and Maine.² This analysis assumes an aggressive target of 2 percent of building stock annually over 20 years, and an average 30 percent energy consumption benefit. The reductions are achieved from residential and commercial energy consumption.

Based on about 260,000 occupied housing units currently in the region, this action would need to retrofit roughly 105,000 homes over 20 years, or 5,000 homes per year. By comparison, the New York Home Performance with ENERGY STAR program recorded 228 projects in 2010 and 389 projects in 2011. The number of commercial buildings in the region is more uncertain, but total floor space of commercial buildings was estimated to be approximately 196 million square feet. This was estimated as part of the commercial sector methodology in the GHG inventory, and was based on county employment by industry sector and average square feet per employee by sector.³ This action would address 40 percent of that, or an estimated 78 million square feet of floor space over the 20 year planning horizon.

2. Develop a regional energy roadmap

Estimated Benefit: This action would help achieve other energy efficiency and renewable energy goals. Its benefits cannot be quantified separately, though once the roadmap is developed the benefits of the specific goals outlined can be quantified.

3. Explore and create financing options for renewable energy and energy efficiency systems

Estimated Benefit: This action would help achieve other energy efficiency and renewable energy goals. Due to the high potential for overlap with other measures, its benefits cannot be quantified separately.

4. Assess energy performance, implement, and monitor energy efficiency upgrades in government facilities

Estimated Benefit: Assuming an aggressive effort that results in all local, state, and Federal government facilities retrofitted or replaced with newer facilities, and that these improvements result in a 35 percent reduction in energy consumption, this action will reduce GHG emissions by an estimated 85,000 MTCO₂e. This

² "Residential Efficiency Retrofits: A Roadmap for the future." Regulatory Assistance Project (RAP), 2011. Available online at: www.raponline.org/document/download/id/918.

³ "Commercial Energy Consumption Survey 2003." U.S. Energy Information Administration (EIA), 2008. Available online at: <http://www.eia.gov/consumption/commercial/index.cfm>.

includes a 30 percent reduction from street and traffic lighting upgrades, though these benefits are likely to be underestimated because street lighting was not reported separately by all utilities.

Detailed Assumptions: Reductions from this measure will depend on the overall penetration of retrofits throughout government facilities and the magnitude of the improvements. Improved energy efficiency in government buildings can decrease energy consumption by 35 percent in existing buildings or 50 percent in new and renovated buildings.⁴ Street and area lighting upgrades can reduce electricity by 16 to 40 percent.⁵ This analysis assumes that governments in the region will lead the way on energy efficiency, with 80 percent penetration in government facilities over 20 years, 35 percent reduction in energy used in government buildings, and 30 percent reduction in energy used in street lighting.

Government buildings were not isolated in the regional inventory, though floor space of local, state, and Federal government facilities was estimated to be approximately 44 million square feet, or 22 percent of the region's estimated 196 million square feet of commercial buildings, as discussed above. Also, electricity from street lighting was separated by some utilities. The reductions were applied to the estimated portion of commercial energy consumption from government facilities. Energy efficiency improvements at water and wastewater treatment plants are discussed under actions 50 and 51.

5. Facilitate deployment of solar photovoltaic (PV) and solar thermal systems

Estimated Benefit: Currently, approximately 530 projects totaling 4 MW-DC of PV capacity have been installed in the region.⁶ Based on an average capacity factor of 14 percent,⁷ these units generate nearly 5,000 MWh per year, or 0.073 percent of current electricity generation. If regional capacity is increased to 110 MW-DC within twenty years, that will represent about 2 percent of baseline energy consumption in the region. This is a 27-fold increase over today's capacity, and is equivalent to doubling capacity every 4.8 years, or adding 5.5 MW-DC of capacity each year, on average. This is equivalent to about 14,600 installations of today's average size project, but due to the number of major solar installations currently in development, the average project size is likely to increase. The resulting capacity will result in avoided annual GHG emissions of approximately 31,000 MTCO₂e.

Detailed Assumptions: This increased capacity would likely include a mix of small installations and large projects already in development. The region is currently seeing an expansion of solar installations, especially through solar leasing agreements. The capacity factor was estimated based on detailed New York State installed capacity and generation reports retrieved from the PowerClerk website on November 28, 2012.⁸

To achieve this level of solar capacity in the region, there is an implicit assumption that costs will continue to decline for solar installations, and interconnection of intermittent technologies will be improved through technical advances. Furthermore, any solar goal would be congruent with NYSERDA's overall strategic renewable energy goals. It is recommended that a potential solar resource study be conducted for the Southern Tier, as part of the energy roadmap action, taking into account both rooftop and utility scale, including such factors as the number of buildings, open unshaded land, shading, interconnection and net metering constraints.

⁴ "Clean Energy Lead by Example Guide: Strategies, Resources, and Action Steps for State Programs." U.S. Environmental Protection Agency (U.S. EPA), 2009. Available online at: http://www.epa.gov/statelocalclimate/documents/pdf/epa_lbe_full.pdf.

⁵ "Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures," p. 115. California Air Pollution Control Officers Association (CAPCOA), 2010." Available online at: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.

⁶ "NYSERDA PV Program Analysis by PowerClerk." NYSERDA, 2012. Available online at: <http://nyserda.powerclerkreports.com/>. Accessed 11/28/2012.

⁷ Ibid.

⁸ Ibid.

6. Study and facilitate mid-scale scale wind projects

Estimated Benefit: If 2.5 MW of new wind capacity are added each year (the equivalent of five systems rated at 500 kW each year) over 20 years, the resulting 50 MW of new wind capacity will result in avoided annual GHG emissions of approximately 30,000 MTCO_{2e}.

Detailed Assumptions: Reductions are driven by the amount of electricity generated by the projects, equal to installation capacity times the capacity factor. This analysis assumed a capacity factor of 30 percent.⁹ The installation amount is based on a mid-point assumption of 500KW per installation (mid-scale is generally defined as 100-1000 kW). Five projects of this size per year over 20 years would yield 50MW of installed capacity.

Emissions reductions could affect both Scope 1 and Scope 2 electricity, depending on whether the electricity is intended for on-site use or fed back to the grid. Generation is considered Scope 1 in the Southern Tier Regional GHG Inventory, but reductions are treated as Scope 2 here, offsetting other regional consumption of electricity. This assumption was repeated for other actions increasing the deployment of renewable energy technology. These estimates do not take into consideration industrial scale wind installations currently planned for the region.

7. Facilitate deployment of demonstration anaerobic digester systems

Estimated Benefit: If half of the region's potential is implemented, GHG emissions will be reduced by an estimated 81,000 MTCO_{2e}. The benefits will be a result of avoided methane emissions (76,000 MTCO_{2e}) and electricity generation (5,000 MTCO_{2e}).

Detailed Assumptions: Based on an estimated regional population of 76,000 cattle, about 60 anaerobic digesters installed on the largest farms in the region could generate between 19,000 and 70,000 MWh of electricity per year, and 7,200 tons of methane can be avoided. Not all systems will be implemented, as it may not be economical at smaller farms. This analysis assumes a midpoint value of 45,000 MWh maximum potential for each farm, and that only 50 percent of the capacity is installed. Benefits from electricity are estimated as the potential electricity generation multiplied by the penetration multiplied by the BAU emission factor. Emission benefits from methane avoided are calculated as the maximum potential multiplied by penetration. Reductions occur from Scope 2 electricity and manure management.

8. Facilitate deployment of geothermal heat pump (GHP) systems

Estimated Benefit: Assuming that GHP systems treating 800,000 square feet of building area are installed annually over 20 years, the total emissions reduced is estimated to be 166,000 MTCO_{2e}. This is equivalent to 200 homes and 50 small commercial projects, and 1 large commercial or institutional project of 100,000 square feet each per year.

Detailed Assumptions: A NYSERDA study estimates that for every 1 million square feet conditioned by GHP systems, energy consumption is reduced by a combined 7.6 million kWh and 38,207 MMBTU of fossil fuel.¹⁰ In the Mid-Atlantic region, average residential square footage is 2100 square feet per unit.¹¹ Average square footage of commercial building varies by type; the Mid-Atlantic median is 5500 sq. ft.¹² Thus 800,000 square feet can translate to 200 average houses, 50 median commercial buildings, and 1 large project (100,000 sq. ft).

⁹ "The Effects of Integrating Wind Power on Transmission System Planning, Reliability, and Operations - Report on Phase 2." NYSERDA, 2005. Available online at: http://www.nyserdera.ny.gov/Publications/Research-and-Development/-/media/Files/Publications/Research/Biomass%20Solar%20Wind/05-xx_wind-integration-rpt.ashx.

¹⁰ "Understanding and Evaluating Geothermal Heat Pump Systems." NYSERDA, 2007. Available online at: <http://www.nyserdera.ny.gov/en/Renewables/-/media/Files/EERP/Residential/Geothermal/geothermal-manual.ashx>.

¹¹ "Residential Energy Consumption Survey 2009." U.S. Energy Information Administration (EIA). 2012. Available online at: <http://www.eia.gov/consumption/residential/index.cfm>.

¹² "Commercial Energy Consumption Survey 2003." U.S. Energy Information Administration (EIA), 2008. Available online at: <http://www.eia.gov/consumption/commercial/index.cfm>.

There are over 1 million installations in the U.S. already, so the technology has been proven, and while adding 250 projects per year for the region is ambitious, it could be done with concerted effort. This compares with an estimated 550 million square feet of occupied residential building floor area (263,000 occupied housing units times 2100 square feet per unit) and 196 million square feet of commercial building floor area. At this rate, by 2032, GHP systems would serve 1.5 percent of residential building floor area and 3.8 percent of commercial.

9. Explore transitioning existing power and thermal generation facilities to more sustainable fuel

Estimated Benefit: Significant GHG reductions could be achieved if the region's coal-fired power plants switched some or all of their fuel consumption to an alternative renewable source, such as biomass, or combustible waste. Assuming no overall change in total energy consumption, if 50 percent of current coal consumption was replaced by either combustible waste or biomass, emissions would be reduced by 562,000 MTCO₂e for combustible waste or 992,000 MTCO₂e for biomass. Assuming a mix of both, emission reductions here have been estimated using the average of those two figures, at 777,000 MTCO₂e. These Scope 1 emissions from electricity generation are not included in the region's baseline inventory, so these reductions cannot be credited to the region's baseline.

However, because this would reduce overall grid emissions, some part of this benefit can be applied to the emissions associated with the region's electricity consumption. This action would reduce emissions from electricity generation in the New York Upstate subregion by about 4 percent, thereby reducing emissions intensity of electricity consumption by 4 percent. In total, actions quantified in this plan would reduce baseline electricity consumption of 6,815 gigawatt-hours (GWh) by 24 percent to 5,187 GWh. Applying this 4 percent reduction to the revised electricity consumption yields 46,000 MTCO₂e of reductions to the region's baseline emissions.

Detailed Assumptions: These calculations assume no overall change in energy input and no change in output efficiency. Life-cycle emissions for the different fuels are not included, as they were not included in the original estimates. Reductions at power plants directly address Scope 1 electricity generation emissions, which were not included in the regional total, but indirect reductions in the grid emission factor can be counted toward the region's Scope 2 emissions from electricity consumption.

10. Facilitate use of biomass for heating

Estimated Benefit: Currently, about 62 percent of the region's households use natural gas or electricity for space heating; 31 percent use fuels such as fuel oil, propane, and coal; and 7 percent use wood. With a regional biomass initiative to encourage the use of locally-sourced biofuels, reaching total market share of 20 percent would require about 33,000 homes in the Southern Tier to switch from oil, propane, or coal to biomass. Combined with similar fuel switching in the commercial and industrial sectors, total regional emissions would be reduced by an estimated 398,000 MTCO₂e.

Detailed Assumptions: This analysis assumes that 41 percent of total consumption (the total needed to achieve 20 percent of market share in the residential sector) for four inventory fuel categories (propane/LPG, distillate fuel oil [#1, #2, and kerosene], residual fuel oil [#4 and #6], and coal) in the residential, commercial, and industrial sectors is switched to biomass with no overall change in energy input and output efficiency. Life-cycle emissions are not included. These reductions directly address fuel combustion emissions in the region's baseline. This would address consumption in the homes of approximately 33,000 households in the region that currently use fuel oil, propane, kerosene and coal, or 13 percent of the regional total, and would amount to 6 percent of current energy consumption in the commercial and industrial sectors.

Both this action, and the action above, assume that the renewable biomass resource available within the region is sufficient to accommodate either or both of these actions. Although a detailed analysis has not been conducted, experts who reviewed these actions have taken a broad look at the forest resources in the region and believe there is sufficient biomass extraction potential from sustainably managed lands, and that these actions are possible. A regional biomass potential analysis should be conducted to confirm this, as part of the energy road map action.

11. Study feasibility of combined heat and power (CHP) in private development projects and public facilities

Estimated Benefit: There is a potential capacity of 324 MW of new CHP in the region at over 700 sites, including industrial, commercial, government, and institutional facilities, based on analysis conducted for this report. The benefit of any given CHP system is a function of the facility's energy needs, the CHP technology used, the operating parameters, and electricity grid characteristics. Benefits can vary widely from site to site, and can even increase net emissions in some scenarios, so care must be taken in site selection and design. Assuming that 50 percent of this potential is realized over the next 20 years, that those systems run 50 percent of the time, and that the observed reduction falls in the mid-point of the general range of benefits (23 percent reduction),¹³ these new installations can reduce regional emissions by 37,000 MTCO₂e.

Detailed Assumptions: This analysis assumes that 50 percent of the identified potential is adopted, for a total of 162 MW of capacity. These systems are assumed to run half the time (4,380 hours per year). This is likely to be low for facilities such as universities, but may be high for office buildings. CAPCOA states benefits ranging from 0-46 percent reduction in emissions associated with electricity consumption; 23 percent was used in this analysis. This may be high due to the region's already low electricity emissions factor. The number of potential projects by building type is shown in Table 2 below.

TABLE 2 ■ Potential CHP Projects and Capacity in the Southern Tier by Building Type

Building Type	Total Sites	Total MW
Manufacturing	93	98
Commercial	428	136.5
Water Treatment Facilities	3	0.2
Schools	96	11.1
Colleges/ Universities	61	67.4
Government Buildings	21	8.9
Prisons	3	1.6
Total	705	323.7

12. Improve connectivity of pedestrian, bike, and transit routes, especially around downtowns, transit stops, and schools

Estimated Benefit: Based on a 1 percent reduction in vehicle miles traveled (VMT) in the region's cities and villages,¹⁴ this measure will reduce regional emissions by 14,000 MTCO₂e.

Detailed Assumptions: The 1 percent reduction is the low end of the 1-2 percent stated by CAPCOA. This was applied to the VMT in the region's cities and villages, and also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the region's population will live in cities and villages.

13. Pilot opportunities for intercity bus service, expanded cross-regional transit, and rural on-demand transit

Estimated Benefit: Based on a 5.9 percent reduction in vehicle miles traveled (VMT) in the region's cities and villages,¹⁵ where higher population densities are more likely to utilize expanded transit, this measure will reduce regional emissions by 81,000 MTCO₂e.

Detailed Assumptions: The reduction percentage is CAPCOA's alternate methodology (preferable for bus), and is on the low end of the 0.5 to 24.6 percent stated by the primary methodology. This was applied to the VMT in

¹³ "Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures," p. 135. California Air Pollution Control Officers Association (CAPCOA), 2010." Available online at: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.

¹⁴ Ibid, p. 186.

¹⁵ Ibid, p. 176.

the region's cities and villages, and also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the region's population will live in cities and villages.

14. Expand 'Way2Go' and other transportation demand management (TDM) programs

Estimated Benefit: Based on a 3.1 percent reduction in vehicle miles traveled (VMT) associated with commuting,¹⁶ this measure will reduce regional emissions by 22,000 MTCO₂e.

Detailed Assumptions: The reduction percentage is half of the maximum 6.2 percent stated by CAPCOA. Commuting VMT was assumed to account for 22.3 percent of regional VMT.¹⁷ The reduction was applied to this portion of the region's total VMT.

15. Facilitate development and expansion of carsharing programs

Estimated Benefit: Based on a 0.55 percent reduction in vehicle miles traveled (VMT) in the region's cities and villages,¹⁸ this measure will reduce regional emissions by 8,000 MTCO₂e.

Detailed Assumptions: The reduction percentage is the midpoint of the 0.4 to 0.7 percent reduction suggested by CAPCOA. This was applied to the VMT in the region's cities and villages, and also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the region's population will live in cities and villages.

16. Update parking policies, codes, management plans, and pricing

Estimated Benefit: Based on a 4 percent reduction in vehicle miles traveled (VMT) in the region's cities and villages,¹⁹ this measure will reduce regional emissions by 55,000 MTCO₂e.

Detailed Assumptions: The reduction percentage is the midpoint of the 2.5 to 5.5 percent reduction suggested by CAPCOA. This was applied to the VMT in the region's cities and villages, and also includes an 18 percent increase in city and village population consistent with the long range target that 45 percent of the region's population will live in cities and villages.

Multiple Goal 4 Actions

18. Encourage adoption of green fleet policies for public and private techniques

19. Create a region-wide electric vehicle and alternative fuel infrastructure deployment plan

Estimated Benefit: If 10 percent of the region's vehicle miles traveled (VMT) is shifted from conventional vehicles to electric vehicles over 20 years, this measure will reduce regional emissions by 262,000 MTCO₂e. This is based on the performance of electric vehicles currently on the market.

Detailed Assumptions: Current electric vehicles average 28 to 46 kWh per 100 miles.²⁰ This analysis assumes the midpoint of that range (37 kWh/100 miles). The reduction was calculated based on the difference between 10 percent of current on road emissions and the emissions associated with the electricity requirement to meet 10 percent of VMT.

Multiple Goal 5 Actions

¹⁶ Ibid, p. 218.

¹⁷ "National Household Travel Survey," FHWA, 2009. Available online at: http://nhts.ornl.gov/tables09/fatcat/2009/vmt_WHYTRP1S.html.

¹⁸ "Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures," p. 245. California Air Pollution Control Officers Association (CAPCOA), 2010." Available online at: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.

¹⁹ Ibid, p. 213.

²⁰ Available online at: <http://www.fueleconomy.gov>.

19. Encourage development and strategic investment in cities, villages, and hamlets

20. Provide gap financing for community revitalization projects

21. Support development in downtown areas at appropriate densities

22. Support redevelopment of strategic sites and vacant properties

23. Update local land use regulations and design codes and provide technical assistance to implement projects

Estimated Benefit: Collectively, these actions support the region's goal to increase the portion of regional population in cities and villages. Cities and villages have a lower estimated per capita VMT than the less-densely populated portions of the region, and an increase in population in higher density areas would result in lower total VMT. The policies would collectively reduce regional emissions by an estimate 17,000 MTCO_{2e}, though this is likely an underestimate due to limitations in the inventory data.

Detailed Assumptions: Per capita VMT were estimated to be 9,913 VMT/year for cities and villages, and 10,719 VMT/year for the rest of the region. This was based on data from two of the region's Metropolitan Planning Organizations and top-down estimates provided by NYSDOT. To reach the 45 percent goal, an estimated 44,000 people would need to move to cities and villages. The emissions reduction was calculated based on the decreased VMT achieved by 44,000 people reducing their VMT by 806 miles/person (10,719 VMT/year outside of cities and villages minus 9,913 VMT/year inside cities and villages). The benefits are relatively difficult to quantify on a regional scale because the VMT data is not very detailed, and does not distinguish between trip types. More detailed local transportation modeling would likely provide more accurate results, but this level of analysis is not possible on the regional scale (which includes three separate MPOs and a largely rural region).

Multiple Goal 6 Actions

24. Assess affordable housing needs and identify target areas for rehabilitation programs

25. Provide financial and technical support to rehabilitate and provide safe, energy efficient housing for low-to-moderate-income households

26. Remove barriers to converting upper floors to residential uses in city and village downtowns

27. Provide technical assistance and gap financing for construction and rehabilitation of new energy-efficient affordable housing

Estimated Benefit: Collectively, these actions would overlap significantly with the energy efficiency retrofits proposed under action 1. All retrofits were calculated under that measure, so benefits calculated here apply only to new housing units that are more energy efficient than the units they replace. In the context of the new housing units needed in the cities and villages to accommodate the target growth there, assuming that new units are 50 percent more energy efficient than existing units, these policies will reduce regional emissions by 66,000 MTCO_{2e}.

Detailed Assumptions: Benefits from new units were estimated based on a savings over average per household consumption based on a set efficiency standard. CAPCOA suggests 25%, though that is based on more stringent California building codes, so 50% is more appropriate here, especially considering that the units are targeted for cities and villages where multi-family and attached units are more common. The number of new units was estimated as 17,600 based on 2010 population per occupied housing unit (2.5) and an assumed population increase of 44,000 in cities and villages.

Multiple Goal 7 Actions

28. Implement the Energy Workforce Development Initiative

29. Identify, train, and certify contractors to meet increased demand for energy efficiency

Supporting Action: These actions would help achieve other energy efficiency and renewable energy goals. Their benefits cannot be quantified separately.

31. Grow local businesses through targeted investment***32. Strengthen university-industry connections to improve and promote workforce development***

Not Quantifiable: The GHG benefits of the above actions cannot be quantified. These actions have the potential to increase regional emissions, or may reduce emissions depending on the type of businesses and workforce that emerges from these investments and partnerships.

30. Promote Regional Broadband Communications Projects

Estimated Benefit: Based on a 1.2 percent reduction in vehicle miles traveled (VMT) associated with commuting,²¹ this measure will reduce regional emissions by 8,600 MTCO₂e. This is similar to action 14, but this represents voluntary increases in telecommuting due to improved technology as opposed to employer-sponsored transportation demand management programs.

Detailed Assumptions: The reduction percentage was interpolated from the reduction table provided by CAPCOA measure TRT-6. This assumes that an additional 8 percent of employees would convert to a 4-day/40-hour schedule.

Multiple Goal 8 Actions***33. Expand and promote culinary and agri-tourism opportunities******34. Coordinate and market educational and green tourism***

Not Quantifiable: The GHG benefits of the above actions cannot be quantified. These actions have the potential to increase regional emissions.

Multiple Goal 9 Actions***35. Support development of processing and distribution facilities (food hubs) for local and value-added products******36. Adopt local food purchasing policies***

Not Quantifiable: While there are potential GHG benefits of increasing local food purchasing, estimating these benefits on a regional scale is extremely challenging. “Food miles” may be a popular measure, but they don’t tell the whole story. Transportation emissions account for a small part of food life-cycle emissions (this, in turn, is a complex question, ranging from about 6-25%), and of that, personal transportation to and from stores and restaurants is greater than upstream supply chain emissions. Furthermore, growing practices are a larger driver of emissions. For example, all things being equal, a local tomato in August will be less GHG-intensive than a long distance tomato in August, but a tomato grown outside in Chile in February and shipped by boat to the U.S. will be less GHG-intensive than a New York tomato grown in a heated and lighted greenhouse in February. This is an extreme example, but the central challenge remains: variations in the life-cycle emissions of food vary greatly by type and production technique, and these differences are greater than differences due to the life-cycle transportation emissions.

Additionally, there are challenging boundary issues. First, any reductions would not be applicable to the region’s baseline, as they would mostly impact transportation and agricultural emissions outside of the region. Second, intensified development of food production, processing, and distribution within the region could potentially increase the region’s GHG emissions. Given all of these complex issues, GHG benefits of local food purchasing policies cannot be credibly estimated.

²¹ “Quantifying Greenhouse Gas Mitigation Measures: A Resource for local government to assess emission reductions from greenhouse gas mitigation measures,” California Air Pollution Control Officers Association (CAPCOA), 2010.” Available online at: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.

37. *Develop a regional program to promote sustainable forestry and wood products*

Estimated Benefit: It has been demonstrated that sustainable forestry management techniques have the potential to increase forest carbon storage depending on the management scenario; however, the baseline data on the whole of the region's forest is insufficient for the detailed calculation needed.

Sustainable management techniques have the largest benefits on lands that are being managed as working timberland. Techniques affecting harvesting cycles, planting, and thinning can increase forest yields, though the ultimate sequestration benefits largely depend on the fate of the forest products, but some measures can have high leakage rates. For example, delaying harvesting by 10 years will increase regional carbon storage, but on the national market, virtually 100 percent of the avoided harvesting will be shifted elsewhere. Dimensional lumber and finished wood products have a long-term storage potential, while the use of forest biomass for fuel will result in the release of biogenic carbon. Considering the region's strong interest in promoting biomass, potentially from both agricultural and forest sources, the changing dynamics of forest carbon in the region need to address the role of biomass fuel as well, and the data are not available at this time.

Management techniques can also improve sequestration on non-working lands (i.e., afforested lands not being harvested), though this depends greatly on the forest type and the point in the forest life-cycle. Northeastern forests have dramatically increased carbon sequestration over the past century as they have been allowed to regrow. Broadly speaking, this is expected to continue for a few more decades, but the increase in carbon sequestration is likely to slow.

In the New York Climate Action Plan Interim Report, measure AFW-7 included estimated benefits for identifying and treating 25 percent of all under-stocked forest stands on timberland by 2025 in order to achieve full stocking level. Other forest measures included reforesting 50 percent of suitable vacant land, though that was not included here because other actions below address reforestation. The detailed methodology for the estimates provided in the NY Climate Action Plan Interim Report were not provided, so benefits from this action were calculated based on the region's share of all forests in New York State (public and private). The state has estimated that treating under-stocked forest stands will reap annual sequestration benefits of 4.7 million MTCO₂e by 2030.²² Since the region contains 13.4 percent of the state's forested land,²³ increased sequestration in the region can be estimated as 630,000 MTCO₂e.

38. *Develop a regional biomass consortium*

Supporting Action: This action would help achieve the benefits of action 10.

39. *Promote adoption and funding of BMPs on farms*

Estimated Benefit: No-till practices can reduce emissions by reducing N₂O emitted from agricultural soils, increasing carbon storage, and reducing the need of diesel fuel for tilling. Adopting such best management practices on 50 percent of the region's cropland would reduce regional GHG emissions by about 74,000 MTCO₂e.

Detailed Assumptions: The soils benefit is estimated as 1.47 MTCO₂e/hectare/year, or 0.6 MTCO₂e/acre/year.²⁴ NYCAC estimates the fuel savings as 3.5 gallons of diesel avoided per acre per year.²⁵ These reductions were applied to 50 percent of the region's estimated 234,000 acres of alfalfa, corn, dry bean, oat, soybean, and winter wheat cropland, or 117,000 acres.

²² "Climate Action Plan Interim Report." New York Climate Action Council (NYCAC), 2010. Available online at: <http://www.dec.ny.gov/energy/80930.html>.

²³ "Forest Inventory Data Online." U.S. Forest Service, 2012. Available online at: <http://apps.fs.fed.us/fido/>.

²⁴ "Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States, A Synthesis of the Literature." T-AGG Report. 2012. Available online at: <http://nicholasinstitute.duke.edu/ecosystem/land/TAGGDLitRev>

²⁵ "Climate Action Plan Interim Report." New York Climate Action Council (NYCAC), 2010. Available online at: <http://www.dec.ny.gov/energy/80930.html>.

40. Encourage new farm startups and farm transfers to next generation

Not Quantifiable: The GHG benefits of this action cannot be quantified.

41. Maximize farm-based renewable energy production opportunities

Supporting Action: This action would help achieve the benefits of the other renewable energy-based actions

42. Coordinate planning and implementation for priority conservation and agricultural protection areas

Estimated Benefit: If each year, 800 acres of currently vacant land are protected and converted to forest, an estimated 219,000 MTCO₂e will eventually be sequestered. In addition to this action, achieving this level of forest conversion will be supported by actions 46 through 49, which will encourage the reforestation of stream banks and buffers. It would take many years to achieve this level of sequestration, but permanent protection would present a clear net reduction in GHG emissions.

Detailed Assumptions: Many of the lands most likely to be added to conservation protection areas may already be forested, so while the protected status would protect carbon sequestration, it would not necessarily increase sequestration. To provide a GHG reduction impact for this action, this estimate assumes that 800 acres of currently vacant, unforested land will be protected each year in this manner, and that over time they will achieve the same average regional sequestration factor of 74.7 MT of carbon per acre. This method recognizes future total sequestration in the year that the lands are protected.

43. Identify and develop priority trail segments to connect key destinations

Supporting Action: This action would help achieve the benefits of 12 for increased accessibility.

Multiple Goal 12 Actions*44. Incorporate anticipated climate projections, impacts, and proposed mitigation strategies into Hazard Mitigation Plan updates**45. Assess the viability of current and potential future crops*

Not Quantifiable: The GHG benefits of the above actions cannot be quantified.

Multiple Goal 13 Actions*46. Update flood insurance rate map, map additional flood-related hazards, and manage development in high-risk areas**47. Prioritize high risk floodplains for conservation through acquisition and easement**48. Establish and promote undeveloped buffers for streams and wetlands**49. Develop incentives to encourage property owners to protect streams and buffers*

Quantified in Action 42: The GHG benefits of the above actions cannot be quantified separately from Action 42, so were incorporated into that emissions reduction figure. These measures are likely to result in reforestation of some stream banks, and will help achieve the 800 acres per year assumed in action 42. In addition, there are likely to be benefits from the avoided energy and materials needed to rebuild after floods, though the energy and emissions cost of events has not been quantified and would rely in large part on life-cycle emissions that may occur upstream from the region's baseline.

Multiple Goal 14 Actions

50. Incorporate energy efficiency, renewables, and advanced controls into policies for new equipment, new plants, and plant upgrades

51. Perform energy audits and install retrofits at major water and wastewater facilities

Estimated Benefits: The Ithaca Wastewater Treatment Plant is reducing net energy use by 70-75% through a variety of investments in energy efficiency and renewable energy. If two-thirds of the region's water and wastewater treatment plants make similar upgrades, the region's emissions can be reduced by about 7,000 MTCO₂e. There are about 320 community water systems serving about 478,000 people (though individual districts within the same system are often counted separately) and about 50 wastewater systems in the region. This action would affect about 210 of the water systems and 33 of the wastewater systems.

Detailed Assumptions: Energy consumption at these facilities was not isolated, so the total potential footprint in the region had to be estimated using available data. Based on a statewide analysis, it was assumed that wastewater treatment systems in New York State use 1,480 kWh per million gallons treated, on average, and that public water systems use 890 kWh per million gallons of water delivered (NYSERDA, 2008). Per capita demand was estimated to be 201 gallons per day (GPD)/person for wastewater and 168 GPD/person for water supply (NYSERDA, 2008). The region's community water systems serve 478,000 people, and it was assumed that 80 percent of this population was also served by the region's wastewater treatment systems. Exact data were not available. Water and wastewater demand were then calculated based on water usage and the population, and electricity usage rates were used to estimate energy consumption. Reductions assumed that two-thirds of the region's systems (weighted by population) would enact major retrofits and investment similar to those done by Ithaca. The specific retrofit strategies employed by each plant would vary based on plant size and technology.

52. Develop new distribution system repair, replacement, and expansion policies that prioritize repair/replacement rather than expansion of service areas

Supporting Action: This action would help achieve the benefits of land use and location efficiency discussed above.

Multiple Goal 15 Actions

53. Expand education, outreach and pilot projects for green infrastructure and Low-Impact Development practices

54. Develop program and guidelines to improve stormwater drainage design and maintenance for rural roadways

55. Support regular updates and implementation of local and County water quality strategies and plans

Not Quantifiable: The GHG benefits of the above actions cannot be quantified. They would likely improve water quality and reduce the intensity of water treatment, but the net effect of these policies is difficult to quantify at this time.

56. Expand Pay As You Throw trash collection

Estimated Benefits: Using the EPA SMART BET tool,²⁶ it is estimated that implementing Pay As You Throw (PAYT) policies at the region's trash collection centers would reduce emissions by about 72,000 MTCO₂e. This is based on conservative assumptions about policy design, and PAYT policies could be leveraged to realize greater reductions.

²⁶ Available online at: <http://www.epa.gov/osw/conservation/tools/payt/tools/smart-bet/>.

Detailed Assumptions: The EPA SMART BET tool and the waste generation and disposal assumption used in the inventory were used to estimate the benefits of PAYT. These emissions would reduce the region's Scope 3 municipal solid waste (MSW) emissions. Actions 16.1 through 16.4 collectively work by decreasing landfilling rates, and enacting PAYT, introducing innovative strategies to reduce waste, and expanding access to recycling and composting, are all components of the overall goal discussed below. In sum, these four actions would divert about 210,000 tons of MSW annually from landfills, or half of current annual landfill inputs.

Multiple Goal 16 Actions

57. Introduce innovative reuse strategies to reduce the waste stream

58. Expand and improve access to recycling

59. Expand and improve access to composting services

Estimated Benefits: Using the EPA WaRM tool²⁷ to estimate an alternative waste scenario that includes source reduction, increased recycling, and increased composting. Assuming that the regional landfilling rate of 4 lbs/person/day is reduced to 2 lbs/person/day through source reduction, recycling, and composting, GHG emissions can be reduced by 427,000 MTCO₂e. Because PAYT programs discussed in action 56 above help achieve the same goal, only the incremental benefits of this action should be counted here: 427,000 MTCO₂e minus 72,000 MTCO₂e, yields 355,000 MTCO₂e. Of this, 328,000 MTCO₂e of reductions result from recycling and source reduction, and 27,000 MTCO₂e result from composting. These benefits include some upstream lifecycle emissions not include in the region's baseline, but for the purposes of this analysis they have been included here.

Key Assumptions: The EPA WaRM tool can be used to estimate the upstream benefits of recycling a wide variety of materials, including plastics, paper, metals, glass, electronics, composted waste, and selected C&D materials. Using the NYS waste composition survey and the current landfilling rate of 4 lbs/person/day, currently landfilling tonnage by waste category was estimated. To meet the goal, it was assumed that one-half of the reduction was met through source reduction and one-half through recycling, with the exception of food scraps and yard trimmings, where 100 percent of the reduction was met through recycling. As discussed in action 16.1 above, the Goal 16 actions would collectively divert about 210,000 tons of MSW per year through recycling, composting, and source reduction.

Multiple Goal 17 and 18 Actions

60. Strengthen the Southern Tier Regional Consortium

61. Develop regional coordinated planning and policy guidance document

62. Hold regular conferences and training for planning boards, agency staff, and community stakeholders

63. Coordinate regional working groups focused on key implementation actions

64. Identify and share examples of existing efficient practices

65. Encourage participation and certification in the Climate Smart Communities program

Not Quantifiable: The GHG benefits of the above actions cannot be quantified. Collectively, they help support other actions.

²⁷ Available online at: http://www.epa.gov/climatechange/waste/calculators/Warm_home.html.



APPENDIX D: GHG INVENTORY REPORT

(Note: See separate Excel Workbook “Final Tier II Regional GHG Inventory”
for the Full GHG Inventory Data)



Cleaner, Greener Southern Tier

Deliverable 6-4: Final Tier II Regional Greenhouse Gas Inventory

Prepared for

Tompkins County and the
Cleaner Greener Southern Tier Planning Team

Prepared by

ICF International

December 14, 2012

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Preface

The purpose of this report is to transmit the Final Tier II Regional Greenhouse Gas (GHG) Inventory for the Cleaner Greener Southern Tier Plan. The report begins with a general background to the inventory, a discussion of key steps in establishing and defining a GHG inventory, and description of how the inventory is organized. For each source that follows, the inventory presents a description of each source, a discussion of the data and methods used, and a brief review of the results.

In order to align the methods used here with those used by other regions in New York State, the State convened the NYGHG Working Group to develop a standard New York GHG Protocol (NYGHG Protocol). This inventory was developed based on the latest methods determined by the NYGHG Working Group, as well as the latest data provided to that group. Protocols were not finalized for all sources. The data and calculations presented here are contained in a separate Regional GHG Inventory Excel workbook and supplementary files, as discussed in Section 1.3 below.

List of Acronyms and Abbreviations

ACS	American Community Survey
ANDOC	Anaerobically degradable carbon
BOD ₅	5-day biological oxygen demand
COLE	Carbon OnLine Estimator
eGRID	Emissions & Generation Resource Integrated Database
EIA	Energy Information Administration
EPA	Environmental Protection Agency
FOD	First-order decay
GHG	Greenhouse gas
GHGRP	Greenhouse gas Reporting Program
C&D	Construction and demolition
CH ₄	Methane
CO	Carbon monoxide
CO ₂	Carbon dioxide
FIDO	Forest Inventory Data Online
HDD	Heating degree days
HFCs	Hydrofluorocarbons
HPMS	Highway Performance Monitoring System
HU	Housing units
IPCC	Intergovernmental Panel on Climate Change
LFG	Landfill gas
LFGTE	Landfill gas to energy
LUAF	Lost and unaccounted for
LULUCF	Land-use, land-use change, and forestry
Mcf	Thousand cubic feet
MF	Multi-family
MMBTU	Million British thermal units
MSW	Municipal solid waste
MMTCO ₂ e	Million metric tons carbon dioxide equivalent
MTCO ₂ e	Metric tons carbon dioxide equivalent
MWh	Megawatt-hour
N ₂ O	Nitrous oxide

NAICS	North American Industry Classification System
NASS	National Agricultural Statistics Service
NYS DEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
NYUP	NPCC Upstate New York (eGRID subregion)
ODS	Ozone-depleting substances
PFCs	Perfluorocarbons
SF ₆	Sulfur hexafluoride
SFA	Single-family attached
SFD	Single-family detached
SIC	Standard Industrial Classification
SIT	State Inventory Tool
T&D	Transmission and distribution
TAM	Typical animal mass
Tg	Teragrams
USDA	United States Department of Agriculture
VMT	Vehicle miles traveled
VS	Volatile solids
WWTPs	Wastewater treatment plants

1. Background

The New York Cleaner, Greener Communities Program empowers regions to create more sustainable communities by funding smart development practices. One of the key outcomes of the Plan is a baseline of regional greenhouse gas emissions (GHG) emissions and energy use. NYSERDA has provided a high-level Tier I analysis of GHG emissions and energy use by region that focuses on fuel combustion emission sources. The Tier I inventory was developed using statewide GHG emissions data and readily available regional data. This report represents a more detailed Tier II analysis that addresses sources not covered in the Tier I inventory and replaces statewide data with more detailed local data wherever possible.

The purpose of this inventory is to help the region better characterize its baseline GHG emissions and energy consumption. Identifying and quantifying key emission sources can help prioritize and inform strategies for reducing emissions and provide a baseline against which progress can be measured in the future. The inventory also identifies and organizes data that are used in other elements of the Cleaner Greener Southern Tier Plan, and which can be used other agencies and stakeholders in the region. Finally, the municipal level allocation provides useful energy, GHG, demographic, and economic data for each of the region's counties, cities, towns, and villages. The municipal allocation, however, is not intended to replace detailed studies conducted by several of the region's municipalities, as it was not feasible to take an equally detailed look at each of the region's roughly 200 municipalities.

To standardize organization and methodologies in the GHG inventories being completed by each of New York's ten regions, NYSERDA has sponsored the NY GHG Protocol Working Group. ICF staff participated in this group throughout the duration of the protocol development process to discuss data sources, methodologies, and organizational structure for the regional GHG inventory. This process resulted in a common inventory protocol to be used by each region in the state. This Working Group also served as the organizing entity for several common data requests to New York State agencies and major electricity and natural gas utilities. Due to differences in data availability between the regions, the protocol did not provide guidance for every methodological decision. Consequently, this inventory was developed based on the available data and methods from the regional perspective.

1.1. Key Steps and Issues in Establishing an Inventory

A GHG inventory identifies activities that are responsible for GHG emissions, quantifies the level of each activity, and then calculates the associated emissions. Each of these steps—defining the activities, measuring the level of the activity, and determining the consequent emissions—must be carefully defined in order to result in a credible, transparent, and easily reproducible inventory. As discussed above, this inventory is based on the NYGHG Working Group protocol, wherever possible.

The process of designing an inventory includes a number of decisions and procedural steps:

- **Inventory geography and boundaries:** The geography for this inventory is that of the eight counties of the Southern Tier region: Broome, Chemung, Chenango, Delaware, Schuyler, Steuben, Tioga, and Tompkins Counties. This inventory includes emissions from the following: fuel use; electricity consumption; transportation; agriculture; waste and wastewater; and industrial processes. It also presents naturally occurring carbon sequestration attributable to water, land, forest coverage in the region.

Product life-cycle emissions (e.g., emissions associated with the production and distribution from imported goods and services) are not included.

- **Sources:** The activities selected for the regional inventory are based on those defined by the U.S. Environmental Protection Agency (EPA) and the Intergovernmental Panel on Climate Change (IPCC). These categories are:
 - **Stationary Energy Consumption**—fuel and electricity use in homes, businesses, and other non-mobile settings for purposes such as space and water heating, lighting, appliances and electronics, and industrial processes;
 - **Mobile Energy Consumption**—use of energy in transportation, including on-road transportation, passenger and freight rail, aviation, marine transportation, and off-road vehicles;
 - **Agriculture**—non-energy emissions from agriculture, including both crops and livestock (e.g., methane emissions associated with livestock and nitrous oxide emissions associated with fertilizer application);
 - **Waste Management**—non-energy emissions related to managing solid waste, including trash and wastewater (e.g., methane emissions associated with the anaerobic decay of waste disposed of in landfills);
 - **Industrial Processes**—non-energy emissions associated with industrial activity (e.g., carbon dioxide emissions associated with cement production or emissions associated with coolants for air conditioners) and fugitive emissions from fuel systems (leakages in the production, distribution, and transmission of fossil fuels), and;
 - **Land Use, Land Use Change, and Forestry**—emissions from changes in the amount of carbon stored in soil and plants due to land use and forestry practices (e.g., from clearing forest land for residential, commercial, or agricultural use).
- **Greenhouse gases included:** This inventory evaluates the impact of the three gases which together comprise 98 percent of national emissions: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), as well as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) emissions from the substitution of ozone depleting substances.¹ Together, these greenhouse gases accounted for 99.6 percent of national greenhouse gas emissions in 2010.²

¹ Different greenhouse gases have different capacities to trap heat in the atmosphere. In order to compare and sum the impacts of different gases, the United Nations' Intergovernmental Panel on Climate Change (IPCC) developed the Global Warming Potential (GWP) concept, where the GWP of each greenhouse gas is compared to that of CO₂, whose GWP is defined as 1. The GWP of methane (CH₄) is 21, and nitrous oxide (N₂O) is 310. GWPs for some gases are much higher—

- **Quantification approach:** This inventory uses a blend of top-down data (e.g., state fuel consumption estimates) and bottom-up data (customer utility data). This mix was dictated by data availability, existing protocols, and resource limitations.
- **Base year:** The base year for this analysis is 2010. 2010 was selected by the Working Group because it is the most current year for many of the data sets used in this report.

All emissions are reported in metric tons of carbon dioxide equivalent (MTCO₂e) or million metric tons of carbon dioxide equivalent (MMTCO₂e). A metric ton is 1,000 kilograms, or 2,206 pounds – about 10 percent larger than the 2,000 pound ton commonly used in the United States.

1.2. Organization of the Inventory Report

The inventory is organized by source and by Scope. Scope refers to the degree of control that the regional community has over the emission source. Although the Scope framework was first developed for corporate-level GHG inventories, a similar principal can be applied here. The basic definition of the Scopes from a community perspective is as follows:

- **Scope 1:** All direct emissions from sources within the geopolitical boundary of the community.
- **Scope 2:** Energy-related indirect emissions that occur outside the community boundary as a consequence of consumption/use of grid-supplied electricity, heating and/or cooling within the community boundary.
- **Scope 3:** All other indirect emissions that occur outside the boundary as a result of activities within the community's geopolitical boundary, as well as trans-boundary emissions due to exchange/use/consumption of goods and services.³

In the case of the NYSERDA regional GHG inventories, the Working Group's definition of Scopes 2 and 3 has been modified slightly. For the purposes of this inventory, Scope 2 includes energy-related indirect emissions regardless of whether they occur inside or outside of the region. For example, emissions from electricity generation that occurs within the region are included in Scope 1, but emissions related to the consumption of electricity by the community are included in Scope 2. This reflects the reality that electricity generated in the region may be consumed inside or outside of the region, while electricity consumed in the region may be generated inside or outside of the region. Only the Scope 2 emissions are included in the total, while Scope 1 emissions are provided as an informational item. Similarly, in this inventory, Scope 3 includes all other indirect emissions regardless of whether they occur inside or outside of the region. The sole Scope 3 source currently in the inventory is methane emissions associated with the deposition of municipal solid waste (MSW) in landfills. Many communities in the region transfer MSW to landfills outside of the region. These emissions are estimated here even though they occur outside of the region, because they result from activities within the region. This source is discussed in greater detail in Section 5 below.

The report below is organized by source and Scope, and the emission totals for each source are listed by county below. Section 9 includes emission totals for each sector at the municipal level. The municipal-level

the GWP for SF₆, for example is 23,900. For more information, see US EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010*, April 2012.

² U.S. EPA. 2012. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010*.

³ C40 Cities Climate Leadership Group and ICLEI Local Governments for Sustainability. 2012. *Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC), Pilot Version 1.0*. Available at http://www.iclei.org/fileadmin/user_upload/documents/Global/Progams/GHG/GPC_PilotVersion_1.0_May2012_20120514_01.pdf.

estimates are either generated bottom-up or represent an allocation of county-level emissions. The methodology used to estimate emissions for methodologies varies by sector and is discussed in Section 9.3.

1.3. Organization of the Inventory Spreadsheet

The data and calculations discussed in this report have been developed in the Excel workbook accompanying this delivery, "CGST Del 6-4 Final Tier II Regional GHG Inventory.xlsx." This Excel file is organized as follows:

- A cover sheet and regional reporting summaries based on the template provided by NYSERDA.
- An Overview sheet providing key information about the file and a Table of Contents with links to each sheet.
- Sheets containing summary tables and figures for the region, including all of the tables and figures presented in this report.
- A series of color-coded sheets covering the inventory calculations. Each lists the source, Scope, and data sources used. The sheets are categorized by inventory sector:
 - Red-tabbed sheets cover stationary energy;
 - Green-tabbed sheets cover mobile energy;
 - Brown-tabbed sheets cover solid waste and wastewater;
 - The yellow tab covers industrial processes;
 - The blue tab covers agriculture; and
 - The black tab covers land-use, land-use change, and forestry (LULUCF).
- County-level reporting summaries based on the template provided by NYSERDA.
- Lastly, the "Factors" tab at the end provides the emission, conversion, and other factors used throughout the file.

2. Summary of Results

The Southern Tier's 2010 baseline gross greenhouse gas emissions were approximately 9.9 MMTCO₂e, and resulting from building and mobile energy consumption of 133 million MMBTU, as well as non-energy sources including waste, agriculture, and industrial processes. The Southern Tier's 2010 GHG emissions represented about 3.9 percent of the 2008 New York State total (the most recent year for which a complete GHG inventory is available), while the region consumed about 4.9 percent of total state energy.

Residential, commercial, and industrial buildings accounted for 46 percent of all Southern Tier emissions (4.6 MMTCO₂e), and 60 percent of regional energy consumption (79,000,000 MMBTUs) for heating, lighting, processes, and other uses. There is clearly a strong impetus for focusing efforts on energy conservation, efficiency, and the incorporation of renewable energy sources and technologies in the Southern Tier to reduce energy use in buildings and related GHG impacts. The region faces what may be its greatest challenges in the transportation sector, which accounted for 37 percent of all emissions (3.6 MMTCO₂e) and 40 percent of all energy consumption (54 million MMBTUs). This is due to the broad geography of the region, with a majority of the population living in low-density, rural areas that are highly automobile-dependent and will require creative solutions to mitigate. Therefore, about 83 percent of the region's emissions resulted from energy consumption in buildings and vehicles.

The region's total emissions by source are summarized in Table 1, with several informational sources not included in the region's baseline in Table 2.

Table 1 – Total 2010 Southern Tier Emissions, by Source (MTCO₂e)

	GHG Emissions	Percent of Gross Emissions
Electricity Consumption	1,546,748	16%
Residential Buildings	602,494	6%
Commercial Buildings	552,146	6%
Industrial Buildings	392,108	4%
Stationary Energy Consumption	3,032,276	31%
Residential Buildings	1,371,583	14%
Commercial Buildings	780,913	8%
Industrial Buildings	879,779	9%
Mobile Energy Consumption	3,601,352	37%
On-road transportation (i.e., Cars and trucks)	3,193,240	32%
Off-road (Agriculture and Recreation vehicles)	343,415	3%
Marine (Boats)	54,581	1%
Rail (Freight)	29,142	0%
Energy Supply (Production, Transmission, and Distribution Losses)	380,243	4%
Waste	372,982	4%
Solid Waste Scope 3 - Waste Generation	308,976	3%
Wastewater Treatment	64,007	1%
Industrial Processes	268,581	3%
Agriculture	651,389	7%
Gross Emissions	9,853,570	

Table 2 – Additional Sources Not Included in Southern Tier Baseline Emissions (MTCO₂e)

	GHG Emissions
Electricity Generation	2,156,136
Air Travel	35,555
Solid Waste Scope 1 - Landfills	235,569
Land Use, Land-Use Change, and Forestry	(6,922,505)

Table 3 contains a summary by county and gas. Figure 1 and Figure 2 show county totals by scope and by source, respectively. Some key county-level trends are highlighted below:

- Broome County, as the largest population center in the region, has the largest share of emissions overall at 28 percent, as well as in the specific transportation, buildings and waste sectors. While Schuyler County had the lowest share of emissions, with 6 percent in the region, as the least populous of the eight Counties, it had the highest per capita emissions (about 33 MTCO₂e/person), due to its relatively high industrial energy consumption from two large industrial facilities – the Cargill Watkins Glen plant and the U.S. Salt Watkins Glen refinery.
- Steuben County has the highest population of dairy and beef cows in the region resulting almost a third of all agriculture emissions in the Southern Tier.

- Delaware County has the region’s only grid-connected municipal solid waste methane capture from their landfill facility, provided electricity on site and back to the grid. Tompkins County has the lowest per capita emissions, at 11 MTCO₂e per person, due to low transportation emissions, which is due in large part to the lack of any interstate highways in the county and a higher than average mode split for community, with extremely high rates of walking to work.
- Chenango, Delaware, and Schuyler Counties actually has negative net emissions, by sequestering large amounts of carbon in their forests. However, for purposes of this inventory, gross emissions are those counted, tracked, and planned for, and these do not include forest carbon sequestration mitigation.

Table 3 – Total 2010 Emissions, by County and Gas (MTCO₂e)

County	CO ₂	CH ₄	N ₂ O	Other	Gross Emissions	Gross Emissions per Capita	Net Change in Forest C	Net Emissions
Broome County	2,376,552	286,840	39,046	80,179	2,782,617	13.9	415,668	3,198,285
Chemung County	1,167,978	106,820	19,974	36,152	1,330,924	15.0	192,003	1,522,927
Chenango County	562,610	133,442	41,151	20,415	757,618	15.0	(2,612,113)	(1,854,495)
Delaware County	635,331	78,336	35,276	19,490	768,432	16.0	(2,371,521)	(1,603,088)
Schuyler County	528,206	52,415	14,306	7,692	602,619	32.9	(1,670,944)	(1,068,324)
Steuben County	1,434,455	239,463	80,473	39,937	1,794,328	18.1	(1,078,995)	715,334
Tioga County	591,234	70,786	26,648	20,414	709,082	13.9	(434,567)	274,515
Tompkins County	913,441	118,354	35,585	40,568	1,107,948	10.9	637,964	1,745,912
Southern Tier Region	8,209,808	1,086,455	292,459	264,848	9,853,570	15.0	(6,922,505)	2,931,066

Figure 1 – Total Gross Emissions by County and by Source

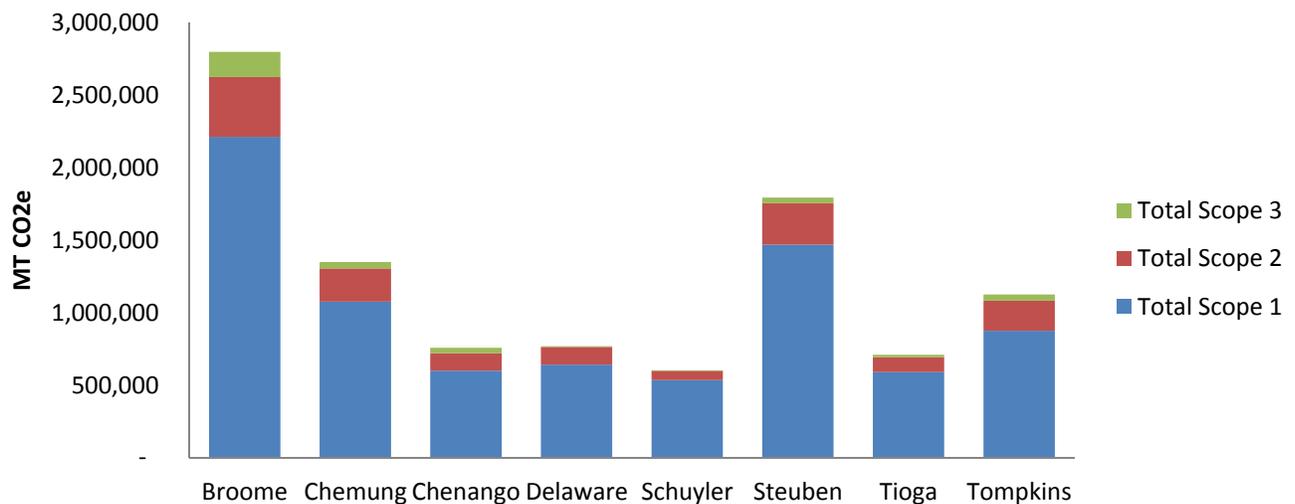
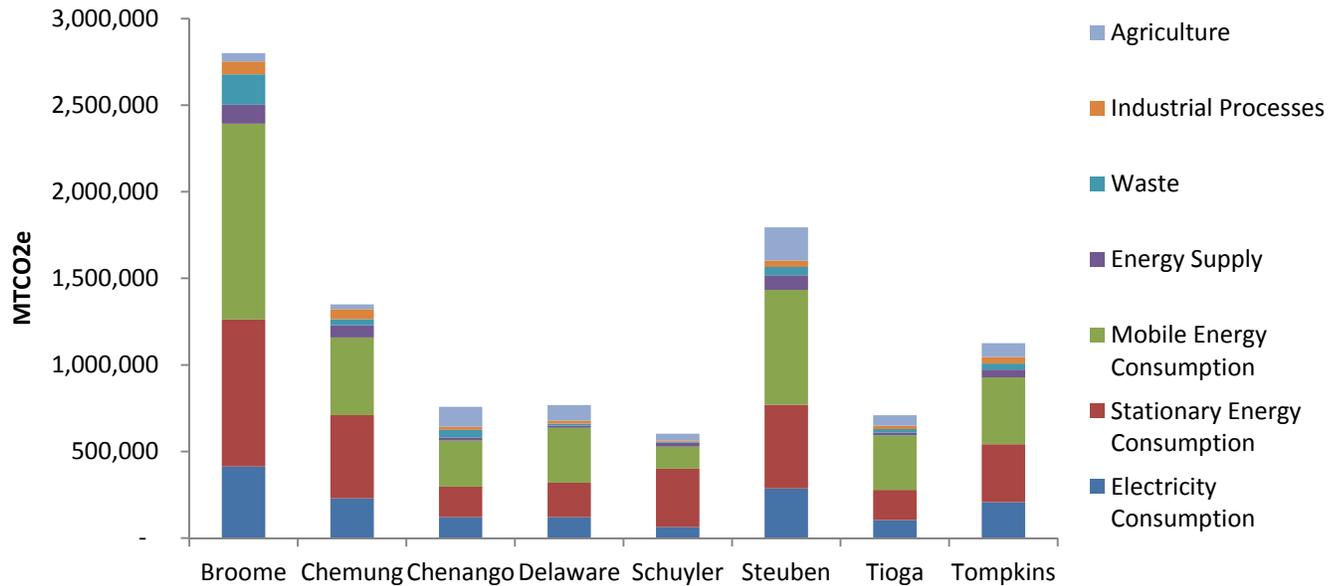


Figure 2 – 2010 Emissions by County and Source (MTCO₂e)



In order to look closely at energy used, as opposed to GHGs emitted, all energy use was converted to one consistent unit: million British Thermal Units (MMBTU). Total energy use for the region in 2010 was about 133 million MMBTU (or 133 trillion BTU). The region’s energy use and emissions by fuel are summarized in Table 4, and by county in Table 5. Total county energy consumption is also shown in Figure 3. Finally, Table 6 presents emissions and energy consumption by source, with emissions from electricity consumption distributed among the end uses (residential, commercial, and industrial). This shows total energy consumption and emissions on a single line, unlike Table 1, where electricity and stationary fuels are listed in separate categories.

Broome County used the largest portion of the region’s energy, with about 29 percent. Electricity and fuel use in building accounted for 60 percent of regional energy use. Transportation accounted for the remaining 40 percent of energy use, the dominant contribution coming from on-road transportation. The energy consumption estimates for stationary energy reflects only the energy value of electricity, and does not incorporate the energy used to generate electricity, but which is lost in the process.

Because of the prominent role of transportation and building energy, it follows that the region’s primary energy sources consumed in 2010 were gasoline, natural gas, electricity and accounted for the bulk of regional emissions, at 30 percent, 27 percent, and 18 percent, respectively. These fuel sources are the most important energy means for transport and buildings in the region. A summary of consumption and emissions by fuel is presented in Table 4 below.

Table 4 – Total 2010 Energy Use, by Fuel (MMBTU)

Fuel Type	Total Energy Use (MMBTU)	Percent of Total	Total Emissions (MTCO ₂ e)	Percent of Emissions from Energy
Electricity	23,253,376	18%	1,546,748	19%
Natural Gas	35,380,893	27%	1,877,822	23%
Fuel Oil	7,274,653	5%	551,571	7%
Coal or Coke	2,357,749	2%	226,166	3%
Wood	8,570,628	6%	16,918	0%
Solar	215,895	0%	-	0%

Fuel Type	Total Energy Use (MMBTU)	Percent of Total	Total Emissions (MTCO ₂ E)	Percent of Emissions from Energy
LPG	1,509,197	1%	256,951	3%
Ethanol (E100)	2,784,084	2%	-	0%
Gasoline	39,607,960	30%	2,792,215	34%
Diesel	10,197,089	8%	761,585	9%
Aviation Gasoline	788,169	1%	54,581	1%
Other/Not specified	778,197	1%	150,399	2%
Total	132,717,890		8,234,956	

Table 5 – Total 2010 Energy Use, by County (MMBTU)

County	Population	Total Energy Use (MMBTU)	Percent of Total
Broome County	200,600	38,484,233	29%
Chemung County	88,830	19,130,549	14%
Chenango County	50,477	9,402,022	7%
Delaware County	47,980	10,528,056	8%
Schuyler County	18,343	7,095,171	5%
Steuben County	98,990	23,627,075	18%
Tioga County	51,125	9,444,826	7%
Tompkins County	101,564	15,005,958	11%
Total	657,909	132,717,890	100%

Figure 3 – Total Energy Use by County (MMBTU)

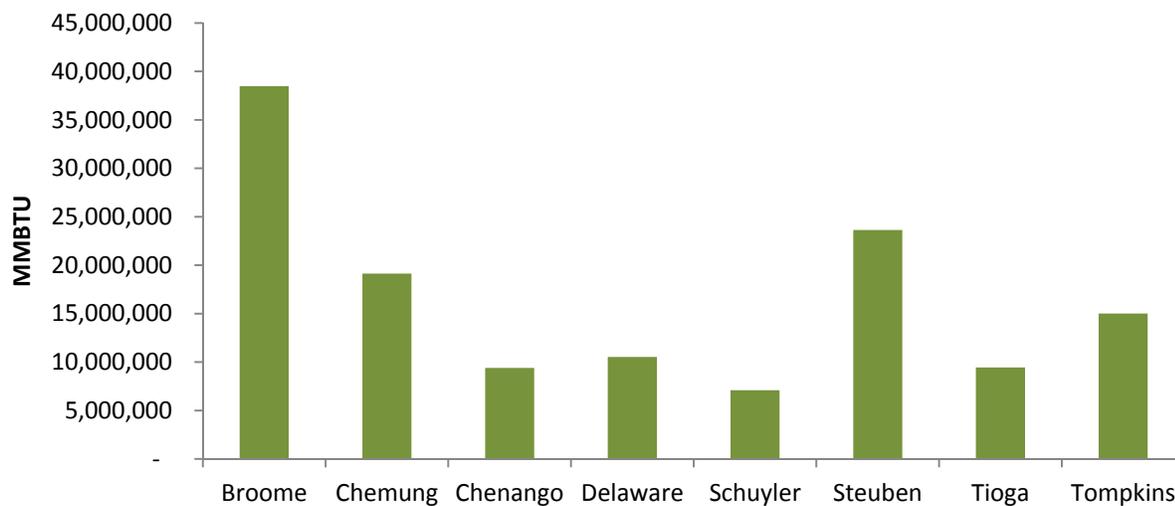


Table 6 – Total 2010 Energy Use and Emissions, by Source, with Electricity Distributed Among End Use Sectors

	GHG Emissions (MTCO ₂ e)	% of Total	Energy Consumption (MMBTU)	% of Total
Residential Energy	1,974,078	20%	37,281,021	28%

	GHG Emissions (MTCO ₂ e)	% of Total	Energy Consumption (MMBTU)	% of Total
Commercial Energy	1,333,059	14%	22,278,446	17%
Industrial Energy	1,271,887	13%	19,410,400	15%
Transportation Energy	3,601,352	37%	53,748,023	40%
Energy Supply	380,243	4%		
Waste	372,982	4%		
Industrial Processes	268,581	3%		
Agriculture	651,389	7%		
Total	9,853,570		132,717,890	

In addition to the energy-related emissions shown above, the region’s power plants generated over 2,500,000 MWh of electricity, resulting in GHG emissions of approximately 2.2 MMTCO₂e. While the inventory captures this data, this energy and emissions are counted separately from the Southern Tier total emissions baseline inventory, since emissions associated with electricity consumption are already included in the regional inventory.

Likewise, this inventory evaluates and quantifies the natural process of carbon sequestration that is occurring in forests, open land, and water in the Southern Tier, and it specifically evaluates changes in forest carbon stocks. While, this category of analysis is not a required source in the NYS GHG protocol, it is included to highlight the significance of the region’s large forest resource and to present an estimate of the GHG reduction benefits this resource provides. As discussed in Section 8, this is an evolving area of science and there is a great deal of uncertainty involved with these estimates. Therefore, the overall inventory results focus on gross emissions, and do not include the region’s substantial forest carbon sequestration resources. Nevertheless, due the extent of forest in the region, it will be important for the Southern Tier to consider carbon sequestration options for the region’s climate actions.

Importantly, though emissions from natural gas production is not a required source in the state protocol, it was included in this analysis due to the fact that the large majority of the New York State natural gas production currently occurs in the region: about 58 percent of statewide production occurred in the Southern Tier Region in 2010 producing emissions of approximately 28,000 MTCO₂e from actual conventional, vertical drilling production.

3. Stationary Energy Consumption

Stationary energy consumption in this inventory includes: 1) Scope 1, direct emissions from the combustion of natural gas, coal, kerosene, distillate fuel oil, motor gasoline and other fuels in residential, commercial, and industrial buildings, and 2) Scope 2, indirect emissions from grid-supplied electricity consumption for these same sectors’ buildings. To avoid double-counting, Scope 1 emissions from electricity generation (i.e., from grid-tied power plants in the region) are not included in the regional GHG emissions total, but are reported here for informational purposes only.

3.1. Electricity Generation – Scope 1

Results

Electricity generation in the Southern Tier resulted in emissions of 2.2 MMTCO₂e in 2010. Emissions by county are presented in Table 7. The vast majority of the region’s electricity generation is located in Tompkins and Broome Counties, from AES Cayuga and AES Westover plant and Cornell University’s CHP plant. Generation by resource is also presented below, in Table 8. Coal is responsible for the majority of the region’s electricity generation, followed by renewables and natural gas.

Table 7 – 2010 Electricity Generation GHG Emissions (MTCO₂e)

County	CO ₂	N ₂ O	CH ₄	Total	Percent of Total
Broome	263,903	644	1,383	265,930	12%
Chemung	-	-	-	-	0%
Chenango	-	-	-	-	0%
Delaware	-	2	6	8	0%
Schuyler	-	-	-	-	0%
Steuben	-	-	-	-	0%
Tioga	-	-	-	-	0%
Tompkins	1,876,439	4,382	9,377	1,890,198	88%
Southern Tier Total	2,140,342	5,028	10,765	2,156,136	100%

Note: Totals may not sum due to independent rounding.

Table 8 – 2010 Electricity Generation by Fuel (MWh)

County	Coal	Petroleum	Natural Gas	MSW	Renewables (Wind and Hydro)	Total
Broome	256,566	435	6,801	-	-	263,802
Chemung	-	-	-	-	-	-
Chenango	-	-	-	-	-	-
Delaware	-	-	-	2,883	-	2,883
Schuyler	-	-	-	-	-	-
Steuben	-	-	-	-	258,668	258,668
Tioga	-	-	-	-	-	-
Tompkins	1,782,807	1,882	188,629	-	2,950	1,976,268
Total	2,039,373	2,317	195,430	2,883	261,618	2,501,621
Percent of Total	81%	0%	8%	0%	10%	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

The primary data source for electricity generation is the U.S. Energy Information Administration's (EIA) Form 923 facility production data for 2010.⁴ This dataset reports total fuel consumption (in physical units and BTUs) and total net generation in MWh. This data can be gathered through EIA's web data query portal.

Emissions from electricity generation are estimated by multiplying total fuel consumption for each plant by the appropriate CO₂, CH₄, and N₂O emission factors to calculate the total emissions by gas. These emissions are summed up by gas and county to provide summary table of total electricity generation emission for the region.

3.2. Electricity Consumption – Scope 2

Results

Results are displayed along with other stationary fuel consumption in Table 9 and Table 10 (see "Scope 2"). Total electricity consumption in the Southern Tier region in 2010 is estimated to be about 6.8 million MWh. Broome County has the largest share of that electricity use, with 27 percent. Total emissions from electricity in the region are 1,546,748 MTCO₂e.

Data & Methods

Scope 2 emissions from electricity consumption are calculated using a combination of reported usage from utilities and, where utility data are unavailable, consumption estimates. Electricity consumption estimates are calculated along with the fuels discussed in the Scope 1 fuels section (Section 3.3). NYSEG, Delaware County Electric Cooperative, Steuben Rural Electric Cooperative, Village of Endicott, Village of Greene, Village of Groton, Village of Sherburne, and Village of Watkins Glen have provided their electricity usage data. The data cover 185 municipalities (towns and villages) fully and 1 municipality partially, leaving 3 towns, cities, and villages without utility-reported electricity consumption data.⁵

For the locations fully served by the utility, the reported usage for that area (in MWh) serves as the full electricity data for that town or village. If utilities did not provide data broken out into Residential, Commercial, and Industrial sectors, the statewide breakdown in electricity consumption was used (36% residential, 55% commercial, and 10% industrial; or if utilities provided Residential and Commercial/Industrial, commercial and industrial were broken out using the same method, 85% commercial, 15% industrial).

For areas only partially covered by the utility data, the portion of that area represented in the utility data is estimated comparing the number of utility data residential accounts with the number of total housing units (occupied + vacant) in the area. This approach was used only for estimating missing data, and the full electricity usage for the partially covered areas is estimated as follows:

$$MWh_{total} = MWh_{partial} \times \frac{Total\ Housing\ Units}{Residential\ Utility\ Accounts}$$

The process resulted in a sum of reported electricity consumption for each city and town in the Southern Tier, along with the number of households the reported data applied to. If 100% of any town or village was represented in the utility data, the utility-reported usage was used. If a non-zero portion of any town or city was represented in the utility data (for example, if a town was missing data for a village within it), the reported usage was divided by the percentage of housing units represented to estimate total usage.

⁴ EIA. 2012. Form EIA-923 detailed data merged with 860 form data. U.S. Energy Information Administration. Available at <http://www.eia.gov/electricity/data/eia923/>.

⁵ The three municipalities without utility data are the town of Lincklaen and the villages of Bath and Waverly.

If no utility data were available for the town or city, the following methods are used for each sector:

Residential – Electricity usage estimates for each town generated using the methods for all other residential stationary fuels area used (see below). These estimates are based on total housing units and housing unit size. Unlike other fuels, electricity usage was not weighted by HDD or home heating fuel use, since electricity is used extensively outside of home heating.

Commercial – Electricity usage estimates for each town generated using the methods for all other commercial stationary fuels are used (see below). These estimates are based on commercial square footage (which in turn is a factor of commercial sector employment and square footage-per-employee), home heating fuel use, and HDD.

Industrial – Industrial electricity consumption is not estimated if it was not provided by the utilities.

Electricity usage in MWh is then converted to MMBTU and emissions using the EPA’s Emissions & Generation Resource Integrated Database (eGRID) 2009 emission factors for the Upstate New York (NYUP) sub-region. County-level electricity consumption and emissions estimates are calculated by summing the results for all cities and towns within each county.

The NYUP CO₂ emission factor for 2009 was 500.4 lbs CO₂/MWh, which is just 41% of the national average emissions rate (1,222.3 lbs CO₂/MWh). The NYUP region’s low emissions are a result of the high use of renewable and nuclear energy in the region. The NYUP region’s electricity supply is mainly generated by hydropower (31 percent), nuclear power (31 percent), natural gas (19 percent), and coal (14 percent), with small amounts of wind, biomass, and oil providing the remaining 5 percent.

3.3.Fuels – Scope 1

Results

Total emissions from stationary combustion are about 4,579,024 MTCO₂e. Emissions by end use sector and by fuel are presented below in Table 9 and Table 10. Natural gas and electricity are the dominant fuels in the region, representing 75 percent of emissions from stationary energy use.

Table 9 – 2010 Stationary Fuel Consumption GHG Emissions (MTCO₂e)

County	Scope	Residential	Commercial	Industrial	Total	Percent of Total
Broome	1	427,456	258,598	163,079	849,134	19%
	2	161,653	179,272	72,194	413,119	9%
Chemung	1	204,252	123,804	152,161	480,217	10%
	2	77,177	86,269	66,169	229,615	5%
Chenango	1	90,963	48,560	36,156	175,679	4%
	2	56,013	37,469	27,781	121,263	3%
Delaware	1	95,242	42,693	60,208	198,143	4%
	2	56,119	37,157	28,104	121,380	3%
Schuyler	1	50,914	36,955	248,707	336,576	7%
	2	30,460	12,894	20,458	63,811	1%
Steuben	1	234,786	89,319	158,929	483,033	11%
	2	90,063	70,443	126,048	286,554	6%
Tioga	1	108,844	42,878	22,501	174,223	4%
	2	53,112	28,535	22,132	103,779	2%
Tompkins	1	159,126	138,106	38,039	335,270	7%

County	Scope	Residential	Commercial	Industrial	Total	Percent of Total
	2	77,897	100,106	29,223	207,226	5%
Southern Tier Total	1	1,371,583	780,913	879,779	3,032,276	66%
	2	602,494	552,146	392,108	1,546,748	34%
	Total	1,974,078	1,333,059	1,271,887	4,579,024	100%

Note: Totals may not sum due to independent rounding.

Table 10 – 2010 Stationary Fuel Combustion GHG Emissions by Fuel (MTCO₂e)

Fuel	Residential	Commercial	Industrial	Total	Percent of Total
Electricity	602,494	552,146	392,108	1,546,748	34%
Natural Gas	851,041	558,113	465,781	1,874,936	41%
Propane / LPG	161,689	42,027	8,569	212,286	5%
Distillate Fuel Oil (#1, #2, Kerosene)	303,099	90,805	43,027	436,931	10%
Residual Fuel Oil (#4 and #6)	0	86,565	28,075	114,639	3%
Coal	40,960	2,615	182,590	226,166	5%
Wood	14,794	787	1,337	16,918	0%
Other	0	0	150,399	150,399	3%
Southern Tier Total	1,974,078	1,333,059	1,271,887	4,579,024	100%

Note: Totals may not sum due to independent rounding. "Other" fuels include Other Petroleum Products, Industrial use of Motor Gasoline, and unspecified fuels reported to EPA.

Data & Methods

Different methods are used to estimate consumption and emissions from natural gas (for all sectors), residential stationary fuels, commercial stationary fuels, and industrial stationary fuels. Each method is described here.

Natural Gas

Similar to electricity, natural gas consumption is estimated using a combination of reported usage from utilities and, where utility data are unavailable, consumption estimates. NYSEG, National Fuel Gas, and Valley Energy provided natural gas utility data for the municipalities they serve in the Southern Tier region. The data cover 105 municipalities fully, leaving 84 municipalities for which no utility data have been received.

NYSEG and National Fuel Gas provided natural gas consumption by municipality and sector. Valley Energy was only able to provide total consumption by municipality and total consumption by sector. Therefore, the overall sector breakdown in their service region is applied to each municipality's total natural gas sales to estimate natural gas consumption for the residential, commercial, and industrial sectors in each municipality.

Natural gas usage information from the utilities separated usage between non-village components of towns and villages. To aggregate all activity data to the city and town level (to include village activity), the method of assigning villages and village components to towns, described in Section 9.2 is used. This method is applied to both natural gas usage and households that heat with natural gas.

The process resulted in a sum of reported natural gas consumption for each city and town in the Southern Tier region, along with the number of households using natural gas as a heating fuel that the reported data applied

to. If 100% of any town or village was represented in the utility data, the utility-reported usage for that area (converted to MMBTU) is used. If only a portion of a municipality was represented in the utility data (for example, if portions of a town are supplied by two different natural gas utilities and only one reported data), the reported usage is divided by the percentage of housing units that use natural gas to estimate total usage.

In the cases of Bath, Corning Natural Gas, and Woodhull Municipal Gas, no data was provided for households that utilize natural gas. Therefore, where no utility data were available for these service areas, the following methods are used for each sector:

Residential – Natural gas consumption estimates for each town generated using the methods for all other residential stationary fuels are used (see below). These estimates are based on total housing units, housing unit size, home heating fuel use, and HDD.

Commercial – Natural gas consumption estimates for each town generated using the methods for all other commercial stationary fuels are used (see below). These estimates are based on commercial square footage (which in turn is a factor of commercial sector employment and square footage-per-employee), home heating fuel use, and HDD.

Industrial – Natural gas consumption from GHGRP and Title V facilities in each municipality is used. If a municipality had no reported utility natural gas consumption and no natural gas consumption from GHGRP/Title V facilities, then no industrial natural gas consumption is used.

County-level natural gas consumption is then estimated by summing the consumption at the city and town level. Finally, natural gas usage in MMBTU is converted to emissions using the MRR natural gas emission factors of 53.02 kg CO₂/MMBTU, 0.001 kg CH₄/MMBTU, and 0.0001 kg N₂O/MMBTU.

Residential

The primary data sources for residential stationary combustion include the US Census Bureau Redistricting data for 2010, the American Community Survey (ACS) 5-year housing characteristic estimates for 2010,⁶ and the Energy Information Administration's (EIA) state energy consumption data by sector for New York in 2010.⁷ Calculation guidance was provided by the NYGHG Working Group to develop a weighted estimate based on the occupancy of single-family detached (SFD), single-family attached (SFA), or multi-family (MF) dwellings, energy use per housing unit by different types of dwellings, the average Heating Degree Days (HDD) for each region in the state, and the use of household heating fuels by household count. This method is calculated for all fuels, including electricity and natural gas. However, utility data are used in lieu of the estimation method when available, as discussed above.

Residential stationary combustion emissions are estimated by first estimating fuel consumption and then multiplying estimated fuel consumption by fuel-specific emission factors. To estimate consumption, housing data—number of housing units by type (single-family detached, single-family attached, or multi-family) and household heating fuel usage counts (oil, natural gas, propane, electricity, coal or coke, wood, and solar)—from the American Community Survey was collected for each county in the state and for each municipality in the region. Total SFD and SFA housing units were indicated in the data. Total MF housing units are assumed to equal categories for 2 or more units, plus mobile home, boat, RV, van, and other. These counts, which included both occupied and vacant housing units, are multiplied by the percentage of occupied housing units in each municipality to convert the housing units by type to occupied units by type. The heating fuel counts are based only on occupied units.

⁶ U.S. Census Bureau, 2012. American Fact Finder.

⁷ EIA. 2012. State Energy Data System for New York (SEDS). Energy Information Administration. Available at http://205.254.135.7/state/seds/seds-states.cfm?q_state_a=NY&q_state=New%20York.

Next, the occupied housing units are adjusted to account for the difference in energy use per housing unit by dwelling type, as provided by the NYGHG Working Group: a SFD uses 108 MMBTU per year, while a SFA uses 89 MMBTU per year, and a MF uses 54 MMBTU per year. The adjusted housing units for each county are calculated as:

$$Adjusted\ HU = \frac{108}{108} \times SFDHU + \frac{89}{108} \times SFAHU + \frac{54}{108} \times MFHU$$

Where:

HU = “housing units”, the total number of housing units by county

SFDHU = “single-family detached housing units”, the number of single family detached units by county

SFAHU = “single-family attached housing units”, the number of single family attached units by county

MFHU = “multi-family housing units”, the number of multi-family units by county (defined as 2+ family houses, plus mobile home, boat, RV, van, and other)

Next, the following process is used to estimate total fuel use by county for each fuel type (with an exception for electricity, noted below):

$$Adjusted\ HU_{fuel} = HU_{fuel} \times \frac{Adjusted\ HU}{HU}$$

Where:

HU = “housing units”, the total number of housing units by county

HU_{fuel} = total number of housing units that heat with each fuel type by county

The residential consumption for each county weighted by structure type and county- specific heating degree day (HDD) is calculated as follows, for each fuel type (with an exception for electricity, noted below):

$$Fuel\ Use_{county} = Total\ Fuel\ Use_{statewide} \times \frac{(Adjusted\ HU_{fuel} \times HDD)_{county}}{(Adjusted\ HU_{fuel} \times HDD)_{statewide}}$$

Once energy use is established for each fuel as described above, it is multiplied by the emission factors to estimate total emissions. Emission factors for CO₂, CH₄, and N₂O for each of the seven fuel types have been gathered from guidance based EPA's Mandatory Reporting of Greenhouse Gases program. Total emissions are calculated by gas and are rolled up into a total for each county.

Electricity consumption, used for purposes such as lighting, electronics, and appliances, is applied to all households, as well as to those using electricity as a heating fuel, and is considered to be Scope 2. HDD weighting is not applied to electricity consumption, since the households use electricity for purposes other than heating. All other fuels considered here are Scope 1.

A modest number of households reported using coal or coke, yet the statewide residential consumption was not available. Energy per housing unit values for fuel oil is used as a proxy to calculate coal or coke to correct for the unreported data.

$$Coal\ Use_{county} = Adjusted\ HU_{coal} \times \frac{Oil\ Use_{county}}{Adjusted\ HU_{oil}}$$

Where:

HU_{oil} = total number of housing units that heat with oil statewide

HU_{coal} = total number of housing units that heat with coal statewide

Commercial

Commercial stationary combustion is estimated using an apportionment of the state commercial energy consumption in a process similar to that described above for residential stationary combustion. First, the amount of commercial square footage by county is determined by multiplying the total number of commercial-sector jobs in each county (collected from the New York State Data Center and provided by the NYGHG Working Group) by the average square footage per worker per building type (collected from the Commercial Building Energy Consumption Survey and provided by the NYGHG Working Group). These are multiplied by the percentage housing units by fuel type as reported in the ACS served to estimate the amount of space heated by each fuel. Finally, the calculated consumption is weighted by HDD: the consumption of each fuel in each county equals the commercial building area using that fuel times the regional HDD, divided by the sum of the products of commercial building area times HDD for all counties in the state. These estimates are overwritten with electricity and natural gas consumption data collected from the utilities wherever possible.

Industrial

The primary data source for industrial stationary combustion is EPA's Greenhouse Gas Reporting Program data for calendar year 2010.⁸ This dataset includes emission information from large facilities (defined as those that emit > 25,000 MT CO₂e per year) in nine industry groups, including: power plants, landfills, metals manufacturing, mineral production, petroleum refineries, pulp and paper manufacturing, chemicals manufacturing, government and commercial facilities, and other industrial facilities. These groups cover 29 source categories of emissions. This data is available through a web tool or for download. This project uses the most comprehensive dataset available, the full 2010 GHG Dataset. In 2012, this EPA dataset will be expanded to include 12 additional industry groups for calendar year 2011.

Total statewide industrial fuel consumption for 2010 from EIA's State Energy Data System, Table CT6 and manufacturing employment in New York State and the Southern Tier counties were also used to supplement the GHGRP dataset. Manufacturing employment data came from the U.S. Census Bureau's 2007 Economic Census, Employment by NAICS Code, codes 31–33.

Industrial stationary combustion emissions are estimated using a combination of reported direct emissions from the Southern Tier region and a method to allocate statewide industrial fuel consumption to the Southern Tier counties. First, data are pulled for known industrial emission in the Southern Tier region from EPA's Greenhouse Gas Reporting Program dataset. To identify industrial facilities located in the Southern Tier region, facilities were filtered by state and county. Next, non-industrial facilities are removed from the list by NAICS code. Facilities that were removed from consideration were Utilities (with NAICS codes beginning with 22-), Lessors of Real Estate (531120), Solid Waste Landfills (562212), Solid Waste Combustors and Incinerators (562213), and Universities (611310). The result was a set of five industrial facilities from the GHGRP dataset located in the Southern Tier.

The same process was completed for New York State, where non-industrial facilities were removed by NAICS code. The result was a final list of 53 industrial facilities in New York State, with NAICS codes related to manufacturing (beginning with 31-, 32-, or 33-) and pipeline transportation of natural gas (486210).

Second, the industrial facilities from EPA's GHGRP dataset were cross-checked with those in the Title V air permit data from the New York State Department of Environmental Conservation. To identify industrial facilities from the Title V dataset located in the Mid-Hudson Region, facilities were filtered by state and county. Non-industrial facilities were then removed from the list based on the listed Standard Industrial Classification (SIC) code, a set of classification codes related to NAICS. Only facilities with SIC codes for Manufacturing (beginning with 20- to 39-), and Gas Production and Distribution (beginning with 492-) were kept. Facilities that were already included in the EPA's GHGRP were removed. The result was a set of eleven additional facilities located in the Southern Tier. Added to the five GHGRP facilities, this resulted in a final list of 16 industrial facilities located in the Southern Tier with reported stationary combustion (in either energy use or emissions) by fuel type.

With the list of industrial facilities and their stationary combustion emissions thus finalized, remaining industrial emissions (for example, from smaller industrial sources) are estimated using a process to allocate statewide industrial fuel consumption emissions to the Southern Tier counties based on industrial employment. Using 2010 industrial fuel consumption data⁹ (in trillion BTU) from EIA's State Energy Data

⁸ Dataset is available at: <http://epa.gov/climatechange/emissions/ghgdata/index.html>.

⁹ 2010 New York industrial fuel consumption data from EIA's SEDS Table CT6 are used directly with one exception; the fuel type "Other Petroleum Products" is adjusted to remove Asphalt and Road Oil, which are non-energy products. Asphalt

System, total New York State emissions by fuel are calculated using the default emission factors per MMBTU established by the NYGHG Protocol. The remaining emissions, statewide, are then allocated to each county by the portion of statewide industrial manufacturing employment in that county (based on employment data by NAICS code from the 2007 Economic Census). Total emissions in each county represent the sum of reported emissions and the allocated emissions.

The following process is followed **for each fuel type**:

NYS Industrial Stationary Combustion Emissions

$$= \sum_{\text{by fuel}} (\text{trillion Btu consumed} \times 10^{-6} \times \text{MT CO}_2\text{e/mmBtu})$$

Remaining emissions_{State}

$$= \text{NYS Industrial Stationary Combustion Emissions} \\ - \text{Reported Southern Tier Stationary Combustion emissions}$$

$$\text{Remaining emissions}_{\text{County}} = \text{Remaining emissions}_{\text{State}} \times \frac{\text{Industrial Employment}_{\text{County}}}{\text{Industrial Employment}_{\text{State}}}$$

Total Industrial Stationary Combustion Emissions_{County}

$$= \text{Reported Emissions}_{\text{County}} + \text{Remaining Emissions}_{\text{County}}$$

3.4. Energy Supply

Emissions that result from energy supply processes are included in the Tier II GHG Inventory. These include electricity transmission and distribution (T&D) losses, natural gas T&D losses, the use of sulfur hexafluoride (SF₆) in the utility industry, and natural gas production emissions. Natural gas production was not a required source in the state protocol, but was included in this analysis due the large portion of the New York State natural gas production currently occurring in the region: about 58 percent of statewide production occurred in the Southern Tier Region in 2010.

Results

Emissions from energy supply activities in the Southern Tier were estimated to be 380,243 MTCO₂e. The emissions from this sector are summarized in Table 11 below.

and Road Oil makes up about 62% of the Other Petroleum Products category, so 38% of the 52.9 trillion BTU (20.1 trillion BTU) was used to distribute among the Mid-Hudson counties.

Table 11 – 2010 Emissions from Energy Supply Activities (MTCO₂e)

County	Electricity T&D Emissions	Natural Gas T&D Emissions	Utility SF ₆ Emissions	Natural Gas Production Emissions	Total	Percent of Total
Broome	21,813	81,746	5,721	-	109,279	29%
Chemung	12,124	52,401	3,180	3,846	71,551	19%
Chenango	6,403	8,019	1,679	2,841	18,943	5%
Delaware	6,409	4,732	1,681	-	12,822	3%
Schuyler	3,369	17,090	884	1,162	22,505	6%
Steuben	15,130	45,578	3,968	19,911	84,587	22%
Tioga	5,480	9,243	1,437	86	16,246	4%
Tompkins	10,942	30,498	2,870	-	44,310	12%
Southern Tier Total	81,668	249,309	21,419	27,846	380,243	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

To estimate losses due to electricity T&D, total electricity consumption (in MWh) is multiplied by a T&D loss factor to determine the quantity of electricity lost during T&D. This analysis used the Eastern regional loss factor from eGRID, 5.28%. The total electricity lost is then multiplied by the electricity emission factors to estimate emissions from electricity T&D.

Natural gas transmission and distribution losses from pipelines are sources of CH₄ emission. Utilities often report their average annual lost and unaccounted for (LAUF) natural gas to the New York Public Service Commission. Natural gas consumption is estimated for each county and municipality as described in Section 3.3. For utilities that do not report LAUF, the statewide average of 1.8% as documented by National Grid in Public Service Commission reporting will be used. The estimated natural gas consumption for each utility is multiplied by the LAUF and then converted from thousand cubic feet (Mcf) to MTCO₂e.

Sulfur hexafluoride (SF₆) is a greenhouse gas that is used as an electrical insulator in electricity T&D equipment.¹⁰ The SF₆ may escape from this equipment and emit into the atmosphere. To estimate these emissions, a national average implied emission factor is used. The emission factor is estimated by dividing 2010 total SF₆ emissions from electricity T&D from the U.S. Greenhouse Gas Inventory¹¹ by total nationwide retail electricity sales from the EIA.¹² The resultant factor of 0.0031 MTCO₂e/MWh was applied to total electricity consumption in the Southern Tier.

Emissions from natural gas production in the region are estimated using data on the number of natural gas wells in the region multiplied by an emission factor. The number of natural gas wells is determined based on a dataset of statewide natural gas and oil production from the New York State Department of Environmental

¹⁰ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Section 4-23, Electrical Transmission and Distribution.

¹¹ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Table 4-1.

¹² EIA. 2012. Summary Electricity Statistics, Table ES-1, "Total Retail Sales." Energy Information Administration. Available at <http://www.eia.gov/electricity/annual/xls/tablees1.xls>.

Conservation (NYS DEC).¹³ The dataset contains information on each natural gas well in the state, along with its location, natural gas production, and number of months of operation. Wells outside of the Southern Tier and with no production are filtered out. Next, the effective number of wells operating in the region in 2010 is calculated based on the total number of months of production for all wells in the region, divided by 12 months per year. Finally, the effective number of wells is multiplied by a methane emission factor of 4.1 MT CH₄ per well per year¹⁴ to estimate annual methane emissions from natural gas production. The region contained 336 active wells in 2010, 237 of which were located in Steuben County.

4. Mobile Energy Consumption

4.1. On-road

On-road mobile transportation includes travel by motor vehicles on roads in the Southern Tier. The combustion of fuel in vehicles results in emissions of CO₂, CH₄ and N₂O. The amount of CO₂ emitted by vehicles depends on the amount of fuel consumed, whereas CH₄ and N₂O emissions vary based on control technologies used by vehicles. On-road vehicles include passenger cars, other 2/4 axle vehicles, single-unit trucks, buses, combination trucks, and motorcycles.

Results

The 2010 (using 2009 as a proxy) on-road emissions in the Southern Tier region were approximately 3,193,240 MTCO₂e, accounting for 87% of the region’s transportation emissions and 32% of all regional emissions. Table 12 lists on-road emissions by county.

Table 12 – 2010 On-Road GHG Emissions

County	Total CO2 Emissions (MT CO ₂)	Total GHG Emissions (MT CO ₂ E)	Percent of Total
Broome	1,012,695	1,027,540	32%
Chemung	379,497	385,060	12%
Chenango	229,450	232,814	7%
Delaware	263,455	267,317	8%
Schuyler	95,094	96,488	3%
Steuben	580,836	589,351	18%
Tioga	274,691	278,718	9%
Tompkins	311,387	315,952	10%
Total	3,147,104	3,193,240	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

There are 3 data components needed to estimate mobile energy emissions:

- Types of vehicles on the road (“Vehicle Mix”)
- Distance traveled by on-road vehicles (“VMT,” vehicle miles traveled)
- Fuel consumption per vehicle type (“Fuel Economy”)

¹³ NYS DEC. 2010. New York Natural Gas and Oil Production Data, 2010. Available at <http://www.dec.ny.gov/energy/1601.html>.

¹⁴ U.S. EPA. State Inventory Tool, Natural Gas and Oil Module. 2010 factor for New York.

Vehicle Mix. Data on the on-road vehicle mix for each functional class of road (e.g., rural interstate, urban freeways and expressways) were obtained for each NYSDOT region from NYSDOT’s Environmental Science Bureau dataset.¹⁵ The Southern Tier region is represented by three different NYSDOT regions: Region 3 (Tompkins County), Region 6 (Chemung, Schuyler, and Steuben Counties), and Region 9 (Broome, Chenango, Delaware, and Tioga Counties). The breakdown of vehicle types for each functional class of road was translated to HPMS vehicle categories by the NYGHG Working Group.

Distance. Data on vehicle miles traveled (VMT) were obtained from Tompkins County and NYSDOT modeled data for all other counties. County-level VMT data were available by functional class, whereas Tompkins County VMT data were presented as totals.

Fuel Economy. State- or regional-level data on the fuel economy of the Southern Tier’s vehicle fleet were not available. As a proxy, national average fuel economy values by vehicle class are used, based on the Federal Highway Administration’s *Highway Statistics 2010* series.

Table 13 presents salient characteristics of the data used to estimate emissions from on-road mobile energy consumption. As shown, 2009 is the latest year currently available for all sources.

Table 13 – On-road Energy Consumption Data Summary

	Granularity	Data by functional class	Vintage of Data	Other issues
VMT	Counties; municipality-level data available for Tompkins County	County-level data: yes. Tompkins municipality data: no	2009	
Vehicle Mix	NYSDOT Regions	Yes	2009	
Fuel Economy	National data	No	2009	Do not have separate fuel economy values for gasoline and diesel vehicles.

The general methodology for estimating CO₂ emissions from mobile combustion is:

$$CO_2 \text{ emissions} = \text{Fuel Consumption} \times \text{Emission Factor}$$

Fuel consumption in the Southern Tier is estimated by determining the distance traveled by different vehicle types and the amount of fuel consumed by each type of vehicle (fuel economy). First, data on total annual distance (VMT) traveled by vehicles within each county is allocated to vehicle types using the NSYDOT dataset on the breakdown of vehicles on NY roads (vehicle mix) by functional class of road. For each vehicle type and functional class, VMT data were multiplied by the average fuel economy of each vehicle type to determine total annual fuel consumption for each vehicle type. Total gasoline and diesel fuel consumption are then multiplied by the CO₂ emission factor for each fuel, which results in an estimate of CO₂ emissions for the region. In equation form:

$$CO_2 \text{ emissions (MT)} = \sum VMT_{ab} \times FC_{ab} \times EF_{ab}$$

Where:

¹⁵ NYSDOT Environmental Science Bureau, 2009. Mobile 6.2 CO Emission Factors for project-Level Microscale Analysis, Appendix A. <https://www.dot.ny.gov/divisions/engineering/environmental-analysis/manuals-and-guidance/epm/repository/coeftab0.pdf>

- VMT = annual vehicle miles traveled (miles/year)
- FC = fuel consumption per mile traveled (gallons per mile; 1/ fuel economy)
- EF = Emission factor (MT CO₂/gallon of fuel)
- a = fuel type (diesel or gasoline)
- b = vehicle type (passenger car, bus, combination truck, motorcycle, single-unit truck, and other 2/4 axle trucks)

Based on guidance from the NYGHG Working Group, the calculations assume that 10 percent of gasoline sold in New York is comprised of ethanol, so 10% of gasoline consumption is assumed to be ethanol. CO₂ emissions from ethanol are assumed to be zero, as biogenic CO₂ is not included in this inventory.

Methane and nitrous oxide make up for less than 2 percent of on-road transportation emissions, and require data on the types of vehicle control technologies in use in the region’s on-road vehicle fleet. For the Southern Tier GHG inventory, per the guidelines of the NYGHG Working Group, non-CO₂ emissions from vehicles are estimated by multiplying CO₂ emissions by the ratio of total (CO₂ + non-CO₂) emissions from transportation per MT of CO₂ emissions (MT CO₂e/MT CO₂). This ratio, obtained from EPA’s national greenhouse gas inventory,¹⁶ is 0.000994 MTCO₂e of CH₄ per MTCO₂ and 0.01367 MTCO₂e of N₂O per MTCO₂ of on-road transportation emissions.

4.2. Air

Airplanes that fly in and out of airports in the Southern Tier region are sources of emissions. The airports in the region are Binghamton (airport code BGM) in Broome County, Ithaca/Cortland (ITH) in Tompkins County, and Elmira/Corning (ELM) in Chemung County.

Results

Emissions for air travel were estimated to be approximately 54,581 MTCO₂e in 2010 and are dispersed approximately evenly across the three airports in the region (see Table 14). Emissions from this source were not included in the regional total per the decision of the NY GHG Working Group.

Table 14 – 2010 Air Emissions (MTCO₂e)

County	Total	Percent of Total
Broome	17,963	33%
Chemung	18,718	34%
Chenango	-	0%
Delaware	-	0%
Schuyler	-	0%
Steuben	-	0%
Tioga	-	0%
Tompkins	17,899	33%
Southern Tier Total	54,581	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

¹⁶ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010.

Emissions from air travel are estimated using a flight statistics dataset from the U.S. Department of Transportation’s Bureau of Transportation Statistics.¹⁷ Data fields of interest include the number of performed flights and the distance traveled in 2010. National flight emissions (114.0 Tg CO₂e) are from the U.S. Inventory for 2010.¹⁸

The flight statistics dataset is filtered to include only domestic flights from and to the three airports in the Southern Tier. Total miles traveled in 2010 are calculated for each route by multiplying the number of performed flights with the distance per trip. The total miles of flights from and to each of the three airports are calculated. Flight miles are halved in the emissions calculations because emissions from half the trip are attributed to the origin airport and half are attributed to the destination airport. This ensures that two regions following the same methodology would not double-count emissions. Regional flight emissions are calculated using the following equation:

$$\begin{aligned}
 & \text{Regional flight emissions} \\
 &= \frac{\text{Regional Departing flight miles} + \text{Regional Arriving flight miles}}{\text{National flight miles}} \\
 & \times \text{National Emissions} \times 0.5
 \end{aligned}$$

4.3.Rail

Emissions from railroad locomotives result from the use of diesel fuel.

Results

Emissions from rail in 2010 were estimated to be approximately 35,555 MTCO₂e. The higher level of emissions in Steuben and Broome Counties are likely due to a greater level of freight traffic and train switching associated with Corning and Binghamton.

Table 15 – 2002 Rail Emissions (MTCO₂e)

County	CO ₂	CH ₄	N ₂ O	Total MTCO ₂ e	Percent of Total
Broome	9,616	16	5	9,637	27%
Chemung	5,363	9	3	5,375	15%
Chenango	2,488	4	1	2,493	7%
Delaware	1,002	2	1	1,005	3%
Schuyler	301	0	0	302	1%
Steuben	10,880	18	6	10,903	31%
Tioga	5,245	9	3	5,256	15%
Tompkins	582	1	0	584	2%
Total	35,478	58	19	35,555	100%

Note: Totals may not sum due to independent rounding.

¹⁷ U.S. Department of Transportation. 2012. U.S. Air Carriers Traffic and Capacity Data: T-100 Segment (All Carriers). Bureau of Transportation Statistics. Available at http://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=293&DB_Short_Name=Air%20Carriers.

¹⁸ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Table 3-12.

Data & Methods

Due to the limited amount of data available in this sector, the NYGHG Working Group elected to use data from the 2002 New York State Locomotive Survey¹⁹ as a proxy for 2010 emissions. The survey collected information on 2002 locomotive fuel use for four categories of locomotives: Class I, Class II/III, commuter/passenger, and switchyard. Class I railroads are large, long-distance line haul railroads and Class II and III railroads consist primarily of regional and local line haul and switching railroads. Yard locomotives move railcars within a particular railway yard.

The survey reported county-level fuel consumption for Class I and system-wide fuel consumption estimates for Class II/III locomotives. The survey also reported county-level fuel consumption estimates from passenger/commuter lines that operate diesel locomotive cars, although there were no estimates for Southern Tier counties. Fuel consumption estimates for a switchyard in Tioga County were reported; some Class I rail companies in New York State operate switchyards and the fuel consumption from other potential switchyards in the Southern Tier region could not be separated out from line haul fuel consumption.

The county-level Class I freight and switchyard fuel consumption estimates are multiplied by the diesel fuel CO₂ emission factor to calculate CO₂ emissions and converted to metric tons. The fuel consumption estimates are converted by the diesel density factor and multiplied by the emission factors, global warming potentials, and unit conversion factors to calculate CH₄ and N₂O emissions.²⁰ The inventory does not report emissions from the Class II/III rail type because the fuel consumption estimates are not reported by county.

4.4. Marine

The marine transportation sector is comprised of boats.

Results

Marine emissions in the Southern Tier were estimated to be approximately 29,142 MTCO₂e in 2010 (using 2007 activity as a proxy). One quarter of those emissions were in Delaware County (see 16).

Table 16 – 2010 Marine Equipment Emissions (MTCO₂e)

County	Marine Emissions (MTCO ₂ e)	Percent of Total
Broome	2,888	10%
Chemung	919	3%
Chenango	1,444	5%
Delaware	7,351	25%
Schuyler	5,907	20%
Steuben	3,938	14%
Tioga	1,444	5%

¹⁹ Southern Research Institute. 2007. NYSERDA Clean Diesel Technology: Non-Road Field Demonstration Program. Development of the 2002 Locomotive Survey for New York State. Available at <http://www.nyserda.ny.gov/Publications/Research-and-Development/~media/Files/Publications/Research/Environmental/locomotive%20survey%20report%20wit%20appendices.ashx>.

²⁰ Default factors from EPA’s 2012 State Inventory Tool (SIT), Mobile Combustion Module. The SIT’s default diesel density factors are from EIA Annual Energy Review 2007. The SIT’s default diesel emission factors are from IPCC 1996 Guidelines for National Greenhouse Gas Inventories.

County	Marine Emissions (MTCO ₂ e)	Percent of Total
Tompkins	5,251	18%
Southern Tier Total	29,142	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

Marine vehicle use and emissions data for each of the eight counties in the Southern Tier in 2007 were obtained using EPA's NONROAD Emissions Model outputs as provided by the New York State Department of Environmental Conservation (NYS DEC) via the NYGHG Working Group. Among other emissions types, the NONROAD model estimates carbon dioxide emissions. The emissions from all off-road vehicles within the pleasure craft classification in each county are summed and converted to MTCO₂e from short tons.

4.5.Off-road

Off-road equipment includes engines used for agricultural, construction, lawn and garden, and off-road recreation purposes.

Results

The results of the off-road emissions estimates are shown in Table 17 and Table 18, below. Off-road activity accounted for an estimated 343,415 MTCO₂e of emissions in the Southern Tier in 2010. Broome County had the largest share of these emissions, primarily due to having the largest share of regional population.

Table 17 – 2010 Off-road emissions by County (MTCO₂e)

County	Total MTCO ₂ e	Percent of Total
Broome	73,728	21%
Chemung	38,391	11%
Chenango	29,321	9%
Delaware	41,628	12%
Schuyler	25,319	7%
Steuben	59,917	17%
Tioga	28,912	8%
Tompkins	46,200	13%
Southern Tier Total	343,415	100%

Note: Totals may not sum due to independent rounding.

Table 18 – 2007 Off-road Emissions by Equipment type

Equipment Type	Total MT CO ₂ e
Recreational Equipment	62,559
Construction and Mining Equipment	64,861
Industrial Equipment	83,755
Lawn and Garden Equipment (Res)	23,288
Lawn and Garden Equipment (Com)	13,152
Agricultural Equipment	68,888

Equipment Type	Total MT CO ₂ e
Commercial Equipment	21,184
Logging Equipment	5,130
Airport Equipment	438
Railroad Equipment	162
Total	343,415

Note: Totals may not sum due to independent rounding.

Data & Methods

Off-road vehicle use and emissions data for each of the eight counties in the Southern Tier region in 2007 were obtained using EPA's NONROAD Emissions Model outputs as provided by NYS DEC via the NYGHG Working Group. The model input values were adjusted by NYS DEC. Among other emissions types, the NONROAD model estimates carbon dioxide emissions. To derive county-level emissions estimates, the emissions from all off road vehicles in each county are summed and converted to MTCO₂e from short tons of CO₂. To avoid double counting, the emission of vehicles in the pleasure craft classification is accounted in the marine emission source and is not included in the off-road emission source.

5. Waste

The waste management sector encompasses solid waste and wastewater. The organic material in solid waste and wastewater degrade during the decomposition and treatment processes, and as a result, emit greenhouse gases.

5.1. Solid Waste

The decomposition of organic matter in solid waste produces methane. For this inventory both Scope 1 and Scope 3 emissions for solid waste are calculated. Scope 1 represents emissions from landfills located within the region, regardless of where the waste originated. Scope 3 represents emissions from waste generated by the region, regardless of where the waste is ultimately transported. To avoid double-counting, only Scope 3 emissions are included in the total. Scope 1 emissions from solid waste are reported here for informational purposes.

5.1.1. Scope 1

Solid waste Scope 1 accounts for emissions from landfills located within the Southern Tier counties. Municipal solid waste landfill facilities in the region include Broome County Landfill, Chemung County Sanitary Landfill, Chenango County Landfill, Delaware County Solid Waste Management Facility, and Bath Sanitary Landfill in Steuben County. Other solid waste facilities that collect designated types of waste, including construction and demolition debris (C&D), include Chemung County Area 3 C&D Landfill, Burton Clark C&D in Delaware County, Delaware County C&D, Hakes C&D Disposal, Inc. in Steuben County, and AES Cayuga Ash Disposal Facility in Tompkins County. There are no waste combustion facilities within the region.

Results

Results indicate that landfills in the region emitted 235,569 MTCO₂e in 2010. See Table 19.

Table 19 –2010 Scope 1 Solid Waste Emissions (MTCO₂e)

County	Total MTCO ₂ e	Percent of Total
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County	Total MTCO ₂ e	Percent of Total
Broome	95,649	41%
Chemung	63,102	27%
Chenango	14,166	6%
Delaware	29,786	13%
Schuyler	-	0%
Steuben	32,865	14%
Tioga	-	0%
Tompkins	-	0%
Southern Tier Total	235,569	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

Data on emissions from landfills came from EPA’s Greenhouse Gas Reporting Program data for calendar year 2010. This dataset includes emission information from large facilities (defined as those that emit >25,000 MTCO₂e per year) in nine industry groups, including landfills. The landfill facilities in the Southern Tier that reported emissions were Broome County Landfill, Chemung County Sanitary Landfill, and Bath Sanitary Landfill. Methane emissions from the facilities’ landfill processes were reported as solid waste Scope 1 emissions.

The inventory assumes Chemung County Area 3 C&D Landfill is the same as Chemung County Sanitary Landfill, Delaware County C&D is the same as Delaware County Solid Waste Management Facility, and Burton Clark C&D and AES Cayuga Ash Disposal Facility do not generate emissions because of lack of waste in place.

Emissions from the remaining landfill facilities (Chenango County Landfill, Delaware County Solid Waste Management Facility, and Hakes C&D), are estimated using the California Air Resources Board’s Landfill Emissions Tool Version 1.3. The tool implements the mathematically exact first-order decay (FOD) model of the 2006 IPCC guidelines. The methodology of the FOD model is available in the Local Government Operations Protocol.²¹

Data on historical waste disposal, 2010 methane recovery, and alternative daily cover (ADC) percentage are available in the NYS DEC 2010 Annual Landfill Reports.²² Landfill waste data reported as an aggregate for a time period in the Landfill Annual Report are allocated evenly across years. The historical waste data and ADC amounts were entered into the emissions tool. The inventory assumes the daily cover is composed of green waste and compost. The default anaerobically degradable carbon (ANDOC) value is assumed for the mixed waste facilities and 2 percent is assumed for the C&D facility. The county and NY State-specific information is used to replace the California-specific default data in the tool. In the “Landfill Model Inputs tab,” the state/country input is set to “US-Other” and the k value is set to 0.038.

The emission outputs for 2010 were adjusted for amounts of methane recovery reported in the Landfill Reports.

²¹ California Air Resources Board. 2010. Local Government Operations Protocol, Version 1.1. California Air Resource Board, California Climate Action Registry, ICLEI – Local Governments for Sustainability, The Climate Registry. Available at <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>.

²² NYS DEC. 2010 Annual Landfill Reports. Available at <ftp://ftp.dec.state.ny.us/dshmf/SWMF/Landfill/Landfill%20Annual%20Reports/Landfill%20Annual%20Reports%20-%202010/>.

5.1.2. Scope 3

Scope 3 solid waste emissions accounts for emissions from waste generated within the Southern Tier counties, regardless of where the waste is sent.

Results

Results indicate that total Scope 3 emissions from solid waste disposal in the region were 308,976 MTCO₂e in 2010. Ninety-five percent of those emissions (293,458 MTCO₂e) came from MSW disposal and the remainder (15,517 MTCO₂e) came from C&D disposal. See Table 20 summarizes the results by county. Broome County has the highest emissions for two reasons: it has the highest total population (hence the greatest MSW generation), and the majority of its waste goes to the Broome County Landfill, which is only 38 percent covered by a landfill gas capture system (most other major landfills that serve the region are between 80 and 100 percent covered).

Table 20 – 2010 Scope 3 Solid Waste Emissions (MTCO₂e)

County	MSW CH ₄ Emissions (MTCO ₂ e)	C&D CH ₄ Emissions (MTCO ₂ e)	Total CH ₄ Emissions (MTCO ₂ e)	Percent of Total
Broome	151,964	3,668	155,632	50%
Chemung	22,023	3,409	25,432	8%
Chenango	37,075	573	37,648	12%
Delaware	4,464	1,478	5,941	2%
Schuyler	4,421	48	4,470	1%
Steuben	33,255	4,913	38,169	12%
Tioga	15,918	110	16,027	5%
Tompkins	24,338	1,319	25,657	8%
Southern Tier Total	293,458	15,517	308,976	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

The NYGHG Working Group provided solid waste data from landfill facilities for the inventory year, which were compiled from NYS DEC 2010 Annual Landfill Facility Reports.²³ The solid waste data are filtered to include landfill facilities that service, or receive waste from, the counties in the Southern Tier region. Landfill gas (LFG) collection acreage, total landfill acreage, and percent alternative daily cover (ADC) data were gathered from NYS DEC 2010 Annual Landfill Facility Reports.

The weighted percentage of landfill area with LFG capture and weighted ADC are calculated for each county based on the landfills that accept municipal solid waste (MSW) from each county. For each unique landfill facility that services the Southern Tier, the percent of land in which gas is collected is calculated by dividing the gas collection acreage over the total landfill acreage. The amount of MSW and C&D generated by each county that was sent to landfills is calculated by summing the amount of waste from the “service area(s)” of interest, which are the counties in the Southern Tier. Then, the percentage of land with LFG capture for landfill facilities that collect MSW from each county are weighted by the amount of MSW received from that county. The ADC percent for landfill facilities that collect MSW from each county are also weighted by the amount of MSW received from that county. The inventory assumes no LFG capture and ADC for C&D waste.

²³ Received via email from Jim Yienger on July 26, 2012 7:30 AM. Data spreadsheets compiled by Shelby Egan.

Municipal waste divisions of Broome, Delaware, and Tioga provided MSW generation data. The inventory estimates total MSW generated for Chemung, Chenango, Schuyler, Steuben, and Tompkins. MSW generation from Broome and Tioga were used to calculate a regional average for waste generated per capita. Delaware County is not included in the regional average because the county's landfill practices exceed standard practices. MSW generated from the remaining counties is estimated by multiplying the counties' population with the waste generated per capita regional average.

Then, using the data from the Working Group and NYS DEC Annual Reports, the percentages of MSW and C&D generated that were landfilled versus combusted in each county are calculated. Southern Tier counties do not send solid waste to combustion facilities in the state. The amount of waste generated is multiplied by the counties' fraction of waste that is sent to landfills to determine the amount of MSW landfilled. The amount of ADC is also calculated by multiplying the amount of MSW landfilled with the weighted ADC percent for each county. The inventory sums up the amount of C&D generated using the data from the Working Group and NYS DEC Annual Reports, as those are the only sources with C&D data.

The California Air Resources Board's Landfill Emissions Tool Version 1.3 is used to calculate Scope 3 emissions. The tool implements the mathematically exact first-order decay (FOD) model of the 2006 IPCC guidelines. The methodology of the FOD model is available in the Local Government Operations Protocol.²⁴

The tool is used to calculate emissions the waste generated in 2010 will emit over its lifetime in a landfill. First, the number of years for which waste generated during the inventory year will be releasing methane was calculated. The half-life of landfilled waste was calculated through the following equation: $k = \ln(2)/\text{half-life}$ in years. The variable k is determined based on the amount of annual rainfall in the county, and an average rainfall of 20-40 inches per year was assumed for all counties. Given the rainfall assumption, $k = 0.038$. The half-life was multiplied by four half-lives to determine T , the number of years for which waste deposited during the inventory year will be releasing methane.

NYS DEC completed a revised solid waste plan, *Beyond Waste: A Sustainable Material Management Strategy*, which includes data on composition of waste discarded in 2008, and is categorized by rural, suburban, and urban settings.²⁵ Population density data are from the NYS Data Center.²⁶ New York State-specific solid waste discard composition data is used to find the fractions of waste types which contain anaerobically degradable carbon (ANDOC). The inventory assumes the waste composition from rural communities. For the purposes of the solid waste analysis, NYS DEC defined rural as communities in the state with a population density of less than 325 people per square mile. The inventory assumes the waste composition for the construction and demolition (C&D) waste emission analysis is 100 percent C&D.

The county and NY State-specific information is used to replace the California-specific default data in the tool. In the "Landfill Model Inputs tab," the state/country input is set to "US-Other" and the k value is set to 0.038. The amount of solid waste generated in the inventory year is entered into the tool "Landfill Model Inputs tab" T years prior to the inventory year. The New York State-specific waste-in-place fractions are entered into the "Landfill Specific ANDOC Values" tab of the tool. The new %ANDOC value is entered into the "Landfill Model Inputs" tab to replace the default numbers. The amount of ADC is entered into the tool for MSW estimates and

²⁴ California Air Resources Board. 2010. Local Government Operations Protocol, Version 1.1. California Air Resource Board, California Climate Action Registry, ICLEI – Local Governments for Sustainability, The Climate Registry. Available at <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>.

²⁵ NYS DEC. 2010. Beyond Waste: A Sustainable Material Management Strategy. Table H-4: New York State MSW Composition. Available at http://www.dec.ny.gov/docs/materials_minerals_pdf/fbeyondwastegi.pdf.

²⁶ NYS Data Center. Table 1: Total Population, Housing Units, Land Area, and Population Density, 2010. Available at <http://esd.ny.gov/NYSDataCenter/Data/Census2010/PL2010Tab1NY.pdf>.

assumes the daily cover is composed of greenwaste and compost. The default %ANDOC value for daily cover that is calculated by the tool is used. The inventory assumes no ADC for C&D waste.

The sum of emission results over T years represents the total amount of methane expected to be released by inventory year waste generated and deposited in a landfill without a landfill gas (LFG) collection system. The methane emissions for MSW waste then are adjusted for a LFG collection system. The EPA default LFG collection efficiency of 75 percent is assumed.²⁷ This default value is multiplied by the weighted percent of land with a LFG collection system per county to find the LFG collection rate for that county. The weighted LFG capture coverage ranges from 36 to 100 percent (i.e., some counties sent a weighted average of waste to landfills where LFG was captured on 36 percent of the landfill, some to landfills with 100 percent LFG collection coverage). The sum of methane emissions is multiplied by 100 percent minus the LFG collection rate to determine methane emissions from MSW generated and deposited in landfills with LFG collection systems. The inventory assumes no LFG collection for C&D waste. Carbon dioxide emission outputs from the solid waste tool are considered biogenic and are not included in the inventory emissions.

5.2.Wastewater

When organic waste material in wastewater degrades during the wastewater treatment process, it emits both methane and nitrous oxide. Methane is emitted during anaerobic digestion of wastewater, and nitrous oxide is emitted when nitrogen components in wastewater degrade. The amount of methane and nitrous oxide emitted from wastewater depends on the type of wastewater treatment processes used, such as septic systems, centralized wastewater treatment plants (WWTPs), and anaerobic digesters. In the Southern Tier, there are at least 47 identified sewer systems owned by cities, districts, private ownership, towns, and villages.

Results

Wastewater treatment emissions are approximately 64,007 MTCO₂e. Table 21 lists wastewater treatment emissions by county.

Table 21 – 2010 Wastewater Treatment Emissions

County	CH ₄ Emissions (MT CO ₂ e)	N ₂ O Emissions (MT CO ₂ e)	Total Emissions (MT CO ₂ e)	Percent of Total
Broome	13,492	6,024	19,516	30%
Chemung	5,975	2,667	8,642	14%
Chenango	3,395	1,516	4,911	8%
Delaware	3,227	1,441	4,668	7%
Schuyler	1,234	551	1,785	3%
Steuben	6,658	2,972	9,631	15%
Tioga	3,439	1,535	4,974	8%
Tompkins	6,831	3,050	9,881	15%
Southern Tier Total	44,251	19,756	64,007	100%

Note: Totals may not sum due to independent rounding.

²⁷ U.S. EPA. 2008. AP 42, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal.

Data & Methods

Wastewater emissions are calculated based on the population served by wastewater treatment processes. Population data in the Southern Tier were obtained from the NYS Data Center.²⁸

Wastewater emissions are calculated using EPA’s State Inventory Tool (SIT) Wastewater module. Methane emissions from municipal wastewater treatment are calculated by multiplying the regional population from by the annual per-capita 5-day biological oxygen demand (BOD₅) rate, then by the emission factor of CH₄ emitted per quantity of BOD₅. Default values for New York State in the SIT were used. In some equations, the percentage of the population not on septic systems is used. For these, the default value for New York State is 79%. It is assumed that the actual value for the region is lower, due to the largely rural character of the Southern Tier region, but given the relatively low emissions from this source, the State value was assumed to be suitable for this use. Both centralized wastewater treatment plants and septic systems are emission sources, though the emission factors and methods are slightly different. The SIT combines these two approaches in a manner appropriate for the relatively low emissions from this source.

$$\begin{aligned}
 CH_4 \text{ Emissions (MT)} &= \text{Population} \times \text{Per capita BOD}_5 \left(\frac{kg}{day} \right) \times \frac{Days}{year} \times \frac{MT}{kg} \times EF \left(\frac{GgCH_4}{GgBOD_5} \right) \\
 &\quad \times \% \text{ of WW anaerobically digested}
 \end{aligned}$$

Where:

- Population = Regional population.
- Per capita BOD₅ = 5-day biochemical oxygen demand per capita. Default value is 0.09 kg BOD₅/day.
- EF = Emission factor of CH₄ emitted per quantity of BOD₅. Default value is 0.6 Gg CH₄/Gg BOD₅.
- % of WW anaerobically digested = Fraction of wastewater BOD₅ that is anaerobically digested. Default value is 16.25%.

Nitrous oxide emissions from municipal wastewater treatment are calculated by multiplying the population served by the percent of the population using centralized wastewater treatment (not septic systems), then by the amount of direct N₂O emissions from wastewater treatment per person per year.

$$\begin{aligned}
 N_2O \text{ Emissions (MT)} &= \text{Population} \times \text{Fraction of population not on septic} \\
 &\quad \times \text{Direct } N_2O \text{ emissions from WWT} \left(\frac{gN_2O}{person \text{ year}} \right) \times \frac{MT}{g}
 \end{aligned}$$

Where:

²⁸ New York State Data Center, Census 2010. Revised2000to2009SubcountyTotals_Population.xls. Available at <http://www.empire.state.ny.us/NYSDataCenter/Census2010.html>.

Population	=	Regional population.
Fraction of population not on septic	=	Percent of population that is served by centralized WWTPs as opposed to septic systems. The default value for New York State is 79%. It is assumed that the actual value for the region is lower, due to the largely rural character of the Southern Tier region, but given the relatively low emissions from this source, the State value was assumed to be suitable for this use.
Direct N ₂ O emissions from WWT	=	The amount of N ₂ O emitted from WWTPs. Default value is 4.0 grams N ₂ O per person per year.

Nitrous oxide emissions from wastewater biosolids are calculated using the following equation:

N in Domestic Wastewater

$$= \text{Population} \times \text{Protein} \left(\frac{\text{kg}}{\text{person year}} \right) \times \text{Frac}(npr) \left(\frac{\text{kg N}}{\text{kg protein}} \right) \\ \times \text{Fraction nonconsumption N} \times \left(\frac{\text{MT}}{\text{kg}} \right)$$

N₂O Emissions (MT)

$$= \text{N in Domestic WW (MT)} - \text{Direct N Emissions from Domestic WW (MT)} \\ \times (1 - \% \text{ of Biosolids used as fertilizer}) \times \text{EF} \left(\frac{\text{kgN}_2\text{O} - \text{N}}{\text{kgsewageN}_{\text{produced}}} \right) \times \left(\frac{\text{N}_2\text{O}}{\text{N}_2} \right)$$

Where:

Population	=	Regional population.
Protein	=	Available protein per person per year (kg/person/year). Default value is 42.6 kg/person/year. ²⁹
Fraction of nitrogen in protein	=	Kg N per Kg protein. Default value is 16 percent. ³⁰
Fraction of non-consumption nitrogen	=	The ratio of total N to N consumed. Default value is 1.75. ³¹
EF	=	Emissions of N in the form N ₂ O per unit of sewage-N produced. Default value is 0.01 kg N ₂ O-N per kg of sewage-N.

²⁹ U.S. EPA. 2012. *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2010*. Table 8-14.

³⁰ Ibid.

³¹ Ibid.

6. Industrial Processes

Industrial process emissions are those produced as by-products of non-energy-related industrial activities. In the Southern Tier, such industrial activities relate primarily to manufacturing of products, including transportation equipment, computer and electronic products, electrical equipment, machinery, furniture, metal, and glass.³²

Results

Industrial process emissions in the Southern Tier in 2010 were approximately 268,581 MTCO₂e. The results are shown in Table 22, by county.

Table 22 – 2010 Industrial Process GHG Emissions by Industrial Activity (MTCO₂e)

County	Glass Production	ODS Substitution	Total	Percent of Total
Broome	-	74,459	74,459	28%
Chemung	25,153	32,972	58,124	22%
Chenango	-	18,736	18,736	7%
Delaware	-	17,809	17,809	7%
Schuyler	-	6,809	6,809	3%
Steuben	-	35,969	35,969	13%
Tioga	-	18,977	18,977	7%
Tompkins	-	37,698	37,698	14%
Southern Tier Total	25,153	243,428	268,581	100%

Note: Totals may not sum due to independent rounding

Data & Methods

Industrial process emissions for the Southern Tier region are estimated for two emission sources to cover the industrial process emissions in the Southern Tier region. These sources are: (1) CO₂, CH₄, and N₂O from general industrial activity as reported by large facilities and (2) hydrofluorocarbon (HFC) emissions from ozone depleting substances (ODS) substitutes.

Data on industrial activity from large facilities came from EPA’s Greenhouse Gas Reporting Program data for calendar year 2010.³³ This dataset includes emission information from large facilities (defined as those that emit > 25,000 MTCO₂e per year) in nine industry groups, including: power plants, landfills, metals manufacturing, mineral production, petroleum refineries, pulp and paper manufacturing, chemicals manufacturing, government and commercial facilities, and other industrial facilities. These groups cover 29 source categories of emissions. This data are available through a web tool or for download. This project used the most comprehensive dataset available, the full 2010 GHG Dataset. In 2012, this EPA dataset will be expanded to include 12 additional industry groups for calendar year 2011.

³² Southern Tier Regional Economic Development Council. Southern Tier Concentrated Industries. <http://regionalcouncils.ny.gov/content/southern-tier>.

³³ Dataset is available at <http://epa.gov/climatechange/emissions/ghgdata/index.html>.

To calculate emissions from ODS substitutes, the inventory calculations use an implied emission factor based on total national ODS substitute emissions and population. National ODS substitute emissions came from Table 4-1 of EPA’s national GHG inventory.³⁴ Total 2010 U.S. population was collected from the U.S. Census Bureau.³⁵

The primary data source for industrial facility emissions is EPA’s Greenhouse Gas Reporting Program data for calendar year 2010. To identify facilities located in the Southern Tier region, the full dataset of facilities was filtered by state and county. The inventory only includes emissions from GHGRP processes other than stationary combustion, electricity production, and landfill emissions, since these emissions are included elsewhere in the inventory. Only one facility in the GHGRP dataset reported industrial process emissions in the Southern Tier: Anchor Glass Container Corporation in Elmira Heights, NY, which has emissions from glass production.

To supplement the Greenhouse Gas Reporting Program data, emissions are also calculated for ODS substitutes, a key industrial process emissions source category not covered in the EPA dataset. The Southern Tier region uses an implied per capita emissions factor based on the national greenhouse gas inventory for 2010.³⁶ Equipment that use ODS Substitutes are widely distributed throughout all households and businesses. Total 2010 ODS substitution emissions (114.6 Tg CO₂e) are divided by total 2010 U.S. population (308,745,538) to derive an implied per capita emission factor. This implied emission factor is multiplied by the population of each of the municipalities in the Southern Tier Region to estimate emissions from this industrial process source category.

7. Agriculture

The Agriculture sector of the Southern Tier regional inventory includes non-carbon dioxide emissions from enteric fermentation in domestic livestock, livestock manure management, and agricultural soil management (including fertilizer application). Carbon dioxide emissions are not included as they are assumed to be biogenic and don’t represent an anthropogenic emission source.

About 29% of the Southern Tier’s total land area is in farmland.³⁷ The primary agricultural industry in the region is dairy industry, along with other livestock production. The primary crops in the region are forage, corn (for grain and silage), oats, and Christmas trees.

Results

Agriculture emissions in 2010 were approximately 651,389 MTCO₂e. Emissions are shown in Table 23. Steuben County, with the highest population of dairy and beef cows, has the largest emissions in the region, accounting for 30 percent of agriculture emissions.

Table 23 – 2010 Agriculture GHG Emissions by Source (MTCO₂e)

County	Enteric Fermentation	Manure Management	Agricultural Soils	Total	Percent of Total
Broome	29,267	5,794	12,624	47,685	7%
Chemung	15,778	3,109	8,711	27,599	4%
Chenango	70,661	14,125	29,581	114,367	18%

³⁴ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Table 4-1.

³⁵ U.S. Census Bureau. 2012. State and County QuickFacts – USA. <http://quickfacts.census.gov/qfd/states/00000.html>.

³⁶ U.S. EPA. 2012. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Table 4-1..

³⁷ Regional Economic Development Council of the Southern Tier. Strategic Economic Development Plan: 2011-2016. Available at http://regionalcouncils.ny.gov/themes/nyopenrc/rc-files/southerntier/CU_RegEcoDevRprt_loR.pdf.

Delaware	55,659	10,755	23,955	90,369	14%
Schuyler	24,065	5,290	9,293	38,648	6%
Steuben	112,028	21,850	58,399	192,276	30%
Tioga	35,666	7,723	17,136	60,526	9%
Tompkins	47,205	10,077	22,637	79,919	12%
Southern Tier Total	390,329	78,724	182,336	651,389	100%

Note: Totals may not sum due to independent rounding.

Data & Methods

Data on 2010 livestock populations and crop productions were available for New York State on the county-level from USDA's National Agricultural Statistics Service (NASS).³⁸ Livestock populations for 2010 included beef cows, milk cows, and all cattle (including calves). Calf populations were calculated by assuming that calves account for 17.4% of the total non-dairy cattle/cow population.³⁹ Data for crop production in the Southern Tier counties covered dry edible beans, corn for grain and silage, hay alfalfa, other dry hay, oats, soybeans, and winter wheat.

Information from EPA's Regional GHG Inventory Guidance on livestock population percentage breakdowns in New York State was also used to allocate dairy cattle and beef cattle populations into sub-categories. The subcategories for dairy cattle are dairy cows and dairy replacement heifers.⁴⁰ The subcategories for beef cattle are beef cows, beef replacement heifers, heifer stockers, steer stockers, feedlot heifers, feedlot steer, and bulls.⁴¹

Fertilizer sales data came from the New York State Department of Agriculture and Markets dataset of total fertilizer and nutrients by county for calendar year 2010. For each county, the dataset includes total fertilizer sales, broken into single, multi-nutrient, and other; Total N, P205, and K20 in multiple-nutrient fertilizer, and total N, P205, and K20 in all fertilizer.

County-level emissions for agriculture are calculated using EPA's State Inventory Tool (SIT) Agriculture module, using default emission factors for New York State. To calculate emissions from enteric fermentation and manure management, the tool requires population information for each livestock subcategory. Total county milk cow population and beef cow population from NASS are multiplied by the percentage breakdowns from EPA's Regional GHG Inventory Guidance to derive subcategory populations. The tool then multiplies the number of animals by a per-head enteric CH₄ emission factor to estimate total enteric fermentation emissions for each county. The tool multiplies the subcategory populations by New York defaults for Typical Animal Mass (TAM), volatile solids (VS), and methane conversion factors for different manure management systems to estimate CH₄ emissions from manure management and by TAM, K-Nitrogen factors, and nitrogen emission factors for different manure management systems to estimate N₂O emissions from manure management.

To calculate emissions from management of agricultural soils, the SIT follows three steps. The tool first calculates emissions from plant residues and allows input of crop production data for 21 crop types. Five of these crop types are grown in the Southern Tier region: Alfalfa (pulled from NASS as "Hay Alfalfa (Dry)"), corn for grain, wheat, oats, and soybeans. The tool multiplies these production amounts by a series of factors,

³⁸ USDA. 2012. National Agricultural Statistics Service, QuickStats. Data downloaded for All livestock items and All crops; Location: New York / All Counties. <http://www.nass.usda.gov/QuickStats/>.

³⁹ Calf population in NYS is 17.38% of total cattle population. Because calf data are not split out at the county level, assumed statewide 17.38% applies.

⁴⁰ U.S. EPA. 2006. Regional GHG Inventory Guidance. Table A-24, Dairy cow population percentages by state, 2006.

⁴¹ U.S. EPA. 2006. Regional GHG Inventory Guidance. Table A-25, Beef cow population percentages by state, 2006.

including residue dry matter fraction, fraction residue applied, and nitrogen content of residue to calculate the amount of nitrogen returned to soils and the amount of nitrogen fixed by crops.

The second step of calculating emissions from agricultural soil management estimates emissions from plant fertilizer application. The tool uses the total amounts of fertilizer nitrogen by type (synthetic fertilizers, dried blood, compost, dried manure, activated sewage sludge, other sewage sludge, tankage, or other organic amendments) to estimate direct and indirect N₂O emissions from fertilizer applications. For each county, the total N in all fertilizer types from the New York State dataset is entered into the tool under “Synthetic Fertilizer” to estimate fertilizer emissions.

Finally, the SIT calculates agricultural soil emissions from animals and runoff. This step uses the livestock population data entered under enteric fermentation and manure management and New York state default distributions of livestock management systems (e.g., managed systems, pasture, and daily spread) along with built-in emission factors to estimate N₂O emissions.

8. Land Use, Land-Use Change and Forestry

Land Use, Land-Use Change and Forestry (LULUCF) measures changes to forest carbon stocks. This measurement reflects the impact of changes in land use on the capacity of forests in the Southern Tier Region to sequester carbon. Since urbanization in the Southern Tier Region is concentrated in already developed areas while abandoned agriculture lands have reverted to forest in recent years, the acreage of forested lands is increasing, not decreasing. This trend is reflected by the fact that carbon sequestration increased in five of the eight counties in the region.

This source is considered optional under the guidance of the NYGHG Working Group. However, it is included here due to the importance of forest resources to the region. This is an evolving area of science and there is a great deal of uncertainty involved with these estimates.

Results

Land use changes in the Southern Tier in (from 2005-2010) resulted in a net sequestration of 6,922,505 MTCO₂e. Given the high rate of sequestration and the region’s plentiful forest resources, improved forest management and targeted reforestation can help increase carbon stocks in the Southern Tier. Broome, Chemung and Tompkins Counties showed net emissions from LULUCF, meaning these three counties marked forest land loss during this period of time, while Chenango, Delaware, Schuyler, and Steuben Counties had net carbon sequestration from LULUCF, perhaps resulting from an increase in marginal agricultural lands naturally reforesting. Results by county are shown in Table 24.

Table 24 – 2010 Net Emissions from LULUCF (MT CO₂e)

County	Net Emissions (MTCO ₂ e)
Broome	415,668
Chemung	192,003
Chenango	(2,612,113)
Delaware	(2,371,521)
Schuyler	(1,670,944)
Steuben	(1,078,995)
Tioga	(434,567)
Tompkins	637,964

County	Net Emissions (MTCO ₂ e)
Southern Tier Total	(6,922,505)

Note: Totals may not sum due to independent rounding.

Data & Methods

Two datasets are used to calculate net emissions from LULUCF: (1) the acres of forested land in each county from 2005 and again in 2010 and (2) the carbon sequestration rates for forests in the region.

The acres of forested land were retrieved from the U.S. Forest Service’s Forest Inventory and Analysis database via the Forest Inventory Data Online (FIDO) website.⁴² Data were originally pulled by county by forest-type group for 1993, 2005 and 2010. The three data samples revealed some inconsistencies in the identification of specific forest-type groups. However, the differences between the total forested area per county demonstrated reasonable changes in acreage. Therefore, to minimize the influence of data sample errors, the calculations are based on the total forested area for each county, and not forest-type groups.

To minimize another source of potential data collection error, the 2005 and 2010 sample years were selected. This decision was based on the fact that the average annual change was more likely to be similar over a shorter time frame and that data collection methodology is more likely to have changed between the 1993 and 2010 data collection than the 2005 and 2010 samples.

The second set of data, the carbon sequestration rates for forested land in the eight counties was retrieved from the Carbon OnLine Estimator (COLE).⁴³ The composite rate for “All” forest-type groups in the Southern Tier counties was selected, 185 metric tons Carbon per hectare). This is a weighted rate that reflects the distribution of forest-type groups in the region. Only some of the forest-type groups had specific sequestration rates. This composite rate was used for all forest-types in the counties.

Calculations estimated the average annual rate of change for carbon sequestration in the counties. The methodology included a four step calculation:

- (1) Subtract the 2005 acres of forest per county from the 2010 acres of forest per county.
- (2) Divide the change by five (years) to get the annual rate of change in acres.
- (3) Convert acres of forest to hectares.
- (4) Multiply the annual rate of change in hectares by the composite carbon sequestration rate.
- (5) Convert carbon sequestered to carbon dioxide sequestered by multiplying by 44/12 (g CO₂/g C).

⁴² US Forest Service, FIA Program: Forest Inventory Data Online. <http://apps.fs.fed.us/fido/> Retrieved July 6, 2012.

⁴³ Carbon OnLine Estimator (COLE) data are based on USDA Forest Service Forest Inventory & Analysis and Resource Planning Assessment data. <http://www.ncasi2.org/COLE/> Retrieved July 16, 2012.

9. Appendix – Municipal-Level Allocation

9.1. Introduction

In addition to the regional GHG inventory presented above, this analysis includes a municipal-level allocation of regional emissions. The inventory team allocated the region’s emissions to individual towns, cities, and villages based on the available data. This effort is intended to provide municipalities with baseline information about their community-level GHG emissions. Because it was not feasible to develop ground-up GHG inventories for each of the region’s 189 cities, towns, and villages, the allocation process was driven by readily available demographic and geographic data. A detailed, ground-up inventory would likely provide more reliable results for any one community, but these estimates serve as a useful resource for those communities unable to complete their own GHG inventories. The challenges and limitations of this process are described below, followed by a description of the methods for each sector. The results are presented in county tables at the end of this report, and may also be viewed in the inventory spreadsheet that accompanies this report.

9.2. Challenges

Data Limitations and Unallocated Portion

As expected at the outset of this process, it was not practical to fully allocate all emissions from each sector in the region. The team allocated those sources where available local-level activity data could be used to reasonably approximate the spatial distribution of emissions. In cases where no such data were available, regional emissions are not allocated to the local level. Specifically, emissions from rail, marine, aviation, and LULUCF have not been allocated to the municipal level for this inventory. It would be possible to allocate sources such as aviation based on a survey of passenger air travel habits by municipality, but conducting such a survey was beyond the scope of this analysis.

Furthermore, only a subset of industrial emissions and off-road emissions were allocated, as discussed below. The percentage not allocated by sector is shown below in Table 25. Furthermore, Scope 1 emissions from electricity generation—which was calculated for informational purposes but not included in the regional total—are not included in the municipal allocation, since Scope 2 emissions from electricity consumption are already included.

Table 25 – Percentage of Emissions Not Allocated, by Sector

Category	Allocated to Municipalities?	Percentage Not Allocated
Stationary Energy Consumption		6%
<i>Residential</i>	Yes	N/A
<i>Commercial</i>	Yes	N/A
<i>Industrial</i>	Partially	19%
<i>Energy Supply</i>	Yes	N/A
Mobile Energy Consumption		7%
<i>On-Road</i>	Yes	N/A
<i>Air</i>	No	100%
<i>Marine</i>	No	100%
<i>Rail</i>	No	100%
<i>Off-Road</i>	Partially	45%
Waste Management		N/A

<i>Solid Waste</i>	Yes	N/A
<i>Wastewater Treatment</i>	Yes	N/A
Industrial Processes	Yes	N/A
Agriculture	Yes	N/A
LULUCF	No	100%
Across All Sectors		5%

Including Villages

Although most villages’ populations are also included within town U.S. Census population estimates, the inventory has allocated to the village level, where possible. Because there is overlap between towns and villages, these allocations should not be viewed additively. For example, three villages could be part of one town; the emissions allocated to each village should not be viewed as mutually exclusive from the town, but are also included in the town’s emissions estimates. However, there is value in understanding emissions from each village for facilitating planning activities to target reducing emissions from specific sectors and locales.

Municipal Boundaries

The Southern Tier region is comprised of 6 cities and 125 towns, in addition to 58 villages that lie within them. Three villages in the Southern Tier lie across county lines. Deposit Village lies partially in Sanford Town in Broome County and partially in Deposit Town in Delaware County. For the purpose of this inventory, Deposit Village is treated as two villages in order to properly allocate county-level emissions to the municipal level. Earlville Village and Almond Village lie in two counties, one in the Southern Tier region and one outside of the region. Neither of these villages have been included in this inventory because the majority of each village’s population resides in the non-Southern Tier county.

With these adjustments, the municipal allocation reports total estimates for each city and town, *including* activity in the underlying villages. Activity and emissions for each village are also tracked and reported separately, but not counted in the totals. Some sectors, however, report activity data for towns *excluding* village activities. In these cases, the following method is applied to assign village activity to the appropriate towns. The primary means of this is simply assigning each village to a town, based on information from the New York State Data Center.⁴⁴ When activity data are reported for towns (excluding villages) and villages, the town activity data are added with those of the village(s) within it. However, five villages in the Southern Tier are split between towns. To assign reported village activity data to the correct towns, the percentage of the village’s population in each town is used. This population breakdown is available from the New York State Data Center.⁴⁵ The split activity data are then included in the totals for each town as appropriate.

⁴⁴ New York State Data Center. 2012. Estimates of the Resident Population: New York State Governmental Units, 2000 to 2009 – Revised September 2010. Available at http://www.empire.state.ny.us/NYSDataCenter/Data/Population_Housing/REVISED2000to2009SubcountyTotals.pdf.

⁴⁵ Ibid.

9.3. Methods by Sector

Stationary Energy Consumption

Electricity – Scope 1

Electricity generation emissions are not allocated to the municipal level, as they are not counted in county emission totals.

Electricity – Scope 2

Electricity consumption emissions are calculated at the municipal level initially and then added up to the county level. See Section 3.2 for methodology details. Municipal-level electricity consumption is based on the consumption reported for each municipality by the utilities.

Fuels – Scope 1

Residential fuel consumption at the municipal level is calculated using the same methodology described in the main inventory text, based on Census data for housing units, heating fuel use, and statewide residential fuel consumption. Utility data for each municipality, if available, override these estimates. Municipality-level natural gas consumption is based on the consumption reported for each municipality by the utilities. See Section 3.3 for details.

Commercial fuel consumption at the municipal level is calculated using the same methodology described in the main inventory text, based on Census data for housing units, heating fuel use, and statewide commercial fuel consumption. Utility data for each municipality, if available, override these estimates. See Section 3.3 for details.

Industrial fuel consumption at the municipal level is based on reported data from three sources: EPA's Greenhouse Gas Reporting Program industrial facilities, the New York State Department of Environmental Conservation (NYS DEC) Title V facilities database, and utility data. Industrial stationary combustion emissions from any facilities within a municipality are assigned to that municipality. For natural gas combustion, utility data overrides GHGRP/Title V facilities data if both are available. The estimated fuel consumption used to account for consumption not covered by these three sources was not allocated due to the lack of sufficient local-level data.

Energy Supply

Electricity and natural gas transmission and distribution emissions at the municipal level are calculated using the same methodology as at the county level. Electricity and natural gas consumption for each municipality is multiplied by a transmission and distribution loss factor and converted to emissions. SF₆ emissions are also calculated in the same manner for municipalities as for counties, using municipal-level electricity consumption multiplied by the SF₆ loss rate in MTCO_{2e} per MWh. Natural gas production emissions are assigned to municipalities based on the location of the wells. See Section 3.4 for details.

Transportation

For the transportation sector, on-road motor vehicle activity, as well as off-road terrestrial vehicle activity, has been allocated to the town level. However, due to lack of data and solid methodological options, rail, marine, and air subsectors have not been similarly allocated.

On-Road Transportation

On-road emissions in Southern Tier Region are allocated to municipalities based on the number of occupied housing units (households) in cities, towns, and villages adjusted based on the journey-to-work mode preference. Household data were obtained from the American Communities Survey 5-year estimates on

selected housing characteristics, as were journey-to-work percentages. First, the weighted proportion of commuters driving alone is calculated for each municipality and each county:

$$\begin{aligned} & \textit{Weighted drive alone \%} \\ & = \textit{Drive alone \%} + \frac{\textit{two - person Carpool \%}}{2} + \frac{\textit{three - person Carpool \%}}{3} \\ & + \frac{\textit{four - or - more person Carpool \%}}{4} \end{aligned}$$

Next, the weighted proportion of commuters driving alone is normalized by dividing by the county-wide average for each county to provide a “journey-to-work factor” (JTWF, in the equation below). Municipal on-road emissions are estimated by multiplying the county-level emission estimates by a weighting based on the number of households within each municipality and the prevalence of vehicle use for commuting relative to the rest of the county:

$$\textit{Emissions}_{\textit{Municipality}} = \textit{Emissions}_{\textit{County}} \times \frac{(\# \textit{Households} \times \textit{JTWF})_{\textit{Municipality}}}{\sum (\# \textit{Households} \times \textit{JTWF})_{\textit{All Municipalities in a County}}}$$

For Tompkins County, municipal-level VMT data are used to estimate on-road emissions for towns, cities, and villages.

Off-Road Transportation

The methodologies for allocating off-road emissions to the municipal level varied by equipment type. Emissions from recreational and logging equipment are allocated based on the inverse of population density, assuming that these types of equipment are more common in areas with more space available per person. The population density is normalized to the county average by dividing the inverse of the log of each municipality’s population density by the inverse of the log of the county’s population density. The normalized population density is multiplied by the municipality’s 2010 population. This is divided by the sum of the products of the population and normalized density of towns and cities to find the proportion of population density with respect to the county. The proportion is multiplied with the county’s emissions from recreational and logging equipment. The net result of this weighting is that usage was weighted by population, but given a higher weighting in places with low population density, and a lower weighting in places with high population density.

Emissions from construction and mining equipment are allocated based on population. The municipalities’ population proportions within their respective county are multiplied by the county’s emissions from construction and mining equipment.

Emissions from residential and commercial lawn and garden equipment are allocated taking into account the number of single family housing units. The number of total single family detached and attached housing units within each municipality is divided by the total within its respective county. The housing unit proportion is multiplied by the county’s emissions from residential and commercial lawn and garden equipment. This methodology is based on the methodology used within EPA’s NONROAD model to generate estimates for these equipment types.

Emissions from commercial equipment are allocated based on emissions from the commercial stationary fuels. The commercial fuel emissions from each municipality are divided by the total emissions from their respective county. The commercial fuel proportion is multiplied with the county’s emissions from commercial equipment.

Emissions from industrial, airport, and railroad equipment are not allocated at the municipal level.

Waste Management

Solid Waste

Scope 1 solid waste emissions are allocated to municipalities based on the location of the landfill facilities. Scope 1 emissions are not included in the allocation totals for waste, similar to in the county-level inventory. Scope 3 emissions are allocated to municipalities based on Census-derived populations. The towns, cities, and villages' population proportions within each of their respective counties are multiplied by the county's overall Scope 3 emissions.

Wastewater

Wastewater emissions are allocated to municipalities based on Census-derived populations. The proportion of the county population residing in each town, city, and village is multiplied by their respective county's CH₄ and N₂O emissions to obtain municipal-level wastewater emissions.

Industrial Processes

Industrial process emissions at the municipal level are calculated using the same methodology as calculating emissions at the county level (see Section 6). Industrial process emissions from the single facility in the region, the Anchor Glass Container Corporation facility located in the village of Elmira Heights, New York, are assigned to that village. The emissions are also assigned to the Town of Elmira, which contains the portion of Elmira Heights Village with the facility. Emissions from ODS substitution are calculated for municipalities based on their population and the implied per capita ODS emission factor.

Agriculture

Emissions from the agricultural sector are apportioned to the municipal level using GIS-based land use data from the USDA's National Agricultural Statistics Service.⁴⁶ The dataset provides land area by crop type throughout the United States. Using this dataset, the area of each land use type within the Southern Tier Region municipalities is determined.

To apportion emissions, first, the relevant land use types were determined. For Ag Soils, the land uses for the crop types grown in the Southern Tier Region and calculated in the State Inventory Tool are used. These crop types are Alfalfa, Corn, Winter Wheat, Oats, Soybeans, and Dry Beans. The sum of the land area for each of these crops for each municipality is considered its "Ag Soils Land Area."

For livestock emissions (Manure Management and Enteric Fermentation in the SIT), land area categorized as "Pasture/Grass" is used to determine the "Livestock Land Area."

Finally, total agricultural emissions (Ag Soils Emissions plus Livestock emissions) for each municipality are determined using the equations below:

$$Ag\ Soils\ Emissions_{Municipal} = Emissions_{County} \times \frac{Ag\ Soils\ Land\ Area_{Municipal}}{Ag\ Soils\ Land\ Area_{County}}$$

$$Livestock\ Emissions_{Municipal} = Emissions_{County} \times \frac{Livestock\ Land\ Area_{Municipal}}{Livestock\ Land\ Area_{County}}$$

⁴⁶ USDA. 2012. National Agricultural Statistics Service Cropland Data Layer. 2010 Published crop-specific data layer. Available at <http://nassgeodata.gmu.edu/CropScape>.

9.4. Results

Emissions for each municipality by sector are presented in the tables below, organized by county.

Table 26 – Broome County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Barker	8,331	4,374	17	13,685	2,120	266	1,014	3,136	652	33,593
City of Binghamton	146,586	144,346	20,375	258,294	36,756	4,609	17,585	0	32,760	661,310
Town of Binghamton	16,568	2,821	295	26,112	3,834	481	1,834	1,050	1,275	54,270
Town of Chenango	36,098	18,358	674	65,289	8,730	1,095	4,177	1,219	4,713	140,353
Town of Colesville	13,834	8,615	21	24,394	4,059	509	1,942	5,294	1,314	59,982
Town of Conklin	16,916	11,203	9,111	30,120	4,221	529	2,020	1,495	2,756	78,371
Town of Dickinson	14,599	14,934	230	22,774	4,095	513	1,959	91	2,963	62,158
Town of Fenton	20,961	6,624	889	37,434	5,178	649	2,477	1,714	1,627	77,553
Town of Kirkwood	16,876	13,073	36,452	31,625	4,544	570	2,174	731	5,787	111,832
Town of Lisle	6,744	4,476	0	13,797	2,134	268	1,021	10,680	630	39,750
Town of Maine	14,398	3,737	114	28,065	4,172	523	1,996	2,592	686	56,283
Town of Nanticoke	4,114	2,707	0	8,646	1,297	163	621	3,927	397	21,871
Town of Sanford	7,450	2,462	174	11,959	1,867	234	893	4,827	664	30,532
Town of Triangle	7,988	6,606	69	15,754	2,286	287	1,093	5,560	855	40,498
Town of Union	174,573	111,426	85,814	335,163	43,715	5,482	20,914	1,167	37,176	815,430
Town of Vestal	66,786	78,630	10,026	108,603	21,757	2,728	10,409	1,187	14,495	314,619
Town of Windsor	16,288	3,478	140	32,675	4,868	610	2,329	3,016	530	63,933
Allocated Total	589,109	437,871	164,401	1,064,388	155,632	19,516	74,459	47,685	109,279	2,662,339
<i>Village emissions, included in town/city totals</i>										
<i>Village of Deposit - Broome County</i>	<i>2,984</i>	<i>1,652</i>	<i>172</i>	<i>4,340</i>	<i>612</i>	<i>77</i>	<i>293</i>	<i>0</i>	<i>496</i>	<i>10,626</i>
<i>Village of Endicott</i>	<i>41,396</i>	<i>26,818</i>	<i>77,360</i>	<i>79,429</i>	<i>10,390</i>	<i>1,303</i>	<i>4,971</i>	<i>0</i>	<i>14,760</i>	<i>256,427</i>
<i>Village of Johnson City</i>	<i>46,359</i>	<i>48,583</i>	<i>1,989</i>	<i>87,745</i>	<i>11,772</i>	<i>1,476</i>	<i>5,632</i>	<i>0</i>	<i>9,871</i>	<i>213,429</i>
<i>Village of Lisle</i>	<i>1,076</i>	<i>574</i>	<i>0</i>	<i>1,726</i>	<i>248</i>	<i>31</i>	<i>119</i>	<i>0</i>	<i>90</i>	<i>3,864</i>
<i>Village of Port Dickinson</i>	<i>5,509</i>	<i>1,180</i>	<i>211</i>	<i>8,455</i>	<i>1,273</i>	<i>160</i>	<i>609</i>	<i>0</i>	<i>713</i>	<i>18,110</i>

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Village of Whitney Point	2,926	3,232	0	5,407	748	94	358	0	377	13,142
Village of Windsor	2,896	2,371	86	5,593	711	89	340	0	304	12,390

Table 27 – Chemung County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Ashland	6,862	1,727	272	8,178	485	165	629	1,122	752	20,193
Town of Baldwin	2,884	1,663	0	4,938	238	81	309	1,450	347	11,910
Town of Big Flats	24,581	31,042	13,615	37,050	2,213	752	2,870	3,137	6,826	122,085
Town of Catlin	7,344	1,183	6	12,630	750	255	972	2,425	1,258	26,822
Town of Chemung	8,433	1,720	3,811	11,243	734	249	951	4,265	790	32,195
City of Elmira	85,378	82,955	25,744	117,863	8,360	2,841	10,838	0	20,296	354,275
Town of Elmira	29,244	18,194	46,130	35,214	1,985	675	27,726	1,548	9,663	170,380
Town of Erin	5,227	626	0	8,971	562	191	728	2,311	851	19,467
Town of Horseheads	68,018	51,728	83,627	98,412	5,578	1,896	7,232	2,212	23,005	341,709
Town of Southport	26,488	14,777	3,749	49,909	3,132	1,064	4,061	2,318	4,810	110,308
Town of Van Etten	3,979	2,317	303	5,342	446	151	578	2,028	1,408	16,552
Town of Veteran	12,991	2,140	567	17,635	948	322	1,230	4,783	1,547	42,164
Allocated Total	281,429	210,073	177,824	407,386	25,432	8,642	58,124	27,599	71,551	1,268,060
<i>Village emissions, included in town/city totals</i>										
Village of Elmira Heights	11,804	5,464	71,983	20,802	1,173	399	26,673	0	11,386	149,685
Village of Horseheads	18,408	21,547	7,908	36,570	1,850	629	2,398	0	4,833	94,143
Village of Millport	1,396	180	0	2,059	89	30	116	0	155	4,026

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Village of Van Etten	1,727	1,072	0	2,170	154	52	199	0	152	5,527
Village of Wellsburg	2,095	595	41	2,114	166	56	215	0	281	5,564

Table 28 – Chenango County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Afton	9,396	3,446	300	15,856	2,126	277	1,058	4,592	429	37,481
Town of Bainbridge	10,374	4,101	327	16,924	2,467	322	1,228	3,882	471	40,097
Town of Columbus	2,592	814	9,676	4,242	727	95	362	6,175	764	25,447
Town of Coventry	4,016	1,228	17	7,433	1,234	161	614	4,562	154	19,418
Town of German	806	196	0	1,336	276	36	137	1,667	29	4,484
Town of Greene	15,979	5,156	7,256	28,493	4,180	545	2,080	10,498	1,032	75,218
Town of Guilford	8,787	2,496	0	13,995	2,179	284	1,085	7,645	405	36,876
Town of Lincklaen	789	6,785	0	1,550	295	39	147	3,388	463	13,456
Town of McDonough	2,683	712	0	4,511	661	86	329	1,823	96	10,901
Town of New Berlin	8,578	3,046	5	13,509	2,000	261	996	6,442	388	35,225
Town of North Norwich	5,341	2,425	4,794	9,070	1,330	173	662	5,582	658	30,035
City of Norwich	21,288	22,909	4,323	36,174	5,363	700	2,669	0	4,666	98,091
Town of Norwich	12,100	11,341	17,869	21,672	2,982	389	1,484	5,623	3,475	76,934
Town of Otselic	3,057	814	294	5,055	786	103	391	3,993	126	14,619
Town of Oxford	11,502	6,474	134	16,477	2,910	380	1,448	7,557	1,080	47,961
Town of Pharsalia	1,624	465	3	2,713	442	58	220	2,246	62	7,832
Town of Pitcher	2,270	595	23	3,630	599	78	298	5,543	79	13,116
Town of Plymouth	5,400	1,099	0	8,882	1,346	176	670	5,993	687	24,251
Town of Preston	2,452	540	0	4,209	779	102	388	3,536	189	12,193

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Sherburne	10,630	9,487	1,487	19,019	3,019	394	1,503	10,596	1,112	57,247
Town of Smithville	3,825	1,089	48	6,340	992	129	494	4,709	152	17,778
Town of Smyrna	3,487	813	1,499	5,408	955	125	475	8,315	2,427	23,503
Allocated Total	146,976	86,029	48,055	246,496	37,648	4,911	18,736	114,367	18,943	722,161
<i>Village emissions, included in town/city totals</i>										
<i>Village of Afton</i>	2,926	1,633	73	4,547	613	80	305	0	169	10,347
<i>Village of Bainbridge</i>	4,009	2,057	100	7,233	1,011	132	503	0	206	15,250
<i>Village of Greene</i>	5,300	1,849	4,480	9,017	1,178	154	586	0	637	23,201
<i>Village of New Berlin</i>	2,735	1,627	0	4,474	767	100	382	0	151	10,235
<i>Village of Oxford</i>	5,166	2,511	110	6,087	1,081	141	538	0	665	16,299
<i>Village of Sherburne</i>	3,995	5,607	1,486	6,806	1,020	133	507	0	641	20,195
<i>Village of Smyrna</i>	538	287	1,499	937	159	21	79	0	128	3,648

Table 29 – Delaware County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Andes	4,434	1,387	1	5,537	161	127	483	4,973	216	17,318
Town of Bovina	2,024	539	0	3,439	78	62	235	3,212	87	9,676
Town of Colchester	7,026	2,886	82	15,000	257	202	771	3,153	297	29,675
Town of Davenport	8,379	3,386	388	18,928	367	288	1,101	3,198	476	36,511
Town of Delhi	14,053	12,771	12,828	24,982	634	498	1,899	6,427	1,159	75,251
Town of Deposit	5,692	3,088	3,779	12,605	212	167	635	3,130	827	30,134
Town of Franklin	7,287	2,319	1	13,466	299	235	895	8,603	306	33,409
Town of Hamden	4,259	1,365	0	8,261	164	129	491	5,734	163	20,566
Town of Hancock	10,051	8,116	370	22,749	399	314	1,197	2,459	1,208	46,863

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Harpersfield	5,567	2,433	846	7,932	195	153	585	4,040	381	22,133
Town of Kortright	5,543	1,812	0	10,042	207	163	622	8,019	229	26,636
Town of Masonville	4,281	1,758	0	9,170	163	128	490	3,579	190	19,760
Town of Meredith	5,139	1,351	0	9,256	189	149	568	5,769	195	22,616
Town of Middletown	13,161	6,037	55	23,745	464	365	1,392	2,784	594	48,596
Town of Roxbury	8,279	3,819	952	14,207	310	243	929	2,964	499	32,201
Town of Sidney	17,547	10,676	19,040	36,553	715	562	2,143	4,954	1,626	93,816
Town of Stamford	7,398	4,191	6,771	13,176	281	221	841	5,780	881	39,539
Town of Tompkins	3,390	995	0	7,768	154	121	463	3,960	105	16,956
Town of Walton	17,851	10,921	10,529	35,577	690	542	2,070	7,631	3,385	89,196
Allocated Total	151,360	79,850	55,643	292,392	5,941	4,668	17,809	90,369	12,822	710,854
<i>Village emissions, included in town/city totals</i>										
<i>Village of Delhi</i>	<i>6,360</i>	<i>7,717</i>	<i>3</i>	<i>11,370</i>	<i>382</i>	<i>300</i>	<i>1,146</i>	<i>0</i>	<i>577</i>	<i>27,855</i>
<i>Village of Deposit - Delaware County</i>	<i>2,741</i>	<i>1,948</i>	<i>181</i>	<i>5,167</i>	<i>202</i>	<i>159</i>	<i>607</i>	<i>0</i>	<i>450</i>	<i>11,455</i>
<i>Village of Fleischmanns</i>	<i>874</i>	<i>602</i>	<i>0</i>	<i>1,263</i>	<i>43</i>	<i>34</i>	<i>130</i>	<i>0</i>	<i>66</i>	<i>3,012</i>
<i>Village of Franklin</i>	<i>1,091</i>	<i>519</i>	<i>0</i>	<i>1,505</i>	<i>46</i>	<i>36</i>	<i>139</i>	<i>0</i>	<i>46</i>	<i>3,382</i>
<i>Village of Hancock</i>	<i>3,700</i>	<i>5,241</i>	<i>38</i>	<i>7,820</i>	<i>128</i>	<i>100</i>	<i>383</i>	<i>0</i>	<i>893</i>	<i>18,303</i>
<i>Village of Hobart</i>	<i>1,277</i>	<i>836</i>	<i>4,156</i>	<i>2,767</i>	<i>55</i>	<i>43</i>	<i>164</i>	<i>0</i>	<i>344</i>	<i>9,640</i>
<i>Village of Margaretville</i>	<i>1,746</i>	<i>2,128</i>	<i>10</i>	<i>2,925</i>	<i>74</i>	<i>58</i>	<i>221</i>	<i>0</i>	<i>159</i>	<i>7,322</i>
<i>Village of Sidney</i>	<i>11,305</i>	<i>8,783</i>	<i>10,178</i>	<i>24,411</i>	<i>483</i>	<i>379</i>	<i>1,448</i>	<i>0</i>	<i>1,421</i>	<i>58,408</i>
<i>Village of Stamford</i>	<i>3,813</i>	<i>2,802</i>	<i>1,277</i>	<i>8,165</i>	<i>139</i>	<i>109</i>	<i>415</i>	<i>0</i>	<i>314</i>	<i>17,034</i>
<i>Village of Walton</i>	<i>10,573</i>	<i>8,179</i>	<i>10,528</i>	<i>18,477</i>	<i>382</i>	<i>300</i>	<i>1,146</i>	<i>0</i>	<i>3,049</i>	<i>52,634</i>

Table 30 – Steuben County, Emissions by Municipality (MTCO₂e)

	Stationary Energy	Mobile	Solid	Wastewater	Industrial	Agriculture	Energy	All Sectors
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Municipality	Residential	Commercial	Industrial	Energy	Waste	Treatment	Processes	Supply		
Town of Catharine	6,137	3,553	212	11,894	429	171	654	2,488	392	25,930
Town of Cayuta	1,451	909	973	3,175	135	54	206	981	154	8,040
Town of Dix	22,360	15,235	112,397	26,142	942	376	1,434	5,894	5,671	190,450
Town of Hector	18,295	8,401	64	30,098	1,204	481	1,834	13,453	938	74,767
Town of Montour	16,142	13,845	537	14,964	562	225	857	1,736	2,787	51,654
Town of Orange	4,447	1,658	6	9,379	392	157	597	3,096	552	20,284
Town of Reading	6,844	4,509	150,194	10,946	416	166	634	3,926	11,782	189,415
Town of Tyrone	5,699	1,739	0	10,294	389	155	593	7,073	230	26,174
Allocated Total	81,374	49,849	264,382	116,892	4,470	1,785	6,809	38,648	22,505	586,714
<i>Village emissions, included in town/city totals</i>										
<i>Village of Burdett</i>	<i>1,226</i>	<i>649</i>	<i>0</i>	<i>2,225</i>	<i>83</i>	<i>33</i>	<i>126</i>	<i>0</i>	<i>60</i>	<i>4,403</i>
<i>Village of Odessa</i>	<i>1,784</i>	<i>1,395</i>	<i>171</i>	<i>3,634</i>	<i>144</i>	<i>57</i>	<i>219</i>	<i>0</i>	<i>134</i>	<i>7,540</i>
<i>Village of Montour Falls</i>	<i>5,199</i>	<i>5,905</i>	<i>205</i>	<i>10,102</i>	<i>417</i>	<i>166</i>	<i>635</i>	<i>0</i>	<i>1,053</i>	<i>23,683</i>
<i>Village of Watkins Glen</i>	<i>6,867</i>	<i>6,908</i>	<i>170,675</i>	<i>11,769</i>	<i>453</i>	<i>181</i>	<i>690</i>	<i>0</i>	<i>2,469</i>	<i>200,012</i>

Table 31 – Steuben County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Addison	10,003	3,995	604	17,064	1,001	252	963	3,721	1,380	38,982
Town of Avoca	6,644	1,840	1,050	12,331	873	220	840	6,514	829	31,141
Town of Bath	33,142	24,457	11,497	78,322	4,773	1,204	4,595	14,882	5,509	178,381
Town of Bradford	2,596	1,030	10	5,158	330	83	317	2,088	486	12,099
Town of Cameron	2,764	1,226	15	6,337	364	92	351	5,705	197	17,050
Town of Campbell	11,115	4,360	6,439	18,618	1,313	331	1,264	2,780	1,957	48,177
Town of Canisteo	10,205	3,202	25	19,893	1,308	330	1,259	4,721	1,165	42,107

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Caton	9,312	2,936	0	17,700	840	212	809	2,499	1,366	35,674
Town of Cohocton	8,561	2,229	332	15,340	987	249	951	10,844	1,076	40,570
City of Corning	42,025	25,730	32,434	76,079	4,312	1,088	4,151	0	9,351	195,170
Town of Corning	25,293	10,376	477	39,992	2,418	610	2,327	1,290	4,654	87,437
Town of Dansville	5,464	779	41	10,285	710	179	684	10,224	180	28,546
Town of Erwin	29,228	23,535	177,345	51,651	3,099	782	2,983	2,074	24,455	315,152
Town of Fremont	5,215	650	89	6,703	389	98	374	6,864	302	20,684
Town of Greenwood	2,413	651	5	4,589	309	78	297	5,686	305	14,333
Town of Hartsville	2,087	211	0	4,924	235	59	226	2,794	44	10,580
Town of Hornby	4,879	545	5	8,943	658	166	633	1,933	713	18,475
City of Hornell	26,285	16,580	1,637	50,554	3,302	833	3,178	154	4,620	107,144
Town of Hornellsville	12,106	9,949	5,485	27,278	1,601	404	1,541	5,545	2,546	66,454
Town of Howard	4,330	698	19	8,498	566	143	545	11,315	206	26,320
Town of Jasper	3,111	1,513	10	5,850	549	139	529	10,949	245	22,893
Town of Lindley	5,568	1,945	125	10,478	758	191	730	2,326	572	22,693
Town of Prattsburgh	6,025	1,607	165	11,272	804	203	0	5,995	923	26,994
Town of Pulteney	5,480	540	4	10,072	495	125	477	5,564	1,071	23,828
Town of Rathbone	2,981	1,167	8	5,662	434	110	418	3,947	177	14,903
Town of Thurston	3,974	1,452	14	8,129	521	131	501	5,327	328	20,377
Town of Troupsburg	3,220	1,447	3	5,937	498	126	479	14,026	414	26,150
Town of Tuscarora	5,142	1,777	24	8,520	568	143	547	4,953	465	22,139
Town of Urbana	8,818	3,784	2,291	14,961	903	228	870	3,213	1,073	36,141
Town of Wayland	12,407	5,132	5,375	26,145	1,582	399	1,523	11,185	1,786	65,534
Town of Wayne	4,448	531	29	6,539	401	101	386	3,076	345	15,858
Town of West Union	1,017	439	6	1,840	120	30	116	5,483	15,086	24,138
Town of Wheeler	3,468	1,178	0	6,332	486	123	468	6,855	199	19,107

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Woodhull	5,524	2,270	56	10,114	663	167	638	7,744	563	27,739
Allocated Total	324,849	159,762	245,619	612,108	38,169	9,631	35,969	192,276	84,587	1,702,970
<i>Village emissions, included in town/city totals</i>										
Village of Addison	7,108	2,953	8	11,146	680	172	654	0	1,087	23,809
Village of Arkport	2,353	1,343	2,248	5,505	325	82	313	0	535	12,706
Village of Avoca	2,870	1,200	141	4,986	365	92	351	0	366	10,371
Village of Bath	15,920	113,708	0	38,769	2,231	563	2,148	0	9,578	182,917
Village of Canisteo	6,815	2,235	20	12,813	875	221	843	0	953	24,775
Village of Cohocton	2,879	877	331	5,990	323	82	311	0	338	11,130
Village of Hammondsport	2,822	1,486	3	4,149	255	64	245	0	406	9,430
Village of North Hornell	2,366	4,101	0	5,200	300	76	289	0	600	12,930
Village of Painted Post	6,418	4,042	116,079	12,429	698	176	671	0	16,349	156,864
Village of Riverside	2,083	1,335	395	3,128	192	48	184	0	374	7,739
Village of Savona	3,103	1,213	0	5,701	319	80	307	0	409	11,133
Village of South Corning	4,557	2,452	2	7,269	441	111	425	0	739	15,997
Village of Wayland	5,705	1,722	2,352	11,321	719	181	692	0	968	23,662

Table 32 – Tioga County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Barton	27,532	8,533	4,174	51,503	2,777	862	3,288	5,396	2,656	106,721
Town of Berkshire	4,055	1,005	90	7,120	443	137	524	6,061	165	19,602
Town of Candor	18,082	5,054	661	30,740	1,663	516	1,969	10,913	1,146	70,744
Town of Newark Valley	11,361	4,132	0	21,645	1,237	384	1,465	8,659	525	49,407
Town of Nichols	7,804	4,700	34	13,376	792	246	937	5,246	502	33,635

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Owego	64,196	39,341	27,065	116,994	6,233	1,934	7,380	11,191	9,406	283,741
Town of Richford	3,397	1,002	7	6,626	367	114	435	2,694	138	14,781
Town of Spencer	10,875	3,567	0	19,742	988	307	1,170	3,871	715	41,236
Town of Tioga	14,653	4,079	1,754	28,301	1,527	474	1,808	6,494	994	60,085
Allocated Total	161,956	71,413	33,785	296,049	16,027	4,974	18,977	60,526	16,246	679,952
<i>Village emissions, included in town/city totals</i>										
<i>Village of Candor</i>	<i>3,300</i>	<i>1,797</i>	<i>0</i>	<i>4,243</i>	<i>267</i>	<i>83</i>	<i>316</i>	<i>0</i>	<i>436</i>	<i>10,441</i>
<i>Village of Newark Valley</i>	<i>3,423</i>	<i>1,956</i>	<i>0</i>	<i>6,134</i>	<i>313</i>	<i>97</i>	<i>370</i>	<i>0</i>	<i>200</i>	<i>12,492</i>
<i>Village of Nichols</i>	<i>1,491</i>	<i>1,670</i>	<i>34</i>	<i>2,653</i>	<i>161</i>	<i>50</i>	<i>190</i>	<i>0</i>	<i>143</i>	<i>6,391</i>
<i>Village of Owego</i>	<i>12,621</i>	<i>11,642</i>	<i>576</i>	<i>19,767</i>	<i>1,221</i>	<i>379</i>	<i>1,446</i>	<i>0</i>	<i>2,525</i>	<i>50,178</i>
<i>Village of Spencer</i>	<i>3,071</i>	<i>1,956</i>	<i>0</i>	<i>4,914</i>	<i>238</i>	<i>74</i>	<i>282</i>	<i>0</i>	<i>365</i>	<i>10,898</i>
<i>Village of Waverly</i>	<i>8,879</i>	<i>53,400</i>	<i>1,393</i>	<i>26,144</i>	<i>1,393</i>	<i>432</i>	<i>1,650</i>	<i>0</i>	<i>4,217</i>	<i>97,508</i>

Table 33 – Tompkins County, Emissions by Municipality (MTCO₂e)

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Caroline	9,285	2,016	26	12,212	829	319	1,218	5,999	677	32,582
Town of Danby	11,666	1,598	415	15,437	841	324	1,236	4,390	604	36,510
Town of Dryden	43,215	26,093	2,620	78,669	3,647	1,404	5,358	16,399	5,431	182,836
Town of Enfield	10,499	1,823	0	11,527	887	342	1,304	6,968	321	33,671
Town of Groton	15,105	4,106	1,013	22,949	1,503	579	2,209	14,128	1,273	62,864
City of Ithaca	44,797	80,687	5,570	41,270	7,582	2,920	11,141	0	13,325	207,292
Town of Ithaca	38,407	75,147	3,888	50,135	5,035	1,939	7,398	3,673	11,575	197,197
Town of Lansing	34,512	34,099	33,316	32,236	2,787	1,073	4,095	15,327	8,324	165,769
Town of Newfield	14,274	3,370	248	26,821	1,308	504	1,922	5,508	992	54,948

Municipality	Stationary Energy			Mobile Energy	Solid Waste	Wastewater Treatment	Industrial Processes	Agriculture	Energy Supply	All Sectors
	Residential	Commercial	Industrial							
Town of Ulysses	15,263	9,274	53	16,592	1,238	477	1,819	7,528	1,786	54,030
Allocated Total	237,023	238,212	47,150	307,849	25,657	9,881	37,698	79,919	44,310	1,027,698
<i>Village emissions, included in town/city totals</i>										
Village of Dryden	5,294	8,319	78	2,086	477	184	702	0	1,420	18,559
Village of Freeville	1,748	787	0	4,138	131	51	193	0	252	7,300
Village of Groton	5,682	2,677	1,013	3,244	597	230	877	0	773	15,093
Village of Cayuga Heights	9,542	4,614	4	10,399	942	363	1,384	0	1,432	28,680
Village of Lansing	9,377	24,684	26,894	21,944	891	343	1,310	0	5,736	91,180
Village of Trumansburg	5,847	21,183	0	577	454	175	667	0	2,120	31,021

APPENDIX E:

GOALS, INDICATORS, TARGETS

This section contains two related reports:

- Sustainability Targets Outline, Deliverable 3.3
- Sustainability Indicator Inventory, Deliverable 2.3



MEMORANDUM

To: Leslie Schill, Tompkins County

From: Harrison Rue, Marian Van Pelt, and Leslie Chinery, ICF International

Date: December 11, 2012

Re: Deliverable 3-3: Cleaner Greener Southern Tier Sustainability Target Outline

This memorandum provides 14 sustainability targets across the 9 topic areas for the Southern Tier that are based on public input and careful Planning Team consideration of the interaction between the Draft Implementation Strategy actions and completed deliverables: 2-1 Regional Sustainability Goals Report, 2-2 Sustainability Indicator Memo, and 2-3 Sustainability Indicator Inventory.

These targets establish a measurable means for evaluating progress toward greenhouse gas reductions in the region in both the short term (5 year) and long term (20 year) periods. The Southern Tier identified a comprehensive list of indicators to track energy consumption changes, greenhouse gas emissions, and improved sustainability across the region, therefore targets for greenhouse gas emissions reductions are defined for only a select group of priority indicators.

Targets have not been identified for a) indicators where there is no available region-wide baseline data and b) indicators incorporated to meet NYSERDA *Common Indicator Guidance* –allowable per instruction by NYSERDA. In addition, two goals that have been established as regional priorities that lack a correlating indicator (Goals 8 and 17) have been omitted from this deliverable, as they do not have a corresponding target.

Targets for each indicator were determined based on the following considerations:

- 1) Current baseline status of the indicator
- 2) Existing trends in the region that may affect the ability to meet these targets
- 3) Targets identified in similar or comparable regions
- 4) Potential to contribute to New York State's goal of reducing the state's greenhouse gas (GHG) emissions to 80% below 1990 level by 2050.
- 5) Ease of tracking progress towards the target on an annual basis.

For any questions, please contact Harrison Rue at harrison.rue@icfi.com or (919) 599-6501, or Marian Van Pelt at marian.vanpelt@icfi.com or (202) 862-1129.

Cleaner Greener Southern Tier Targets Outline

The following sections outline the baseline values for each indicator and recommended targets for select indicators, together with a discussion of how each target was developed. The format for each indicator section is to provide the indicator, baseline value, and long and short-term targets in a text box for reference, along with a narrative providing some related data and discussion.

Each of the 9 topic areas has at least one indicator and associated short and long-term targets have been developed for at least one indicator per topic area. Targets for indicators that lack available, region-wide baseline data have not been developed, as targets are dependent upon baseline conditions. For this reason, NYSEERDA-required indicators do not have associated targets (targets are not required for these indicators).

1. Energy and GHG Emissions

Goal 1: Reduce building energy use.

All energy consumption and GHG emissions estimates below are based on the final iteration of the 2010 Regional Tier II GHG/energy inventory. Note: As energy consumption data were collected as part of the Regional Tier II GHG Emissions Inventory, this level of information will not likely be available annually.

Indicator 1a

In 2010, the Southern Tier consumed a total of 58.6 trillion Btu of on-site building natural gas and electricity, which represents 74 percent of stationary combustion - the lion's share of energy used in buildings in the region. Targets for reducing on-site building energy consumption were based on existing initiatives and studies, including the Seattle City Light Conservation Potential Assessment, the U.S. EPA National Action Plan for Energy Efficiency, and the U.S. Department of Energy's Building Technology Program. These studies demonstrated potential savings from energy efficiency programs ranging from 10-50% over a period of 20 years and vary by sector. It is anticipated that due to the region's older building stock and the lack of a dedicated energy efficiency initiative serving the entire region (small scale plans and programs do currently operate within the region), there is potential to achieve gains in energy efficiency at the high end of the range. The targets vary by sector due to differences in energy consumption by end use among the sectors, and the relative opportunities for increasing efficiency. For example, some of the most cost-effective measures for increasing energy efficiency include lighting retrofits. Lighting is responsible for a larger portion of electricity consumption in the residential and commercial sectors than in the industrial sector, where motors are often the largest consumer. Therefore, cost-effective lighting retrofits will have a disproportionate impact in the residential and commercial sectors, leading to greater overall opportunities for reduction in these sectors.

Indicator 1a: On-site building natural gas and electricity consumption per end use (residential, commercial, and industrial)

Baseline (2010):

58.6 trillion Btu total on-site building natural gas and electricity consumption

- Residential – 25.1 trillion Btu
- Commercial – 18.8 trillion Btu
- Industrial – 14.7 trillion Btu

Targets:

- Long-Term (20 years): Reduce on-site building fuel and electricity consumption
 - 40% in residential & commercial sectors
 - 30% in the industrial sector
- Short-Term (5 years): Reduce on-site building fuel and electricity consumption
 - 10% in residential & commercial sectors
 - 7.5% in the industrial sector

presents baseline fuel consumption in the buildings, by sector, in 2010. Natural gas accounted for 60 percent of this consumption on an MMBtu basis, and electricity consumption accounted for 40 percent. The residential and

commercial sectors accounted for 43 percent and 32 percent of building energy consumption, respectively, while the industrial sector accounted for 25 percent of energy consumption. The Southern Tier Tier II GHG Emissions Inventory was the source for all indicators for Goal 1.

Table 1-1. Indicator 1a: On-Site Building Energy: Natural Gas and Electricity (2010)

Customer Class	Natural Gas (MMBtu)	Electricity (MMBtu)	Total (MMBtu)	Percent of Total
Residential	16,035,597	9,057,729	25,093,326	43%
Commercial	10,516,155	8,300,804	18,816,959	32%
Industrial	8,776,404	5,894,844	14,671,248	25%
Total	35,328,157	23,253,376	58,581,534	100%
% of Total	60%	40%	100%	

Targets for reducing on-site building energy consumption were based on existing initiatives and studies, including the Seattle City Light Conservation Potential Assessment, the U.S. EPA National Action Plan for Energy Efficiency, and the U.S. Department of Energy’s Building Technology Program. These studies demonstrated potential savings from energy efficiency programs ranging from 10-50% over a period of 20 years and vary by sector. It is anticipated that due to the region’s older building stock and the lack of a dedicated energy efficiency initiative serving the entire region (small scale plans and programs do currently operate within the region), there is potential to achieve gains in energy efficiency at the high end of the range. The targets vary by sector due to differences in energy consumption by end use among the sectors, and the relative opportunities for increasing efficiency. For example, some of the most cost-effective measures for increasing energy efficiency include lighting retrofits. Lighting is responsible for a larger portion of electricity consumption in the residential and commercial sectors than in the industrial sector, where motors are often the largest consumer. Therefore, cost-effective lighting retrofits will have a disproportionate impact in the residential and commercial sectors, leading to greater overall opportunities for reduction in these sectors.

Indicator 1b

Total number of building retrofits performed with NYSERDA funding is an informative metric for measuring progress toward reducing regional building energy consumption, but data are not currently available to estimate the baseline and targets for this indicator. This indicator will provide evidence of energy efficiency upgrades in the region, an important goal for the Southern Tier. By focusing on NYSERDA-funded projects, data collection can be centralized. While data are not currently collected, it would be beneficial to track this data in the future to measure progress towards Goal 1.

Indicator 1b: Total number of building retrofits performed with NYSERDA funding

Baseline (2010): 75 assisted ENERGY STAR® retrofits. Data are not publicly available across all NYSERDA energy efficiency programs.

Indicator 1c (Required NYSEERDA Indicator)

Energy consumed in the region includes electricity, natural gas, fuel oil, coal or coke, LPG, renewables, gasoline, diesel, and ethanol. Schuyler County has the highest per capita energy consumption in the Southern Tier but the lowest total energy consumption. While Tompkins County has the lowest per capita energy consumption, it has the second highest total consumption in the region, behind Broome County. Total county energy consumption is directly correlated to county population size.

Indicator 1c: Regional energy consumption per capita (MMBtu)

Baseline (2010):
Average regional energy consumption is 201.7 MMBtu per capita

Table 1-2. Regional Energy Consumption per Capita

County	Energy Consumption (MMBtu)	Per Capita Energy Consumption (MMBtu/person)	Percent of Total
Broome County	38,484,233	191.8	29%
Chemung County	19,130,549	215.4	14%
Chenango County	9,402,022	186.3	7%
Delaware County	10,528,056	219.4	8%
Schuyler County	7,095,171	386.8	5%
Steuben County	23,627,075	238.7	18%
Tioga County	9,444,826	184.7	7%
Tompkins County	15,005,958	147.7	11%
Southern Tier	132,717,890	201.7	100%

Indicator 1d (Common NYSEERDA Indicator)

According to the Tier II GHG Inventory, stationary energy consumption and electricity consumption ("fuel combustion") was the highest emitter of greenhouse gas emissions, followed closely by mobile energy consumption ("transportation"). These two sectors combined account for 83 percent of absolute and per capita GHG emissions in the Southern Tier. Table 1-3 shows absolute and per capita 2010 GHG emissions by emission source.

Indicator 1d: CO₂e emitted by emission source (fuel combustion, industrial production, agriculture, transportation), absolute and per capita

Baseline 2010 Absolute Emissions (MTCO₂e):

9.854 million MTCO₂e

- Stationary Energy Consumption and Electricity ("Fuel Combustion"): 4,579,024
- Industrial Processes ("Industrial Production"): 268,581
- Agriculture: 651,389
- Mobile Energy Consumption ("Transportation"): 3,601,352

Baseline 2010 Per Capita Emissions (MTCO₂e):

14.98 MTCO₂e per capita

- Stationary Energy Consumption ("Fuel Combustion"): 6.96
- Industrial Processes ("Industrial Production"): 0.41
- Agriculture: 0.99
- Mobile Energy Consumption ("Transportation"): 5.47

Table 1-3. 2010 Absolute and Per Capita GHG Emissions by Emission Source

Emission Source	Absolute Emissions (MTCO ₂ e)	Per Capita Emissions (MTCO ₂ e)	Percent of Total
Stationary Energy Consumption (Fuel Combustion)	4,579,024	6.96	46%
Industrial Processes (Industrial Production)	268,581	0.41	3%

Agriculture	651,389	0.99	7%
Mobile Energy Consumption (Transportation)	3,601,352	5.47	37%
Waste and Wastewater Treatment ¹	372,982	0.57	4%
Energy Supply ²	380,243	0.58	4%
Southern Tier	9,853,570	14.98	100%

Table 1-4 shows absolute and per capita GHG emissions by County. In 2010, Broome County had the largest absolute gross emissions (directly associated with highest energy consumption-highest population in region), while Schuyler County has the highest per capita gross emissions.

Table 1-4. Absolute and Per Capita GHG Emissions by County

County	Absolute (Gross) Emissions (MTCO ₂ E)	Per Capita (Gross) Emissions (MTCO ₂ E/person)	Percent of Total
Broome County	2,782,617	13.87	28%
Chemung County	1,330,924	14.98	14%
Chenango County	757,618	15.01	8%
Delaware County	768,432	16.02	8%
Schuyler County	602,619	32.85	6%
Steuben County	1,794,328	18.13	18%
Tioga County	709,082	13.87	7%
Tompkins County	1,107,948	10.91	11%
Southern Tier	9,853,570	14.98	100%

Goal 2: Develop, produce, and deploy local renewable energy sources and advanced technologies across the Southern Tier.

Indicator 2

Capacity from NYSERDA-funded renewable energy installations is an informative metric for measuring progress towards increasing renewable energy resources in the region, but data are not currently available to estimate the baseline and targets for this indicator. This indicator was selected because these data are measurable, trackable, and specific to installations in the region. By contrast, other potential indicators such as clean power purchases or average regional GHG intensity for electrical generation could include resources outside of the region, resulting in difficulties in setting boundaries and accounting for inter-regional exchanges. By focusing on installations in the region, this indicator will directly relate to activities in the region.

Note that focusing on NYSERDA-subsidized installations will facilitate data collection but may miss trends driven by technologies not supported by NYSERDA. While data are not currently collected, it would be beneficial to track this data in the future to measure progress towards Goal 2.

Indicator 2: Capacity from NYSERDA-funded renewable energy installations.

Baseline (2010): Data exist but are not publicly available across all NYSERDA renewable energy programs.

¹ Please note that reported waste and wastewater treatment emissions include emissions from the decomposition of organic materials in waste and wastewater. While these were not included in the description of the required NYSERDA indicator, they were estimated in the Regional Tier II GHG Inventory.

² Emissions from energy systems will be included in the final GHG inventory results.

2. Transportation

Goal 3: Create a regional multimodal transportation system that offers real transportation choice, reduced costs and impacts, and improved health.

Indicator 3 (Required NYSEERDA Indicator)

The number of commuters and percentage by county is listed in Table 2-1 below. Tompkins County is a significant outlier for the region, and compared to other counties nationwide, due to strong historic downtown linked to walkable university core, focused redevelopment, investment in a combined countywide transit system, and well-coordinated transportation demand management, outreach, and education.

The total percentage of workers commuting via walking, biking, transit, and carpooling was calculated using the American Community Survey's 5 year estimates of "journey to work" data in each of the eight Southern Tier Counties (ACS Table B08301 – Journey to Work; 2006 – 2010 estimates). The data point used for the indicator is the proportion of commuters within each county who report carpooling, taking public transportation, biking, or walking.³

Indicator 3: Total percentage of workers commuting via walking, biking, transit, and carpooling.

Baseline (2010):
19% of commuters

Targets:

- Long Term (20 year): Increase non-SOV mode share to 28%
- Short Term (5 year): Increase non-SOV mode share to 21%

Table 2-1. Total number of commuters via walking, biking, transit, and carpooling

	Total number of commuters	Percentage of commuters using walking, biking, transit, and carpooling
Broome County	14,314	16%
Chemung County	5,166	14%
Chenango County	3,809	17%
Delaware County	4,277	20%
Schuyler County	1,262	15%
Steuben County	6,391	15%
Tioga County	3,100	13%
Tompkins County	17,802	36%
Southern Tier	56,121	19%

Targets for percentage of commuters walking, biking, taking transit, or carpooling were determined in two ways, which differ for Tompkins County versus the other seven counties:

- For Tompkins County, the County has established a specific mode shift goal to meet a 51% non-Single Occupant Vehicle (SOV) mode share⁴ for the County by 2020. This existing goal was adjusted for the 2013 to 2033 (20 year) time period and adjusted to exclude working from home, as per the indicator definition, resulting in a 61% mode shift target selected for Tompkins County. For the five year (2018) target for Tompkins County, a 45% mode shift was selected.

³ This baseline does not include those who "work from home" as this was not included in the indicator description. Five percent of commuters telecommute.

⁴ The Tompkins County goal established in the Tompkins County 2020 Energy Strategy 2010 is 61%, but this includes 10% for working from home, which is excluded from the indicator definition and thus excluded from the target adjustment.

- For the other seven counties in the Southern Tier, the five-year target is equal to a 5% increase in non-SOV mode share, and for the 20-year target a 20% increase was selected. Given the demonstrated success of increasing walking, biking, carpooling, and transit use in Tompkins County – in similar terrain, climate, and a mix of urban and rural residents – these targets were determined to be feasible, especially in the cities (for walking, biking, and transit) and rural areas (for carpooling).
- These separate county targets were then averaged to calculate the regional targets.

Goal 4: Reduce fossil fuel consumption and GHG emissions from transportation by reducing vehicle miles traveled (VMT), increasing efficiency, improving system operations, and transitioning to less carbon intensive fuels and power sources.

Indicator 4a

Estimated Annual Gasoline Sales for 2010 was calculated as the sum of the fuel sales in 2010 for the eight counties.

Table 2-2 presents fuel sales by county from the Energy Patterns and Trends—New York State Energy Profiles Report, Appendix C.

Table 2-2. Estimated Annual Gasoline Sales by County (Thousands of Gallons)

County	Annual Gasoline Sales (Thousands of Gallons)	Percent of Total
Broome	105,479	34%
Chemung	35,463	11%
Chenango	22,620	7%
Delaware	24,069	8%
Schuyler	9,046	3%
Steuben	55,990	18%
Tioga	22,804	7%
Tompkins	34,621	11%
Southern Tier	310,092	100%

Indicator 4a: Estimated annual gasoline sales, aggregated by county.

Baseline (2010):
310 million gallons

Targets:

- Long Term (20 year): Decrease regional gas sales by 40%
- Short Term (5 year): Decrease regional gas sales by 2.5%

Targets for the reduction in fuel sale target reductions were considered based on a reasonable reduction in fuels sales, based on an analysis of counties in NY with comparable populations. By reviewing other counties statewide, it was determined that there was not a wide variability in what comparable counties' sales, and thus it was assumed that there was some incremental opportunity available, but that a larger reduction would be less likely. The long term reduction is expected to be greater due to the combined influence of expected national and state policies on fuel efficiency standards and emissions, innovation in technology and alternative fuels, and the long term effect of public and private investments.

Indicator 4b (Required NYSERDA Indicator)

Baseline data for Indicator 4b were obtained as part of the Regional Tier II GHG Emissions Inventory, and are modeled by NYSDOT for 2009 (2010 data not available). Table 2-3 presents Annual VMT and per capita VMT for each of the counties in the Southern Tier developed with this state-based data. Regional VMT data, which is more accurate, was not available for the 8-county Southern Tier, as the three MPOs that serve the region do not have jurisdiction in 3 of the 8 rural counties, and only cover parts of others. The VMT data from NYSDOT presented below is an estimate that provides an overall picture of the region's travel.

Indicator 4b: Vehicle miles traveled per capita

Baseline (2009):
10,497.7 VMT per capita.

Table 2-3. Vehicle Miles Traveled per Capita

County	Yearly VMT (miles/year)	Per Capita VMT (miles/year)	Percent of Total
Broome	2,145,960,148	10,698	12%
Chemung	835,542,612	9,406	11%
Chenango	510,604,829	10,116	12%
Delaware	587,612,953	12,247	14%
Schuyler	216,463,973	11,801	14%
Steuben	1,247,917,755	12,607	15%
Tioga	619,994,357	12,127	14%
Tompkins	742,413,444	7,310	8%
Southern Tier	6,906,510,071	10,498	100%

3. Land Use and Livable Communities

Goal 5: Strengthen and revitalize existing cities and villages.

Indicator 5a

Currently, 38 percent of the region's population lives in places designated as cities and villages in the Southern Tier, as defined by the US Census Bureau.

Targets for increasing the proportion of the population living in cities, villages, and hamlets are based on the assumption that during the next five years, as the implementation of this sustainability plan commences and a variety of transportation, housing, and community revitalization projects begin to impact livability in the region, it would be reasonable for the Southern Tier to aim for a relatively modest increase of 2 percent. Over the next 20 years, an increase of 7 percent of the region's population living in cities and villages correlates with policies relating to downtown employment, revitalization in historic core areas, regional multimodal transportation network improvements, and other transformative changes projected for downtowns and main streets, based on current redevelopment plans that should attract residents to live in cities and villages.

These targets are consistent with and build upon national population trends. Between 2000 and 2010, absent consistent and widespread national efforts to channel population into particular areas, the proportion of the US population living in urban areas increased by over 12 percent, which was higher than the national population increase of 9.7 percent. U.S. residents are increasingly locating to already-developed areas, and this trend is likely to be furthered in the presence of supportive development policies, revitalization, and employment growth.

Data from the US Census Bureau were evaluated to assess the baseline for Indicator 5a.

Indicator 5a: Proportion of Southern Tier residents who live in existing cities and villages.

Baseline (2010): 38% of Southern Tier residents live in existing cities and villages

Targets:

- Long Term (20 year): 45% (7% increase over 20 years)
- Short Term (5 year): 40% (2% increase over 5 years)

Indicator 5b (Required NYSERDA Indicator)

Per capita land consumption from developed land was estimated by using data provided by the Multi-Resolution Land Characteristics (MRLC) Consortium's National Land Cover database and transposed by ArcGIS to provide numerical data points.

Table 3-1 presents per capita land consumption of developed land areas. Broome and Chemung Counties have the highest per capita land consumption, whereas Tompkins County has the lowest.

Indicator 5b: Land-Use Patterns – per capita land consumption

Baseline (2010): 0.10 acres per capita

Table 3-1. Per Capita Land Consumption of Developed Land Areas

County	Developed Land Areas (Acres)	Per Capita Land Consumption (Acres/person)
Broome	22,017	0.11
Chemung	9,865	0.11
Chenango	4,004	0.08
Delaware	4,994	0.10
Schuyler	1,473	0.08
Steuben	10,079	0.10
Tioga	4,583	0.09
Tompkins	6,579	0.06
Southern Tier	63,593	0.10

Goal 6: Support development of housing that is energy and location efficient and offers choices to reflect changing demographics.

Indicator 6

As shown in

Table 3-2, there are significantly more affordable renter-occupied units in the region, which is typical of housing markets in most regions, since renting is easier and less costly than buying a home. Ensuring that there is ample low-moderate income housing in the region’s cities and villages is an important step to making sure that all residents, including seniors, have the opportunity to live in energy- and location-efficient housing that is close to existing jobs and services.

Indicator 6: Percentage of housing units located within cities and villages that are affordable to low-moderate income households.

Baseline (2010):
37% of the housing units in cities and villages in the region are affordable to low-moderate income households.

Targets:

- Long Term (20 year): 42%
- Short Term (5 year): 38%

Table 3-2. Low-Moderate Income Household Data

Housing type	Number of units in cities and villages affordable to low-moderate income households	Total units in cities and villages	Percentage of units affordable to low-moderate income households
Owner-occupied	12,014	66,673	18%
Renter-occupied	33,990	57,504	59%
Total	46,004	124,177	37%

Based on 2011 data for the eight Southern Tier counties, 42 percent of the region’s households are currently low-moderate income households. This proportion of the population is likely to hold constant or increase due to the aging of the region’s population and the continued need for a regional workforce.

Targets developed for this indicator propose increasing housing affordability across both owner-occupied and renter-occupied units. For this reason, the target recommended for a 20-year housing development is that 42 percent of the units in cities and villages be affordable to low-moderate income households. In recognition of the fact that new housing development can be slow to occur, especially in light of the current slowdown in the housing market, the proposed 5-year target of increasing the share of housing units in cities and villages that are affordable to low-moderate income households by an absolute 1 percent represents a modest and achievable step toward reaching the long-term target.

Data from the U.S. Department of Housing and Urban Development’s (HUD) Community Planning and Development Maps (CPD Maps) Tool⁵ was used to calculate this baseline. HUD defines a low-moderate income household as a household earning 80 percent or less of the HUD area median family income (HAMFI). HAMFI is similar to traditional measures of area median income, but is adjusted to reflect differences in household size.

Table 3-2 presents low-moderate income household data; the percentage of units affordable to these households was aggregated across both renter- and owner-occupied housing.

⁵ <http://www.hud.gov/offices/cpd/systems/census/ny/lowmod/sumfy11.xls>

4. Economic Development

Goal 7: Create and retain more good paying jobs by building on the Southern Tier's regional strengths, including advanced energy and transportation technologies, globally-competitive industry, and workforce development and technology transfer partnerships with educational institutions.

Indicator 7a (Common NYSERDA Indicator)

The Southern Tier average weekly wage of \$777/week, is considerably less (15 percent lower) than the national average of \$899/week.

Many factors contribute to average wage rates, most of which are not easily controlled by public policy. Wages are based on the decisions of private companies, the competitiveness of the regional labor market and broader aspects of cost of living. As the Southern Tier strengthens its economy, it should aim to create an economic climate that fosters sustainable, well-paying jobs.

The short-term target would represent a milestone on the path to achieving the long-term goal of wage parity with the nation. To achieve this, a short-term target would be to increase average regional wages to 90 percent of the national wage. The long-term (20 year) target for the region would be to have average weekly wages that are 100 percent of the national average. The region seems capable of reaching this goal, as exemplified by the fact that one of the counties, Steuben, already has an average weekly wage that is on-par with the national average. The fact that this wage is already supported in the region also indicates that one of the critical factors may be occupation mix, and not only broader factors such as regional labor market competitiveness and cost of living, which are harder to change. Also, in the last decade (2000-2011), average wages in the region grew 31%, so achieving 19%, with supportive policies, over the next 20 years seems achievable.

Indicator 7a: Average wages in region over time, by county.

Baseline (2010): \$777/week, annual regional average

Targets:

Long Term (20 year): 100 percent of national average

Short Term (5 year): 90 percent of national average

Table 4-1: Annual Weekly Wage in Dollars by County

County	Annual Weekly Wage in dollars (2010)
Broome	\$716
Chemung	\$751
Chenango	\$702
Delaware	\$690
Schuyler	\$625
Steuben	\$939
Tioga	\$875
Tompkins	\$828
Southern Tier (average weighted by county employment)	\$777

The baseline average weekly wage in dollars for the region was estimated based on the quarterly census of employment and wages (QCEW) as provided by the Bureau of Labor Statistics for 2010.

Indicator 7b (Required NYSEERDA Indicator)

The Housing + Transportation Affordability Index, also known as the H+T Index, factors in a typical household's primary expenditure – housing and its second largest expenditure – transportation. The index examines the neighborhood level and is available for metropolitan areas only. It is noted that this indicator might be a good or better fit for the Livable Communities and Land Use topic area, though it is required by NYSEERDA for the Economic Development topic area.

Table 4-2 presents the 2010 baseline for Indicator 7b. **Note that baseline data are not available for three of the region's counties (Chenango, Delaware, and Schuyler).** Of the counties for which data are available, Tompkins County has the highest H&T index, and Broome County has the lowest.

Table 4-2. Transportation / Housing Affordability Index

County	Transportation/Housing Affordability Index (2010)
Broome	50.99
Chemung	55.11
Chenango	N/A
Delaware	N/A
Schuyler	N/A
Steuben	56.46
Tioga	56.03
Tompkins	56.88
Southern Tier (average)	55.09

Indicator 7b: Economic Development - Housing + Transportation Index: Transportation/Housing affordability

Baseline (2010): 55.09 (for 5 of the region's 8 Counties)

Goal 9: Support farming and related businesses to reinvigorate the rural economy, enhance residents' incomes and standards of living, and promote local food and agriculture.

Indicator 9

Steuben County accounted for the vast majority of farm marketing in the region – over \$100M in cash receipts, followed by Chenango County with approximately \$49M; the values ranged from \$13M for Chemung County to \$109M for Steuben County. Data were estimated from the USDA's National Agriculture Statistics Service for 2009 (the latest year with available data), presented in Table 4-3, below.⁶

Indicator 9: Cash receipts from farm marketings

Baseline (2010): \$338 million in 2009 from cash receipts

Targets:
 Long Term (20 year): \$497 million (2009 dollars)
 Short Term (5 year): \$417 million (2009 dollars)

⁶ http://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Annual_Statistical_Bulletin/2011/2011%20page90%20-%20Cash%20Receipts%20County%20Estimates.pdf

Table 4-3: Cash Receipts from Farm Marketings by County

County	Cash Receipts from All Products (2009)
Broome	\$22,968,000
Chemung	\$12,788,000
Chenango	\$48,890,000
Delaware	\$41,500,000
Schuyler	\$27,830,000
Steuben	\$108,803,000
Tioga	\$27,465,000
Tompkins	\$47,799,000
Southern Tier	\$338,043,000

The region’s farm cash receipts have seen significant fluctuation over the past 10 years. During the early part of the decade (2001-2005), farm receipts in the region grew 9 percent; however, between 2005 and 2009 they declined by 12 percent. The most recent two years of data (2008-2009) show an even more dramatic decline of 25 percent. Since 2009, there has been significant development in existing and new markets, such as dairy (yogurt and cheese) and wine. The region continues to capitalize on the existing local market through resurgence in farmers markets, and is continuing to explore new opportunities in value-added goods.

In the interest of setting realistic yet optimistic targets for growth, the 10-year low was compared to the 10-year high, and found that at its height, the regional farm receipts were 47% higher than at their low. This differential represents our estimate for long-term achievable growth. With policy support, coupled with the current successes in new markets, the market should be able to grow an additional 47% over the next 20 years. The short-term target (5 years) anticipates half of this growth (23.5%) based on anticipated growth in the agriculture sector over the short term in the Southern Tier.

5. Working Lands and Open Space

Goal 10: Promote best management of fields, forests, and farmland to keep working lands in production, protect natural resources, and increase carbon sequestration.

Indicator 10

This indicator measures the increase in the acreage of Southern Tier working lands—farms and forests—participating in programs that measure a commitment to accepted farmland and forest best management practices. This indicator is the aggregation of acres enrolled in several programs that collectively show progress towards improvement in accepted best management practices.

Over 12,000 farms of all types and sizes statewide are involved in the Agricultural Environmental Management (AEM) Program. In New York State, participation in AEM is a required first step in gaining access to funding from a variety of state and federal programs including USDA's Natural Resources Conservation Service (NRCS). Farmers work with local AEM resource professionals to develop comprehensive farm plans using a tiered process; Tier 4 status, with an implemented conservation plan, is recommended for tracking this indicator.

Calculation of well-managed farmland is likely to be best accomplished by the County Soil and Water Conservation Districts (SWCDs) by tabulating total acreage and number of farms participating in the County's AEM program. NYS Department of Agriculture and Markets does not track this data on in a readily retrievable, centralized database.

Indicators for forested lands include two certification programs administered by the Forest Stewardship Council (FSC) and the American Tree Farm System. FSC accredited, independent, "third-party" certification bodies or "certifiers" certify forests. They assess forest management using the FSC principles, criteria, and standards; each certifier uses their own evaluative process. The American Tree Farm System offers certification to landowners who are committed to good forest management. ATFS certification is the certification of land management practices to a standard of sustainability. The current certified acreage in the National Tree Farm database is 68,181 acres.

All state forests in the Southern Tier region are FSC certified, with a total of 171,813 acres. Information on private forestlands that are certified can be found on the FSC and/or ATFS web sites where all certified forests are listed.⁷ In Tompkins County, there are 983 acres of privately-owned forests certified under the FSC program with 21,364 in NYSDEC ownership.⁸

These targets are based on an initial protection and certification estimate of 5,000 acres per year. Targets are set as absolute acre additions to these programs as opposed to a percent increase to account for potentially

Indicator 10: Acres of agricultural land enrolled in Agricultural Environmental Management Program (AEM) and Acres of Certified, Managed Forestland

Baseline (2010):

240,000 acres minimum, representing known certified forestland (largely state lands) in region. Complete data not available for forests and no data publicly available for AEM programs across state units at present.

Targets:

Long Term (20 year): 100,000 added acres enrolled in these programs.

Short Term (5 year): 25,000 added acres enrolled in these programs.

⁷ According to Justin Perry of NYSDEC.

⁸ According to Tompkins County GIS specialist Sharon Heller.

missing data in the baseline. The selected target allows for progress toward increased commitment to accepted farmland and forest best management practices, to help provide GHG sequestration and other environmental benefits at a reasonable cost.

Goal 11: Preserve and connect natural resources, open spaces and access to waterways, to protect regional environment, ecology, habitat and scenic areas, and support outdoor recreation.

Indicator 11

A successful regional conservation strategy includes both expanding and creating buffers for existing protected forests and natural areas and creating linear corridors that connect and enhance access to these protected areas. Collectively, this indicator aggregates the total acres protected under the following programs/agencies:

- Acreage of land that is owned by agencies or permanently protected under conservation easements by New York State agencies – the Department of Environmental Conservation or Office of Parks, Recreation and Historic Preservation.
- Acreage of forested land owned or protected under conservation easement or owned by the Finger Lakes Land Trust (FLLT).

Under the ownership of NYS Department of Environmental Conservation along with numerous other public, non-profit, and privately protected lands, the current baseline is 246,326 acres.

To calculate protected lands data is pulled from the NYS GIS Clearinghouse for Protected Lands; County-specific land protection data where known (Tompkins County); and Finger Lakes Land Trust for FLLT private holdings and easements. Future tracking should include: acreage from other state, municipal and county parks, Nature Conservancy and other nature center lands can be collected from the NYS GIS Clearinghouse, that are currently not housed in a comprehensive manner at any one agency. Once this data set of protected lands is created, annual data updates would be needed between the FLLT and Southern Tier Regional agencies.

Targets are based on the acquisition of 1,500 acres annually in the region, which are proposed as realistic regionally by the leading private/non-profit land protection organization in the Southern Tier, the Finger Lakes Land Trust.

Indicator 11: Acres protected through NYS DEC and other public, non-profit and private protected lands.

Baseline (2010):

246,326 acres (DEC Lands).

Complete data on other public, non-profit, and private protected lands not available.

Targets:

Long Term (20 year): 30,000 added acres protected in these programs.

Short Term (5 year): 7,500 added acres protected in these programs.

6. Climate Change and Adaptation

Goal 12: Identify and plan for the economic, environmental and social impacts of climate change.

Indicator 12 (Common NYSERDA Indicator)

The baseline was determined by the extent to which climate change is addressed in the most recent Hazard Mitigation Plans (HMPs) for counties in the Southern Tier (see Table 6-1, following page). These plans assess and determine mitigation actions to minimize the impacts of several climate-related natural hazards. In order to be eligible for federal emergency funding, every county is required to submit an update every 5 years. By considering the impact of climate change on the existing threats, the counties will provide initial guidance for adaptation planning.

This indicator was designed with three implementation tiers:

Tier One: HMP mentions climate change.

Tier Two: HMP discusses climate change impacts and specific vulnerabilities.

Tier Three: HMP includes a climate change vulnerability assessment and suggests specific adaptation strategies to reduce climate-related vulnerabilities.

It is not essential for a county's HMP to progress through the tiers sequentially. For example, Schuyler County did not mention climate change in the 2008 HMP. However, in the 2013 update Schuyler County could include a climate change vulnerability assessment and suggest specific adaptation strategies to reduce climate-related vulnerabilities, skipping Tier One and jumping straight to Tier Three.

The short and long term targets were developed based on the 2010 baseline and the requisite effort to include climate change in HMP Updates. The effort for each of the various tiers is outlined below:

Tier One: All counties in the region should be able to achieve this with a minimal level of effort, during the next HMP Update. The requirement is to mention climate change in the HMP Update.

Tier Two: The target for the second tier is slightly more graduated. It is feasible that half of the counties will achieve this level of climate change assessment within the next five years and all of the counties can reach this level of discussion within twenty years. This tier requires more technical expertise and scientific information than

Indicator 12: The degree to which climate change and adaptation is discussed within the required Hazard Mitigation Plans (and 5-year updates).

Baseline (2010):

- Tier One: 4 of 8 (50%) of HMPs mention climate change
- Tier Two: 1 of 8 (12.5%) of HMPs discuss climate change impacts and specific vulnerabilities
- Tier Three: 0 of 8 (0%) of HMPs include a climate change vulnerability assessment and suggest adaptation strategies to reduce climate-related vulnerabilities

Targets:

Inclusion of climate risks in HMPs and associated strategies to reduce vulnerability to these risks.

Long Term (20 year):

- Tier One: 8 of 8 (100%) of HMPs mention climate change
- Tier Two: 8 of 8 (100%) of HMPs discuss climate change impacts and specific vulnerabilities
- Tier Three: 6 of 8 (75%) of HMPs include a climate change vulnerability assessment and suggest adaptation strategies to reduce climate-related vulnerabilities

Short Term (5 year):

- Tier One: 8 of 8 (100%) of HMPs mention climate change
- Tier Two: 4 of 8 (50%) of HMPs discuss impacts and specific vulnerabilities
- Tier Three: 1 of 8 (12.5%) of HMPs include a climate change vulnerability assessment and suggest adaptation strategies to reduce climate-related vulnerabilities

the first tier. However, through collaboration and sharing best management practices, this tier is within reach for all counties today.

Tier Three: The target for the third tier is low in the short term because it requires significantly more technical expertise. However, within twenty years (or four update cycles), it is reasonable to expect that most, if not all, counties in the region would have the ability and will benefit from a solid understanding of how climate change will impact the region.

Table 6-1. Climate Change as Assessed by HMPs by County

County (Year of most recent HMP)	Degree to which climate change was addressed in the most recent Hazards Mitigation Plan Update (HMP)		
	Tier One: Mentions climate change	Tier Two: Discusses impacts and specific vulnerabilities	Tier Three: Includes a climate change vulnerability assessment and suggests specific adaptation strategies
Broome (2010)	Yes	No	No
Chemung (2012 – draft)	No	No	No
Chenango (2008)	Yes	No	No
Delaware (2006)	No	No	No
Schuyler (2008)	No	No	No
Steuben (2009)	Yes	No	No
Tioga (2012 – draft)	Yes	Yes	No
Tompkins (2006)	No	No	No
2010 Baseline (percentage)	4 of 8 (50%)	1 of 8 (12.5%)	0 of 8 (0%)
Short Term (5-year) Target	8 of 8 (100%)	4 of 8 (50%)	1 of 8 (12.5%)
Long Term (20-year) Target	8 of 8 (100%)	8 of 8 (100%)	6 of 8 (75%)

Goal 13. Minimize flood losses by preserving and enhancing floodplain and watershed functions, and by limiting development in flood-prone areas.

Indicator 13

The Community Rating System (CRS) is a voluntary program for National Flood Insurance Program (NFIP)-participating communities with the goals of reducing flood losses, facilitating accurate insurance rating, and promoting the awareness of flood insurance. CRS participation offers flood insurance premium discounts for policy holders in communities that go beyond the minimum floodplain management requirements and develop extra measures to provide protection from flooding. The CRS program credits 18 floodplain management activities within four categories: public information, mapping and regulations, flood damage reduction, and flood preparedness.⁹

⁹ See the CRS Coordinators Manual 2007 <http://www.fema.gov/library/viewRecord.do?id=2434>

Currently, thirteen New York Southern Tier municipalities participate in the CRS program. A total of 189 communities in the Southern Tier Region participate in the National Flood Program.¹⁰ Roughly 7 percent of communities that are eligible are participating in the CRS program.

Targets were established based on current eligibility and the feasibility of adoption based on the number of NFIP policies in a municipality. All communities that have NFIP policy holders are eligible to participate in CRS; however, the documentation to participate in CRS can be overly burdensome and costly for communities with few NFIP policy holders. Based on the cost of implementation, municipalities with more than 100 policies have an increased incentive to participate in CRS. Consequently, the target for such municipalities is set to increase to 30 percent in the first year (this accounts for the fact that some such municipalities already participate in CRS) and 100 percent within twenty years. Also, several municipalities that have 50 to 100 NFIP policies already participate in CRS. Since the per policy cost of participation is higher, the targets for this group of municipalities is lower with 15 percent of municipalities with 50 to 100 NFIP policies participating within 5 years and 50 percent participating within twenty years.

Targets are set as percents as the number of NFIP policies in a municipality will likely change over the five and twenty year period based on updated FEMA maps and the status of levee accreditation.

Indicator 13: Increased participation in the Community Rating System (CRS) program of the National Flood Insurance Program.

Baseline (2010):
13 municipalities participate in CRS

Targets:

- Long Term (20 year): Increase CRS participation to
 - 100% of municipalities with more than 100 NFIP policies and
 - 50% percent of those with 50-100 policies.
- Short Term (5 year): Increase CRS participation to
 - 30% of municipalities with more than 100 NFIP policies
 - 15% of municipalities with 50-100 NFIP policies.

The table below presents the list of municipalities currently participating in the CRS program and status.¹¹

Table 6-2: Municipalities in the New York's Southern Tier Participating in the FEMA-CRS Program

Community Name	CRS Entry Date	Current Effective Date	Current Class	% Discount for SFHA ¹	% Discount for Non-SFHA ²	Status
Ashland, Town of	10/1/91	05/1/08	9	5	5	Current
Big Flats, Town of	10/1/91	10/1/96	8	10	5	Current
Chemung, Town of	10/1/91	05/1/08	9	5	5	Current
Corning, City of	10/1/91	05/1/08	9	5	5	Current
Elmira, City of	10/1/91	05/1/97	8	10	5	Current
Elmira, Town of	10/1/91	10/1/91	9	5	5	Current
Erwin, Town of	10/1/91	05/1/08	8	10	5	Current
Horseheads, Town of	10/1/91	10/1/91	9	5	5	Current
Horseheads, Village of	10/1/91	10/1/91	9	5	5	Current
Johnson City, Village of	10/1/91	10/1/91	9	5	5	Current
Southport, Town of	10/1/91	10/1/91	9	5	5	Current
Union, Town of	10/1/91	10/1/08	8	10	5	Current
Wellsburg, Village of	10/1/91	10/1/91	9	5	5	Current

¹ For the purpose of determining CRS discounts, all AR and A99 zones are treated as non-SFHAs (Special Flood Hazard Areas).

¹⁰ <http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book>

¹¹ The baseline for Indicator 13 (number of communities participating in CRS) represents the baseline data available at the time of this memorandum. Additional information on the number of policies filed by CRS participants in the Southern Tier will be required to quantify targets.

7. Water Management

Goal 14: Efficiently manage and upgrade existing water, sewer, and other utility infrastructure to support compact development and reduce energy use.

Indicator 14

Energy use by water and sewer utilities per million gallons supplied or treated is an effective metric for measuring progress toward this goal, but data are not currently available to estimate the baseline and targets for this indicator in the Southern Tier. Benchmarking water and wastewater utilities through energy usage for a given volume of wastewater is an industry standard for measuring energy efficiency at a water utility. For example, ENERGY STAR Portfolio Manager uses energy per unit of plant flow (e.g., MGD) as a way to benchmark facilities energy usage.¹² Similarly, it has been used in a number of different reports as an indicator for energy usage.¹³ Trends in energy usage differ by type of system (e.g., aeration type, decontamination system), so systems must be benchmarked against past years' data and other similar treatment systems in the region.

Indicator 14: Energy use by water and sewer utilities per million gallons supplied or treated.

Baseline (2010):
Data not currently available.

Energy use by water and sewer utilities is a strong indicator for efficient management of infrastructure for both maintenance and upgrades (fixing leaks, replacing pumps, and more energy-efficient processes) since around 50% of water/waste utility budgets can be electricity costs. The metric can also be a minor indicator of efficiencies of infill vs. sprawl development (less energy used for infill vs. system expansion).

It is possible that NYSEDA could work with appropriate state agencies, likely NYS Department of Conservation, to require water and sewer utility operators to report their energy usage or to permit it to be gathered and reported by electric utilities. This would be very useful information for operators across the state and especially in small municipalities these facilities have significant cost, energy and GHG impacts.

Given the large number of systems to track (approximately 40 water supply plants that serve over 2,000 people per plant and approximately 50 wastewater treatment plants with a capacity of over 500,000 mgd per plant) this target could also be tracked through a voluntary reporting system by operators. This could be supported by an incentive based system.

¹² See <http://www.cce1.org/files/WEFTEC2008Session981130Manuscript.pdf> and <http://www.epa.gov/statelocalclimate/documents/pdf/waterwastewater.pdf>

¹³ EPA, 2008. Water and Energy: Leveraging Voluntary Programs to Save Both Water and Energy. Prepared by ICF International for U.S. Environmental Protection Agency. Available online at: <http://water.epa.gov/scitech/wastetech/upload/Final-Report-Mar-2008.pdf>
EPA, 2008. Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities. Available online at: http://www.epa.gov/region1/eco/energy/pdfs/guidebook_si_energymanagement.pdf

Goal 15: Improve and protect water quality and quantity.

Indicator 15 (Common NYSERDA Indicator)

The baseline for Indicator 15 was estimated from the NYSDEC 303d list of impaired waterbodies.¹⁴ There are 9 waterbodies in the Southern Tier on the NYSDEC 303d list of impaired waters (Table 7-1) as of 2010 (Cayuga Lake is listed three times for different pollutants). The three categories of impaired waterbodies are:

- 1 – Individual waterbodies with an impairment requiring development of a total maximum daily load (TMDL)
- 2 – Multiple segment/categorical impaired waterbodies, including acid rain, fish consumption, and shellfishing waters
- 3 – Waterbodies for which development of a TMDL may be deferred, including waters that require verification of impairment, cause/pollutant, and waters where implementation and evaluation of other restoration measures is pending.

Indicator 15: Total Number of Impaired Waters

Baseline (2010):

9 waterbodies

Targets:

Long Term (20 year): 66 percent reduction (3 waterbodies)

Short Term (5 year): 11 percent reduction (8 waterbodies)

Table 7-1. Southern Tier Impaired Waters on 303(d) List

Category	Waterbody Name	County	Type of Waterbody	Pollutant	Year
1	Smith Pond	Steuben	Lake	Phosphorus	2008
1	Whitney Point Lake/Reservoir	Broome	Lake	Phosphorus	2002
1	Owasco Inlet, Upper, and tribs	Tompkins	River	Phosphorus	2008
1	Cayuga Lake, Southern End	Tompkins	Lake	Pathogens	2008
1	<i>Cayuga Lake, Southern End</i>	<i>Tompkins</i>	<i>Lake</i>	<i>Phosphorus</i>	<i>2002</i>
1	<i>Cayuga Lake, Southern End</i>	<i>Tompkins</i>	<i>Lake</i>	<i>Silt/Sediment</i>	<i>2002</i>
1	Fly Pond, Deer Lake	Broome	Lake	Phosphorus	2010
2b	Koppers Pond	Chemung	Lake	PCBs	1998
2b	Trout Creek, Upper, and tribs	Delaware	River	PCBs	2002
3b	Canisteo River, Middle, and minor tribs	Steuben	River	Unknown Toxicity	2008
3b	Minor Tribs to Lower Susquehanna (north)	Broome	River	Phosphorus	2010

Targets for reducing the number of waterbodies listed on the NYSDEC 303(d) list were developed based on review of the types of pollutants and the degree to which actions in this plan can influence improvements in water quality. Phosphorus, silt, sediments, and pathogens are projected to be pollutants that can be reduced significantly through changes in development patterns, green infrastructure, stream buffer protection and agricultural best management practices, and improvements to wastewater infrastructure. This would mean six out of the nine water bodies could be substantially remediated.

¹⁴ <http://www.dec.ny.gov/chemical/31290.html>

8. Waste Management

Goal 16: Promote innovative waste reduction and management strategies.

Indicator 16a

Baseline per capita landfilling in the Southern Tier is estimated at approximately 4 pounds of solid waste per person per day. This value was calculated by averaging the per-capita landfilling rate across the three counties that had available data: Broome, Delaware, and Tioga. This number also aligns with statewide waste generation data from the New York DEC *Beyond Waste* report which cited a 2008 statewide landfilling rate of 4.1 pounds per person per day.¹⁵ The baseline for this indicator could be improved with additional county data, as 5 of the 8 counties are not represented in this figure.

The targets were established by consulting several sources, including: (i) the NYDEC's statewide goals, (ii) county-level waste goals within the Southern Tier, and (iii) waste targets established by other states. First, targets consistent with the goals established in the DEC *Beyond Waste* report were established. The DEC report establishes a short-term goal of a 0.5 pound reduction in per capita daily MSW by 2016, and a long-term 2 pound reduction goal by 2030. These short- and long-term goals roughly correspond to 12.5 and 50% reductions from baseline MSW landfilling in the Southern Tier.

Next, the targets were evaluated based on the levels of source reduction and increased recycling that would be required to meet them, and compared against similar targets established in the Southern Tier and other states. Our estimates indicate that a 1% reduction in MSW generation each year alongside MSW recycling rates of 25% by 2016 and 65% by 2030 would be sufficient to meet these targets.¹⁶ These rates seem aggressive, but reasonable given experience in other jurisdictions:

The proposed increase of 1% per year is on the lower end of rates that been achieved in Maryland (which range from 1 to 5%), but equates to a 20% reduction in MSW generation by 2030, which is a sizeable absolute reduction.¹⁷

The short-term recycling rate target is consistent with targets established in the Southern Tier and other states. The 2030 recycling target is more aggressive, but also longer-term than other targets. For example, Broome County has established a 45% recycling rate target in 2015, and Tompkins County has established a target for its waste diversion rate of 75% by 2015 in its *Energy Strategy*.

Indicator 16a: Per capita waste disposal rate (lbs. per capita/day)

Baseline (2010):
4 lbs. of solid waste/ capita/day

Targets:

Long Term (20 year): 50% reduction from baseline (2010) (i.e., 2 lbs. MSW/capita/day)

Short Term (5 year): 12.5% reduction from baseline (2010) (i.e., 3.5 lbs. MSW/capita/day)

¹⁵ New York Department of Environmental Conservation, 2010, "Beyond Waste: A Sustainable Materials Management Strategy for New York State", p. 27

¹⁶ We assumed that the current rate of recycling in the Southern Tier is 20% on average, equivalent to the average recycling rate in New York State in 2008. Recycling rates include composting of yard, food, and other organic waste.

¹⁷ Maryland Department of the Environment, "Maryland State and County Recycling", Available at: <http://www.mde.state.md.us/programs/Land/RecyclingandOperationsprogram/StateCountyandCityContactInfo/Pages/programs/landprograms/recycling/local/recyclingrates.aspx>

Indicator 16b (Common NYSERDA Indicator)

The total per capita landfilling in the Southern Tier is estimated at approximately 0.73 tons of solid waste per person per day. This value was calculated by compiling the 2010 waste generation rates across the three counties that had available data: Broome, Delaware, and Tioga. These waste generation totals were then divided by 2010 population estimates for the three counties to determine the per capita annual rate.

Indicator 16b: Total Solid waste generated per capita

Baseline (2010)
0.73 tons per capita

The baseline value for Indicator 16b is identical to the baseline for Indicator 16a due to available data; however, there is an important distinction between the two indicators—Indicator 16a covers waste *disposal* (landfilled waste), whereas Indicator 16b includes waste *generation*. The additional data to determine the baseline for Indicator 16b are not currently available, and therefore the baseline is incomplete for Indicator 16b.

9. Governance

Goal 18: Increase fiscal efficiency and effectiveness in local government through energy and waste reduction, coordinated infrastructure investments, and integrated planning for smart growth.

Indicator 18 (Common NYSERDA Indicator)

Currently, one county (Tompkins) and four municipalities have adopted the Climate Smart Communities pledge in the Southern Tier. Municipality Climate Smart Communities including the City of Binghamton in Broome County, and the City of Ithaca, Town of Caroline, and Town of Ithaca in Tompkins County. There are currently an unknown number of certified Climate Smart Communities.¹⁸

It seems plausible that getting majority significant number of the region's municipalities to sign the Climate Smart Communities pledge would be reasonable within a 5-year period (the pledge involves a public commitment to reduce GHGs and prepare for climate change). Many communities are already undertaking efforts to reduce GHGs and adapt to climate change in the Southern Tier, but not under the guise of Climate Smart Communities. As such, 100 percent participation among counties and 50 percent participation among municipalities should be attainable within a 20-year period.

Certification involves setting goals and actions (based on emissions assessments), decreasing energy demand in local government operations, encourage renewable energy for local government operations, and realize the benefits of recycling and other climate smart solid waste management practices. The existing five communities would likely be able to achieve some progress on these topics within five years, leading to certification. It also seems reasonable that activities under this project would help to contribute and facilitate progress for an additional five communities as well. Over the 20-year period, it also seems reasonable that communities would be able to be certified at a faster rate than the initial 5 year period, based on economies of scale.

Indicator 18: Number of Climate Smart Communities within region and number of certified Climate Smart Communities.

Baseline (2010):

5 Climate Smart Communities

Targets:

Long Term (20 year): 100 percent of counties and 50 percent of municipalities

Short Term (5 year): 25 percent of counties and 12.5 percent of municipalities

¹⁸ The aforementioned communities may be certified or in the process of certification but the list was unavailable from NYSDEC.



To: Leslie Schill, Tompkins County
From: Marian Van Pelt, Philip Groth, Harrison Rue, ICF International
Date: December 11, 2012
Re: Final Cleaner Greener Southern Tier Sustainability Indicator Inventory, Deliverable 2.3

The purpose of this memorandum is to transmit a revised version of Deliverable 2.3, the Cleaner Greener Southern Tier Sustainability Indicator Inventory.

This revision provides two updates:

- This revision adds additional context on data availability and baselines for new NYSERDA required indicators in each topic area, as required by the “New York State Cleaner Greener Communities Program Common Sustainability Indicators” guidance released on September 11, 2012. Note that ICF International and the Southern Tier Planning Team developed a set of indicators (delivered in the August 10, 2012 version of this inventory) that are appropriate for the region and reflect the region’s characteristics and sustainability goals. These additional indicators have been added per NYSERDA’s requirements, but in many cases the data is not available to fully reflect the largely rural region.
- Baseline values for each indicator have been updated in this version of the indicator inventory.
- This revision reorders the original order of the nine topic areas and numbering of the eighteen goals, which were revised in the draft implementation plan. These numbers will be aligned in the final implementation plan.
- This revision removes parts 2 and 3, which presented redundant information.

For any questions, please contact Marian Van Pelt at marian.vanpelt@icfi.com or (202) 862-1129 or Harrison Rue at harrison.rue@icfi.com or (919) 599-6501.

CLEANER GREENER SOUTHERN TIER

SUSTAINABILITY INDICATOR INVENTORY

This indicator inventory provides recommendations for the indicators that will be reported in the Cleaner Greener Southern Tier Regional Sustainability Plan (the Plan) to track progress in the region for each topic area of the Plan. At least one indicator has been identified for each of the nine topic areas for the Plan: Energy/GHG Emissions, Transportation, Economic Development, Livable Communities, Water, Waste, Working Lands/Open Space, Climate Change/Adaptation, and Governance.

Process used to identify indicators

To develop the indicator inventory, the Planning Team and ICF worked to first develop a suite of eighteen goals that represent stakeholders' goals for the region. These goals formed the basis for the indicators, such that all indicators developed for the Plan track progress toward goals.

Thus, the following criteria were used to identify the indicators for each goal within topic areas:

- Tracking sustainability goals for the Southern Tier region
- Utilizing indicators suggested by the NYSERDA *Sustainability Indicator Guidance Version 1* (“*Guidance*”)
- Data availability and reliability
- Frequency of data publication
- Simplicity of calculation

While tailored to the goals of this project, the indicator selection process generally follows the “SMART” indicator selection criteria:

- Specific
- Measurable
- Achievable
- Relevant
- Time-bound

Format for the indicator memo and inventory

The indicator inventory is guided by the *NYSERDA Sustainability Indicator Guidance Version 1* and *Version 2* (“*Guidance*”). This document presents a discussion of the selected indicators by goal, together with the methodology and data requirements for any new indicators proposed. For those indicators selected from the *Guidance*, the methodology is not repeated, but an assessment of the availability of the NYSERDA-recommended datasets is provided.

This revised version updates the order and numbering of the nine topic areas and eighteen goals, which were re-ordered in the implementation strategy.

Key considerations

It should be noted that data availability differs by county, and between MPO/urban areas and rural areas. Since there are multiple jurisdictions represented in the Southern Tier— including 3 separate MPOs, two separate regional planning and development boards, separate central cities and urban counties, and most of the region is very rural – there is no single regional agency charged with data collection and modeling for the region.

Data availability and simplicity of data collection are primary concerns for the Planning Team. To that end, several indicators require data to be provided by NYSERDA. It is essential that NYSERDA agree to provide the data (which only NYSERDA collects) to the region on a routine and consistent basis, in order to accurately report on these particular indicators. In addition, the Southern Tier partners will need to collect indicators that are readily published.

Indicators by Topic Area

This inventory provides a discussion of each goal, proposed indicator associated with the goal, rationale for goal selection, methodology (where indicator is new) and data sources. The goals are organized by topic area. In total, the Southern Tier Region is proposing 23 indicators to track progress toward 18 regional goals.

A range of potential indicators for each topic area was developed based on the NYSERDA *Sustainability Indicators Guidance* and proposed alternate indicators. Potential indicators were evaluated based on the availability of data needed to regularly calculate the indicator and the applicability of the indicator to measure real progress towards regional goals. The list of indicators presented here represents those indicators chosen to be most applicable and practical for each goal, as agreed upon by the Planning Team.

Energy/GHG Emissions

Goal 1: Reduce building energy use.

This includes energy efficient retrofits, energy conservation strategies, green building codes, and smart building technologies. Both this goal and the next would support new technologies, markets, and jobs.

Indicator 1a (Option #1):

On-site building natural gas and electricity consumption per end use (residential, commercial, and industrial).

Baseline (2010): 58.6 trillion Btu

-Residential – 25.1 trillion Btu

-Commercial – 18.8 trillion Btu

-Industrial – 14.7 trillion Btu

Two potential indicators are proposed for consideration for Goal 1. Option #1 is preferable if data are available; Option #2 can be used if required data are not available for Option #1.

The *Guidance* proposed a calculation for estimating building energy consumption based on the number of households in the region, per-household energy consumption factors, the number of employees in the region, and statewide commercial and industrial consumption. While such a calculation is relatively easy to develop and can provide a good snapshot of the region, the reliance on state and national consumption averages would make it difficult for the indicator to reflect changes in regional behavior over time.

Therefore, this modified indicator is proposed because it will track trends in energy consumption in the region within each sector over time. The GHG Inventory Protocol Working Group is currently collaborating with major natural gas and electricity utilities in the state to provide data for the regional GHG inventories. If the Working Group and NYSERDA can successfully acquire this data and encourage the large utilities to modify their reporting systems to allow regular reports of electricity and natural gas consumption, then all ten New York regions can use this data for regular updates to indicators. Electricity and natural gas represent the large majority of building energy use, and this indicator would be a highly responsive indicator. Other building fuels, by contrast, largely rely on apportionment from statewide consumption.

This indicator requires that NYSERDA provide annual data to the region. The data requirements for this indicator have been identified as likely accessible, though will require ongoing cooperation from utilities.

Calculation:

For each customer class (residential, commercial, industrial):

$$\text{On-site building natural gas and electricity consumption} = \text{Reported consumption of natural gas} + \text{Reported consumption of electricity}$$

Required data	Definition	Suggested dataset
Natural gas and electricity consumption by customer class	Total reported consumption of natural gas and electricity by customer class (residential, commercial, industrial).	NYSERDA and utilities. The feasibility of this option is pending the outcome of the Working Group's collaboration with the utilities.

Indicator 1b (Option #2):**Total number of building retrofits performed with NYSERDA funding.**

Baseline (2010): 75 assisted ENERGY STAR® retrofits. Data are not publicly available across all NYSERDA energy efficiency programs.

This indicator will provide evidence of energy efficiency upgrades in the region. By focusing on NYSERDA-funded projects, data collection can be centralized. This would not directly document reduction of energy use, so it is recommended that periodic inventories of energy be developed using the methods and data collection resources being developed by NYSERDA through this project. **This indicator requires that NYSERDA provide annual data to the region.**

Calculation:

No calculation required.

Required data	Definition	Suggested dataset
Energy efficiency building retrofits	Total number of building retrofits performed with NYSERDA funding, 2013 to current year.	NYSERDA.

Indicator 1c: (Required NYSERDA Indicator)**Regional energy consumption per capita (MMBtu)**

Baseline (2010): 201.7 MMBtu per capita

The NYSERDA Indicator Guidance released on September 11, 2012 requires reporting of this indicator. Energy consumption per capita is an indicator that encompasses all of the energy use within a region on a scale that is highly relatable. Understanding how much energy is consumed per capita can be very effective in illuminating the need to reduce overall energy consumption regardless of its source. To calculate the value for this indicator, the calculations for several other indicators are needed and should include all sources of energy consumption (fuel combustion, electricity, renewables, etc.).

Calculation:

Regional energy consumption per capita =

Σ (regional energy consumption) ÷ regional population

Σ (regional energy consumption) = Residential Energy Consumption + Commercial Energy Consumption + Industrial Energy Consumption + Transportation Energy Consumption

Required data	Definition	Suggested dataset
Residential Energy Consumption	Use of energy for residential purposes. Includes all sources (fuel combustion, electricity, renewables, etc.)	Regional Tier II Greenhouse Gas Inventory
Commercial Energy Consumption	Use of energy for commercial purposes. Includes all sources (fuel combustion, electricity, renewables, etc.)	Regional Tier II Greenhouse Gas Inventory
Industrial Energy Consumption	Use of energy for industrial purposes. Includes all sources (fuel combustion, electricity, renewables, etc.)	Regional Tier II Greenhouse Gas Inventory
Transportation Energy Consumption	Use of energy for transportation purposes. Includes all sources (fuel combustion, electricity, renewables, etc.)	Regional Tier II Greenhouse Gas Inventory

Indicator 1d: (Common NYSERDA Indicator)**CO₂e emitted by emission source (fuel combustion, industrial production, agriculture, transportation), absolute and per capita****Baseline (2010):****Absolute Emissions (MTCO₂E):**9.854 million MTCO₂e

Stationary Energy Consumption and Electricity (“Fuel Combustion”): 4,579,024

Industrial Processes (“Industrial Production”): 268,581

Agriculture: 651,389

Mobile Energy Consumption (“Transportation”): 3,601,352

Per Capita Emissions (MTCO₂E):14.98 MTCO₂e per capita

Stationary Energy Consumption and Electricity (“Fuel Combustion”): 6.96

Industrial Processes (“Industrial Production”): 0.41

Agriculture: 0.99

Mobile Energy Consumption (“Transportation”): 5.47

The NYSERDA Indicator Guidance released on September 11, 2012 requires that regions report a common indicator for each topic area. Indicator 1d fulfills that requirement for the GHG emissions topic area. This indicator provides an overview to emissions related to fuel combustion. Emission estimates are provided from the Regional Tier II GHG Inventory, and will not be available on an annual basis.

Calculation:

Calculation for total emissions done within Tier II GHG inventory

Emissions per capita = GHG emissions in CO₂e/population of region

Required data	Definition	Suggested dataset
Total GHG emissions by source	Total GHG emissions in region broken down by source	Regional Tier II GHG inventory
Population of Region	Total population of region	U.S. Census Bureau – Census – http://quickfacts.census.gov/qfd/states/36000.html

Goal 2: Develop, produce, and deploy local renewable energy sources and advanced technologies across the Southern Tier.

Local renewable energy sources include biomass, solar, wind, hydro, and geothermal. Advanced technologies include cogeneration, distributed heat and power districts, smart energy management, and energy distribution systems.

Indicator 2:

Capacity from NYSERDA-funded renewable energy installations.

Baseline (2010): Data exist but are not publicly available across all NYSERDA renewable energy programs.

This indicator was selected because these data are measurable and trackable. Data exist related directly to installations in the region, but data on NYSERDA-funded renewable energy installations are not publicly available. By contrast, other potential indicators such as clean power purchases or average regional GHG intensity for electrical generation could include resources outside of the region, resulting in difficulties in setting boundaries and accounting for inter-regional exchanges. By focusing on installations in the region, this indicator will directly relate to activities in the region. Note that focusing on NYSERDA-

subsidized installations will facilitate data collection, but may miss trends driven by technologies not supported by NYSERDA. **This indicator requires that NYSERDA provide annual data to the region.**

Calculation:

For NYSERDA-funded renewable energy installations,

Total Capacity =

On-site Biomass Capacity + On-site Solar Capacity + On-site Wind Capacity + On-site Hydro Capacity + On-site Geothermal Capacity + On-site Anaerobic Digestion Capacity

Required data	Definition	Suggested dataset
On-site renewable capacity supported by NYSERDA	Total capacity of all on-site generation from the use of renewable sources that were installed with financial support from NYSERDA, 2013 to current year.	NYSERDA.

Transportation

Goal 3: Create a regional multi-modal transportation system that offers real transportation choice, reduced costs and impacts, and improved health.

This includes enhanced urban, rural, and regional transit and rail; Complete Street networks, interconnected sidewalks, pedestrian paths and bike trails that connect neighborhoods and employment centers; and car share, carpool, park-and-ride, and telecommuting; all supported by compact mixed-use development.

Indicator 3: (Required NYSERDA Indicator)

Total percentage of workers commuting via walking, biking, transit, and carpooling.

Baseline (2010): 19% of commuters

This indicator was selected based on four general criteria: (1) availability of data at the county level, (2) relevance to the goal's fundamental purpose of expanded transportation mode choice and access, (3) relevance to the breadth of the goal (in which non-SOV mode share is related to costs and impacts as well as public health outcomes), and (4) recent guidance from the US HUD Office of Sustainable Housing and Communities on flagship sustainability indicators to reflect sustainability goals related to the Partnership for Sustainable Communities' livability principles (of which transportation choice is one goal). The NYSERDA Indicator Guidance released on September 11, 2012 requires reporting of this indicator.

Refer to the 3 pages that outline the step-by-step methodology and data sources in the HUD OSHC *Guidance on Performance Measurement and Flagship Sustainability Indicators* (pages 9-12). In summary: from the correct ACS dataset that covers all counties in the region, sum the number of workers commuting by carpool, public transportation, bicycling, and walking. Divide by the total number of workers

and multiply by 100 to calculate the percentage of workers commuting by carpool, public transportation, bicycle, and foot. This indicator and guidance were developed by ICF for HUD.

Calculation: For each mode,

$$\text{Percent of workers commuting by mode X} = \frac{\text{Number of workers traveling by mode X in region}}{\text{Total number of workers in region}} \times 100$$

See HUD OSHC Guidance on Performance Measurement and Flagship Sustainability Indicators, p9, for step-by-step instructions on how to calculate and access data sources:
<http://portal.hud.gov/hudportal/documents/huddoc?id=PerfMeasGuidJune2012.zip>

Required data	Definition	Suggested dataset
Total number of workers in region	Persons who are employed full or part time during a given payroll period. Temporary employees and those on paid-leave are included.	American Community Survey (ACS). Select Topics, then People, then Employment, the Commuting (Journey to Work), then appropriate Geography http://factfinder2.census.gov
Number of workers commuting by carpool, public transit, bike, walk	The number of employed persons that commute to work by carpool, public transportation, bike, or walking in the region/county	American Community Survey (ACS) Table B0830: Means of Transportation to Work. Universe: Workers 16 years and over 2008-2010 American Community Survey 3-Year Estimates

Goal 4: Reduce fossil fuel consumption and GHG emissions from transportation by reducing vehicle miles traveled (VMT), increasing efficiency, improving system operations, and transitioning to less carbon intensive fuels and power sources.

Indicator 4a:
Estimated annual gasoline sales, aggregated by county.
Baseline (2010): 310 million gallons

This includes hybrid and electric vehicles, fleet management, and new technologies; and systems operations strategies such as signals management, parking management, and coordinated real-time information technology.

Three potential indicators would show that investment in non-single occupancy vehicle (SOV) modes would be successful: VMT, fossil fuel consumption, and GHG emissions. A GHG

indicator was not selected because it is unavailable at the regional level from year to year. Outside of this project's inventory, it is assumed that a GHG inventory would not be collected/updated annually, thus making it an undesirable choice. VMT would be available through NYSDOT, but would require an annual request. Although the MPOs may have VMT for their regions, there is no source for rural/non MPO region VMT, separate from NYSDOT; this is a substantial portion of the eight-county region. It also does not speak to improved efficiencies in transportation technologies that may occur. Fossil fuel consumption could reasonably be captured through aggregated county-level estimated fuel sales data.

Calculation:
 Estimated annual gasoline sales in the region = Σ Estimated annual gasoline sales in each county.

Required data	Definition	Suggested dataset
Estimated annual gasoline sales by county	Annual gasoline sales in thousand gallons	NYSERDA Patterns and Trends: 1990-2010 Appendix C

Indicator 4b: (Required NYSERDA Indicator)

Vehicle miles traveled per capita

Baseline (2009): 10,497.7 VMT per capita

The NYSERDA Indicator Guidance released on September 11, 2012 requires reporting of this indicator. This indicator provides a view to automobile usage in a region. NYSDOT-modeled data from 2009 are available for all counties in the region. Regional VMT data, which is more accurate, was not available for the 8-county Southern Tier, as the three MPOs that serve the region do not have jurisdiction in 3 of the 8 rural counties, and only cover

parts of others.

Calculation:

(Vehicle miles traveled in MPO areas + Vehicle miles traveled in non-MPO areas) ÷ Total population of region

Required data	Definition	Suggested dataset
Vehicle miles traveled in MPO areas	Number of miles traveled in a personal vehicle for MPO areas within region	Metropolitan Planning Organizations
Vehicle miles traveled in non-MPO areas	Number of miles traveled in a personal vehicle for locations outside of MPO areas within the region	Get estimates from DOT website

Land Use and Livable Communities

Goal 5: Strengthen and revitalize existing cities and villages.

This includes plans, policies, codes, and infrastructure investments focused on restoring existing historic places, redeveloping village commercial districts with new walkable mixed use centers as transit targets, “place-making” to support social interactions, and maximizing the value of existing infrastructure.

Indicator 5a:

Proportion of Southern Tier residents who live in existing cities and villages.

Baseline (2010): 38%

The proportion of the population living within existing cities and incorporated villages – as compared to the total population in the surrounding areas – is a workable indicator of whether the local jurisdictions’ growth and reinvestment policies are working to focus development and redevelopment within the cities and villages. The data and calculations are more available and easier to calculate than more complicated indicators that would require

tracking actual development.

The increase in the proportion of Southern Tier residents who live in existing cities and villages will be calculated based on the formula explained in the box below. The baseline calculation of the indicator is based on 2010 Census population estimates, and we recommend using ACS 3-year estimates (Table B01003: Total Population) for subsequent updates to achieve the most accuracy. Rather than using all cities and villages to calculate this indicator, it would also be possible to use only villages and cities above a certain population threshold.

Calculation:

Proportion of population within existing cities and villages =

$$(City+Village_currentpopulations) / Region_currentpopulation$$

Required data	Definition	Suggested dataset
CVpopcurrent = current population in cities and villages	Sum of most recent ACS population estimates for all cities and villages in the Southern Tier	American Community Survey http://factfinder2.census.gov
Rpopcurrent = current year region-wide population	Sum of most recent ACS population estimates for all eight Southern Tier counties	American Community Survey

Indicator 5b: (Required NYSEDA Indicator)
Land-use Patterns – Per capita land consumption
Baseline (2010): 0.10

The NYSEDA Indicator Guidance released on September 11, 2012 requires reporting of this indicator. This indicator correlates to environmental consumption.

Calculation:
 Characterize land-use within region according to the MRLC’s National Land Cover Database. Compute the total amount of land that is developed. Divide this total regional area by the population of the region to compute the per capita land consumption.

Required data	Definition	Suggested dataset
Area of developed land within region	Total area of developed land within region	MRLC – Multi-Resolution Land Characteristics Consortium - National Land Cover Database - http://www.mrlc.gov/

Goal 6: Support development of workforce and senior housing that is energy and location efficient and offers choices to reflect changing demographics.

This includes workforce housing that is affordable for middle-income workers such as factory workers,

Indicator 6a:
Percentage of housing units located within cities and villages that are affordable to low-moderate income households.
Baseline (2010): 37%

teachers and police officers. Energy efficient housing is generally considered to be 50% more efficient than current building codes require, reducing household costs and GHGs. Location efficiency means siting new homes within current population/employment centers, such as cities and villages that provide access to transit and commercial businesses.

While low-moderate income households are not necessarily the same as workforce and senior households, there is a strong overlap between the two populations. This indicator was selected based on the fact that low-moderate housing is much easier to define than workforce and senior housing, and data is readily available for the region’s cities and villages. Furthermore, the definition used for low-moderate income housing in this indicator is the same definition used by HUD, which has funded many affordable housing projects within the Southern Tier, and this will make it easy to determine how future HUD-funded projects contribute to progress toward meeting this goal. Ensuring that there is ample low-moderate income housing in the region’s cities and villages is an important step to making sure that seniors and members of the workforce have the opportunity to live in energy- and location-efficient housing that is close to existing jobs and services. This indicator measures the extent to which such housing is available. Refer to **Error! Reference source not found.** for step-by-step instructions for obtaining data from CPD maps.

Calculation:

Percentage of units located in the region's cities and villages that are affordable to low-moderate income households =

$$\frac{[\sum \text{The number of owner-occupied housing units located within cities and villages that are affordable to households earning 80\% HudAnnualMedianFamilyIncome(HAMFI)} + \text{the number of rental units in cities and villages affordable to households earning 80\% HAMFI}]}{[\sum \text{Total number of total owner-occupied units in cities and villages} + \text{the total number of rental units in cities and villages}]}$$

[Σ Total number of total owner-occupied units in cities and villages + the total number of rental units in cities and villages]

Required data	Definition	Suggested dataset
Owner-occupied affordable housing units within cities and villages	The number of owner-occupied housing units located within cities and villages that are affordable to households earning 80% HAMFI	http://egis.hud.gov/cpdmaps/
Renter-occupied affordable housing units within cities and villages	The number of rental units in cities and villages affordable to households earning 80% HAMFI	http://egis.hud.gov/cpdmaps/
Owner-occupied housing units within cities and villages	The total number of total owner-occupied units in cities and villages	http://egis.hud.gov/cpdmaps/
Renter-occupied housing units within cities and villages	The total number of rental units in cities and villages	http://egis.hud.gov/cpdmaps/

Economic Development

Goal 7: Create and retain more good paying jobs by building on the Southern Tier's regional strengths, including advanced energy and transportation technologies, globally-competitive industry, and workforce development and technology transfer partnerships with educational institutions.

Indicator 7a:

Average wages in region over time, by county.

Baseline (2010): \$777/week, regional annual average

This includes working with existing and emerging industries, entrepreneurs and educators to accelerate business growth and employment across key sectors that support regional sustainability goals. It supports growth of both urban industry and rural businesses.

At the county level, this indicator will demonstrate if or how policy changes or programs affect one region or industry

disproportionately, in terms of wage. While census data is released quarterly, the average yearly wage can be used as an indicator because it will account for seasonal shifts. According to the BLS's Quarterly Census of Employment and Wages, "Average annual wages per employee for any given industry are

computed by dividing total annual wages by annual average employment. A further division by 52 yields average weekly wages per employee.”¹

Calculation:
Average Annual Weekly Wage, by county, adjusted to 2012 dollars

Required data	Definition	Suggested dataset
Average Annual Weekly Wages by County	Average weekly wages, by county	Quarterly Census of Employment and Wages (http://www.bls.gov/cew/) http://data.bls.gov/pdq/querytool.jsp?survey=en In the query window, select: <i>New York State – County X – Total, all industries – Total covered – Average Weekly Wage.</i>

Indicator 7b: (Required NYSERDA Indicator)

Economic Development - Housing + Transportation Index: Transportation / Housing affordability

Baseline (2010): 55.09

The NYSERDA Indicator Guidance released on September 11, 2012 requires reporting of this indicator. This indicator provides insight into the cost of living within the region. Information quantifying this indicator is not available for all counties in the Southern Tier, since the Index was designed for metropolitan areas. Data for Chenango, Delaware, and Schuyler Counties are not available.

Calculation:
None required.

Required Data	Definition	Suggested Dataset
H + T Index	Percentage of household income spent on housing and transportation	H+T Affordability Index – Center for Neighborhood Technology (http://htaindex.cnt.org/)

Goal 8: Support tourism industry development with coordinated marketing, preservation, and enhancement of historic, cultural, educational, and natural resources and events.

Indicator 8:
No indicator required.

This builds on the strengths of the region’s destinations and attractions – including historic downtowns and villages; parks, waterways, and natural resources; educational and civic institutions, and agriculture and other industries. It includes

¹ Quarterly Census of Employment and Wages, <http://www.bls.gov/cew/>.

coordination and marketing support for programs, events, and sites, as well as management, planning, and financial support for destinations and programs. While an important goal for the region, an indicator has not been identified for Goal 8 at this time.

Goal 9: Support farming and related businesses to reinvigorate the rural economy, enhance residents' incomes and standards of living, and promote local food and agriculture.

Indicator 9:
Cash receipts from farm marketings.
Baseline (2009): \$338,043,000

This includes coordinated policies, plans, marketing, and investments to increased production, sales, and consumption of local food; reduced energy/GHG related to food transportation; production and marketing; and increased jobs and green/agriculture tourism.

A growth in receipts would indicate strength in the agriculture economy.

Calculation:
 Total cash receipts = Σ Cash Receipts from All Products by County

Required data	Definition	Suggested dataset
Cash receipts	Cash receipts by county from farm marketings	USDA National Agricultural Statistics Service Annual Statistical Bulletin http://www.nass.usda.gov/Statistics_by_State/New_York/Publications/Annual_Statistical_Bulletin/2011/2011%20page90%20-%20Cash%20Receipts%20County%20Estimates.pdf

Working Lands/Open Space

Goal 10: Promote best management of fields, forests, and farmland to keep working lands in production, protect natural resources, and increase carbon sequestration.

This includes planning, education, financial, marketing, and management support for farming and forestry and other resource-based businesses. It also includes carbon sequestration, where landowners are paid for the natural systems on their property capturing and holding carbon from the atmosphere.

Indicator 10:
Acres of agricultural land enrolled in Agricultural Environmental Management Program (AEM) and Acres of Certified, Managed Forestland
Baseline (2010): 240,000 acres minimum, representing known certified forestland (largely state lands) in region. Complete data not available for forests and no data publicly available for AEM programs across state units at present.

Indicators were chosen to measure the increase in the acreage of Southern Tier working lands – farms and forests – participating in programs that measure a commitment to accepted farmland best management practices. New York State’s Agricultural Environmental Management (AEM) Program is a voluntary, incentive-based program that helps farmers make common-sense, cost-effective and science-based decisions to help meet business objectives while protecting and conserving the State’s natural resources. The AEM partnership of farmers, Soil and Water Conservation Districts (SWCDs), local, state and federal agencies, and the private sector share the goal of farming cleaner and greener into the future. New York’s AEM program is delivered locally by County SWCDs in cooperation with the State Department

of Agriculture and Markets. AEM is the vehicle by which environmental regulations have been effectively

implemented on larger livestock farms, using science-based Comprehensive Nutrient Management Plans to control runoff, conserve soil and recycle nutrients. In recent years, Districts have also expanded to help connect farmers with new opportunities including the production of renewable energy and reduction of greenhouse gas emissions.

Over 12,000 farms of all types and sizes statewide are involved in the AEM program. In New York State, participation in AEM is a required first step in gaining access to funding from a variety of state and federal programs including USDA’s Natural Resources Conservation Service (NRCS). Farmers work with local AEM resource professionals to develop comprehensive farm plans using a tiered process; Tier 4 status, with an implemented conservation plan, is recommended for tracking this indicator.

Calculation of well-managed farmland is likely to be best accomplished by the County SWCDs by tabulating total acreage and number of farms participating in the County’s AEM program. NYS Department of Ag and Market does not track this data on in a readily retrievable, centralized database.

Indicators for forested lands include two certification programs administered by the Forest Stewardship Council (FSC) and the American Tree Farm System. FSC accredited, independent, “third-party” certification bodies or “certifiers” certify forests. They assess forest management using the FSC principles, criteria, and standards; each certifier uses their own evaluative process. The American Tree Farm System offers certification to landowners who are committed to good forest management. ATFS certification is the certification of land management practices to a standard of sustainability. The current certified acreage in the National Tree Farm database is 68,181 acres.

All state forests in the Southern Tier region are FSC certified, with a total of 171,813 acres. Information on private forest lands that are certified can be found on the FSC and/or ATFS web sites where all certified forests are listed.² In Tompkins County, there are 983 acres of privately owned forests certified under the FSC program with 21,364 in NYSDEC ownership.³

<p>Calculation:</p> <p>Areas protected =</p> $\begin{aligned} & \Sigma \text{ Acres of agricultural land enrolled in NYS Soil \& Water Conservation Committee's Agricultural} \\ & \text{Environmental Management Program (AEM)} \\ & + \\ & \Sigma \text{ Acres of Certified, Managed Forestland (FSC Certification + American Tree Farm System)} \end{aligned}$
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Required data	Definition	Suggested dataset
Acres of agricultural land enrolled in NYS Soil & Water Conservation Committee’s Agricultural Environmental Management Program (AEM)	AEM is the vehicle by which environmental regulations have been effectively implemented on larger livestock farms. With the assistance of AEM Certified Planners, these farms have developed science-based Comprehensive Nutrient Management Plans to control runoff, conserve soil and recycle nutrients.	Tracked by Soil & Water Conservation Districts.
Acres of Certified, Managed Forestland (FSC)	Assesses forest management using the FSC principles, criteria, and standards, each certifier uses their own evaluative process. Certifiers evaluate both forest	http://www.fsc.org/certification.4.htm

² According to Justin Perry of NYSDEC.

³ According to Tompkins County GIS specialist Sharon Heller.

Certification)	management activities (forest certification) and tracking of forest products (chain-of-custody certification).	
Acres of Certified, Managed Forestland (American Tree Farm System)	Forest certification is the certification of land management practices to a standard of sustainability. A written certification is issued by an independent third-party that attests to the sustainable management of a working forest.	http://www.treefarmssystem.org/certification

Goal 11: Preserve and connect natural resources, open spaces and access to waterways, to protect regional environment, ecology, habitat and scenic areas, and support outdoor recreation.

This includes trails, parks, and opens spaces; resource conservation, green infrastructure, and stream buffers; and lake and river access. It also includes planning and education along with access to build public awareness and support.

Indicator 11:

Acres protected through NYS DEC and other public, non-profit and private protected lands.

Baseline (2010): 246,326 acres (DEC Lands). Complete data on other public, non-profit, and private protected lands not available.

A successful regional conservation strategy includes both expanding and creating buffers for existing protected forests and natural areas and creating linear corridors that connect and enhance access to these protected areas. This indicator is a good measure of such a strategy.

The steps to calculate protected lands include pulling data from the NYS GIS Clearinghouse for Protected Lands. Where local county data on protected lands is available, compare County data to Clearinghouse data (data availability from Tompkins County has been confirmed). Additional data availability for

protected natural areas needs to be verified from Southern Tier Central and Southern Tier East, and/or the seven counties, and checked against NYS GIS Clearinghouse data.

For private and non-profit lands, the best single source is data from the Finger Lakes Land Trust for FLLT preserves, conservation easements and other protected lands. In addition, acreage from other state, municipal and county parks, Nature Conservancy and other nature center lands will be collected from the NYS GIS Clearinghouse. The regional planning agencies do not have this data in their systems, and it is unlikely to have been recorded in County GIS systems, other than Tompkins County. Once this data set of protected lands is created, annual data updates will be required between the FLLT and Southern Tier Regional Planning Agencies.

The following table lists the proposed data sources for tallying acres of permanently protected forest and natural areas.

Calculation:

Acres protected =

Σ Acreage protected through state-owned forested lands and conservation easements, state parks, conservation easements and other public, non-profit, and private protected lands.

Required data	Definition	Suggested dataset
Forested land purchased or protected by NYSDEC or OPRHP	Acreage of land that is owned agencies or permanently protected under conservation easements by New York state agencies – Department of Environmental Conservation or Office of Parks, Recreation and Historic	NYS GIS Clearinghouse home http://gis.ny.gov/index.cfm NYS DEC http://gis.ny.gov/gisdata/inventories/member.cfm?organizationID=529

	Preservation.	NYS Parks http://gis.ny.gov/gisdata/inventories/member.cfm?organizationID=588 Note: DEC is working on a 'Conserved Lands' dataset that should combine many sources of information into one more easily accessible data source. No timeline for completion was available.
Forested land protected under conservation easement or owned by FLLT.	Acreage of land owned or protected by Finger Lakes Land Trust	Finger Lakes Land Trust www.fllt.org
Forested land owned or protected by NYC Department of Environmental Protection	Acreage of land owned or permanently protected by the NYC DEP to protect the water supply for New York City. This applies mainly to Delaware County in the ST region.	NYC Department of Environmental Protection Terry Spies, Section Chief, GIS 845 340 7809 (office), tspies@dep.nyc.gov
Farmland protected by PDR	Acreage of land protected in Purchase of Development Rights Programs (PDR)	TBD; Counties CUGIR (Cornell University Geospatial Information Repository) http://cugir.mannlib.cornell.edu/index.jsp

Protected Farms are not recommended as an indicator for this goal. There is no centralized data collection site for farmlands that have been protected under the State's and other Purchase of Development Rights (PDR) programs. This data could be collected from individual counties in the Southern Tier, but it appears that tracking this program annually may be too time consuming for regional staff to undertake on an annual basis. Tompkins County does track PDR acreage, with 2,241 acres of farmland now protected under the PDR program.

Climate Change and Adaptation

Goal 12: Identify and plan for the economic, environmental and social impacts of climate change.

This includes mitigation for anticipated increases in frequency and severity associated with flood, heat, drought and severe storm events, as well as invasive species management. Adaptation strategies are also incorporated into other goals.

Indicator 12 (Common NYSERDA Indicator):

The degree to which climate change and adaptation is discussed within the required Hazards Mitigation Plans (and 5-year updates).

Baseline (2010):

- Tier One: 4 of 8 (50%) of HMPs mention climate change
- Tier Two: 1 of 8 (12.5%) of HMPs discuss impacts and identify potential vulnerabilities
- Tier Three: 0 of 8 (0%) of HMPs include a climate change vulnerability assessment and suggest adaptation vulnerabilities

This indicator was selected based on five general criteria: (1) availability of data, (2) relevance to the goal, (3) relevance to the breadth of the goal (not only one section, such as flooding or electricity service), (4) feasibility of implementation (this is both tangible for the region and a rating scale could make it progressive so that incremental steps could be credited), (5) direct correlation to adaptation (that the task is done specifically to address climate uncertainty - as opposed to land conserved vs. developed that may be a result of other decisions regardless of climate change considerations). The NYSERDA Indicator Guidance released on September 11, 2012 requires that regions report a common indicator for each topic area. Indicator 12

fulfills that requirement for the Climate Change and Adaptation topic area. .

The methodology will include the following steps: (1) Collect a set of each FEMA-required Hazard Mitigation Plans (HMP) in the Southern Tier region. (2) "Score" each HMP for each of the ratings: includes climate change discussion, assesses local climate change impacts and vulnerabilities, and conducts a vulnerability assessment and suggests adaptation options. (3) Calculate a percentage of HMPs that meet each of the three thresholds or scores.

Calculation:

$\% \text{ of Hazard Mitigation Plans (HMPs) that mention climate change} = \frac{\# \text{ of HMPs that mention climate change}}{\text{total \# of completed HMPs in the region}}$

$\% \text{ of HMPs that discuss local impacts and specific vulnerabilities} = \frac{\# \text{ of HMPs that discuss local impacts and specific vulnerabilities}}{\text{total \# of completed HMPs in the region}}$

$\% \text{ of HMPs that include a climate change vulnerability assessment and suggest specific adaptation options} = \frac{\# \text{ of HMPs that include a climate change vulnerability assessment and suggest specific adaptation options}}{\text{total \# of completed HMPs in the region}}$

Required data	Definition	Suggested dataset
Copies of the Hazards Mitigation Plans for all required counties and municipalities in the Southern Tier region.	The percentage of Hazards Mitigation Plans in which (1) climate change is discussed, (2) local climate change impacts and vulnerabilities are assessed, and (3) adaption actions are identified. In most cases, the HMP scoring should be inclusive – HMPs that are in the third category would also be counted in the first and second.	Each municipality and county that submits a FEMA-required Hazards Mitigation Plan that should be readily available during each update.

Goal 13: Minimize flood losses by preserving and enhancing floodplain and watershed functions, and by limiting development in flood-prone areas.

Includes plans, policies, education, and investment to preserve and restore critical lands.

Indicator 13:

Number of municipalities participating in the Community Rating System (CRS) program of the National Flood Insurance Program.

Baseline (2010): 13 municipalities

This indicator was selected because it tracks progress on implementing proactive activities to reduce damage caused by flooding. Municipalities participate in the National Flood Insurance Program (NFIP) to make flood insurance available in their jurisdictions. Participation involves enforcement of minimum standards for managing development in mapped floodplains. The proposed indicators enable tracking of efforts to go beyond the minimum requirements and improve local resilience to

flooding.

To participate in the CRS, a community can choose to undertake some or all of the public information and floodplain management activities described in the CRS Coordinator’s Manual. Communities must recertify that they are continuing to perform activities being credited by the CRS on an annual basis. To evaluate this indicator, the *initial* number of communities (i.e., 13) participating in the Community Rating System in the Southern Tier will be subtracted from the *current* number of Southern Tier communities participating in the program.

Calculation:

Participation in CRS =

Difference between the starting number of Southern Tier communities participating in the Community Rating System (13) and the **current** number of communities participating in the Community Rating System.

Required data	Definition	Suggested dataset
Alternate: Community Rating System Participation and Score	The NFIP’s Community Rating System (CRS) recognizes community efforts beyond those minimum standards by reducing flood insurance premiums for the community’s property owners. The CRS is similar to — but separate from — the private insurance industry’s programs that grade communities on the effectiveness of their fire suppression and building code enforcement.	Community Rating System: http://www.fema.gov/business/nfip/crs.shtml CRS Credit for Outreach Projects Document: http://training.fema.gov/EMIWeb/CRS/2007%20Model%20330%20Outreach.pdf

Water

Goal 14: Efficiently manage and upgrade existing water, sewer, and other utility infrastructure to support compact development and reduce energy use.

Includes plant processes, equipment, and distribution system upgrades focused on increased efficiency and supporting existing development areas rather than continued expansion of service areas.

Indicator 14:

Energy use by water and sewer utilities per million gallons supplied or treated.

Baseline (2010): Data not currently available.

Benchmarking water and wastewater utilities through energy usage for a given volume of wastewater is an industry standard for measuring energy efficiency at a water utility. For example, ENERGY STAR Portfolio Manager uses energy per unit of plant flow (e.g., MGD) as a way to benchmark facilities energy usage.⁴ Similarly, it has been used in a number of different reports as an indicator for energy usage.⁵ Trends in energy usage differ by type of system (e.g., aeration type, decontamination system), so systems must be benchmarked against past years’ data and other

similar treatment systems in the region.

⁴ See <http://www.cee1.org/files/WEFTEC2008Session981130Manuscript.pdf> and <http://www.epa.gov/statelocalclimate/documents/pdf/waterwastewater.pdf>

⁵ EPA, 2008. Water and Energy: Leveraging Voluntary Programs to Save Both Water and Energy. Prepared by ICF International for U.S. Environmental Protection Agency. Available online at:

<http://water.epa.gov/scitech/wastetech/upload/Final-Report-Mar-2008.pdf>

EPA, 2008. Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities. Available online at: http://www.epa.gov/region1/eco/energy/pdfs/guidebook_si_energymanagement.pdf

Energy use by water and sewer utilities is a strong indicator for efficient management of infrastructure for both maintenance and upgrades (fixing leaks, replacing pumps, and more energy-efficient processes) since around 50% of water/waste utility budgets can be electricity costs. The metric can also be a minor indicator of efficiencies of infill vs. sprawl development (less energy used for infill vs. system expansion).

To estimate this indicator for the indicator inventory, data would be compiled from the water supply and wastewater treatment facilities. The approach for estimating the indicator would require data on water supply, treated wastewater, and energy usage are published; for those water utilities for which data are lacking, contact water utility for data and calculating the energy usage per mgd water supplied or treated.

While tracking energy use at all of the region's water and wastewater systems would be a worthwhile effort, it appears to not be practical until regional system operators voluntarily self-report their energy use, or a system is set in place by NYSERDA to require utility companies to aggregate and report the data. Since there are approximately 40 water supply plants that serve over 2,000 people per plant and approximately 50 wastewater treatment plants with a capacity of over 500,000 mgd per plant, it appears to be an unrealistic effort to gather energy data by calling each plant individually. **Once reporting of such data is required, this indicator will be regularly tracked.**

Calculation:

Energy use (MMBtu) per quantity of water treated =

$$\Sigma \text{ Energy use by water and sewer utilities} / \Sigma \text{ million gallons supplied or treated}$$

Required data	Definition	Suggested dataset
Public water and wastewater treatment facilities in Southern Tier	Public water and wastewater treatment facilities in Southern Tier	Descriptive Data of Municipal Wastewater Treatment Plants in New York State (http://www.dec.ny.gov/docs/water_pdf/descdata2004.pdf)
Energy usage by local WWTPs	Energy used by local wastewater treatment plants (WWTPs)	WWTPs; Future centralized data collection
Water supply treated (if available)	The amount of water supply treated by WWTPs	Descriptive Data of Municipal Wastewater Treatment Plants in New York State (http://www.dec.ny.gov/docs/water_pdf/descdata2004.pdf)
Alternate: energy usage at Southern Tier utilities	Energy usage at Southern Tier water or wastewater utilities	Local/regional utilities; Future centralized data collection
National estimates on energy usage at water facilities	National estimates of the energy usage of water facilities	CEC, 2005. California's Water-Energy Relationship. Prepared in response to the 2005 Integrated Energy Policy Report Proceeding (04-IEPR-01E). (http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF).

Goal 15: Improve and protect water quality and quantity.

Indicator 15: (Common NYSERDA Indicator)
Total Number of Impaired Waters
Baseline (2010): 9

The NYSERDA Indicator Guidance released on September 11, 2012 requires that regions report a common indicator for each topic area. Indicator 15 fulfills that requirement for the Water topic area.. This indicator quantifies those waters that do not support appropriate uses and that may require development of a Total Maximum Daily Load (TMDL).

Calculation:

Σ bodies of water in region listed in part 1 and 2 of NYDEC Section 303(d)

Required Data	Definition	Suggested Dataset
Total number of impaired waters	Part 1 - Individual Waterbodies with Impairment Requiring a TMDL Part 2 - Multiple Segment/Categorical Impaired Waterbodies - Includes Acid Rain Waters, Fish Consumption Waters, and Shellfishing Waters	NYSDEC http://www.dec.ny.gov/chemical/31290.html (updated every 2 years)

Waste

Goal 16: Promote innovative waste reduction and management strategies.

This includes recycling, composting, reuse, and repurchasing. It also includes waste-to-energy opportunities across agriculture, industry, wastewater management, and waste recovery systems that can reorient end use products into energy production.

Indicator 16a:
Per capita waste disposal rate (lbs. per capita/day).
Baseline (2010): 4 lbs. of solid waste/ capita/day

This indicator provides a simple metric to calculate. The indicator is related to waste prevention and efforts to increase municipal solid waste (MSW) recycling, composting, and other forms of waste diversion. It can be applied to track progress over time. A benefit to this indicator is that it is inclusive of both waste prevention and recycling or waste diversion opportunities.

Landfilling per capita is the second most common waste indicator encountered in local and regional sustainability plans reviewed during the development of this indicator,⁶ whereas none of the plans reviewed use total tonnage of solid waste landfilled as a metric. New York

⁶ Plans reviewed include: New York State DEC's *Beyond Waste Report*, <http://www.dec.ny.gov/chemical/41831.html>; *Binghamton Energy Action Plan*; county-level *Local Solid Waste Management Plans (LSWMPs)*, New York State's *1987 Solid Waste Management Plan*; Biocycle's *The State of Garbage in America 2010* report, www.seas.columbia.edu/earth/wtert/sofos/SOG2010.pdf; Oregon Department of Environmental Quality's *Reduce Per Capita Waste Generation by 2% Target*, <http://www.deq.state.or.us/lq/sw/twopercent/reducepercapita.htm>; and *California Recycles: Reducing Per Capita Disposal Rates*, <http://www.calrecycle.ca.gov/lqcentral/basics/PerCapitaDsp.htm>.

State’s regional plan used per capita waste disposal rates as a target, and it is also used in state-level plans in other States, as well as BioCycle’s third-party landfilling report, “The State of Garbage in America”, which compares New York’s per capita waste generation rate to other states. Additionally, the New York State “Beyond Waste” report relies heavily on this metric to set waste reduction goals for the entire state. As populations change, the sum of landfilled waste changes in proportion, making Total Tonnage Landfilled a less desirable indicator. For example, Tennessee generates seven times as much waste as South Dakota, yet they have the same per capita generation rate—the difference in population between the two states distorts the metric.

Sufficient information to calculate this indicator may be directly available from county solid waste managers. For example, Tioga County tracks the total amount of waste generated in the county that is sent for landfilling for both MSW and construction and demolition debris. The County also tracks the destination of the landfilled waste.⁷ This information could be supplemented by county-level annual landfill reports, which provide information on the amount of solid waste landfilled and the service area of the waste. This will allow identification of the amount of solid waste landfilled by each county, including exports to other New York state landfills. Waste exports outside of the State, however, will not be tracked in these reports, and it will be more effort- and time-intensive to extract this information than via direct contact with county waste managers. Consequently, follow-up with county solid waste managers is recommended to determine total waste sent for landfilling or, at minimum, to which landfills waste is sent.

To calculate this indicator, first calculate the annual amount of solid waste sent for landfilling for each county by summing the amount of solid waste generated by the county that is landfilled in the county and the amount of solid waste sent to landfills outside of the county. This first step can be skipped if the total amount of solid waste sent for landfilling (including waste exports) is directly available from the county. Calculate total waste landfilled per capita by dividing total amount of solid waste sent for landfilling by the region’s population in the same year.

Calculation:

Lbs. per capita/day =

$$\frac{(\text{Annual short tons of solid waste generated and landfilled in county} + \text{Annual short tons of solid waste generated in the county that is exported for landfilling})}{\text{Population} / 365}$$

Required data	Definition	Suggested dataset
Amount of solid waste generated that is landfilled annually	The amount of solid waste generated by the county that is sent to landfills—including waste sent outside of the county for landfilling, in short tons	Contact with county solid waste managers (recommended). Annual Landfill Reports for each county, available by DEC region at: ftp://ftp.dec.state.ny.us/dshm/SWMF/Landfill/Landfill%20Annual%20Reports/
Regional population	The annual population in the region	U.S. Census Bureau: http://quickfacts.census.gov/qfd/states/36000.html

Indicator 16b: (Common NYSERDA Indicator)

Total Solid waste generated per capita

Baseline (2010): 0.73 tons per

⁷ According to Ellen Pratt, Solid Waste Manager at Tioga County, this information is available for 2011, but historical records in Tioga County were lost in a recent flood.

capita (waste disposal rate)

The NYSERDA Indicator Guidance released on September 11, 2012 requires that regions report a common indicator for each topic area. Indicator 1d fulfills that requirement for the Waste topic area. This indicator provides an overall view of the region's

contribution to waste, including municipal solid waste (MSW), industrial, construction and demolition, and bio-solid waste. The baseline value for Indicator 16b is identical to the baseline for Indicator 16a due to available data; however, there is an important distinction between the two indicators—Indicator 16a covers waste *disposal* (landfilled waste), whereas Indicator 16b includes waste *generation*. The additional data to determine the baseline for Indicator 16b are not currently available, and therefore the baseline is incomplete for Indicator 16b.

Calculation:

Total regional solid waste generated per year =

Σ (MSW + Industrial + C&D + Bio Solids + Hazardous) per municipality per year

Solid waste generated per capita = total regional solid waste generated per year / regional population

Required Data	Definition	Suggested Dataset
Total MSW generated per year	Total municipal solid waste in tons per year for the entire region.	For year 1: use the Regional Tier II Greenhouse Gas Inventory OR DEC Landfill reports (currently available on the wiggio site under http://sustainableny.wiggiosites.com/folder/solid and sewage waste/2010_DEC_Landfill_and_WTE_data.xlsx
Total Industrial Solid Waste generated per year	Total industrial solid waste in tons per year for the entire region.	On an ongoing basis use NYS Department of Environmental Conservation datasets http://www.dec.ny.gov/chemical/65541.html
Total C&D Solid Waste generated per year	Total construction and demolition (C&D) waste in tons per year for the entire region	Solid Waste planning units
Total bio-solids waste generated per year	Total bio-solids waste in tons per year for the entire region.	
Total Hazardous waste generated per year	Total hazardous waste in tons per year for the entire region.	
Population of region	Total population of region	U.S. Census Bureau – Census – http://quickfacts.census.gov/qfd/states/36000.html (updated every 10 years)

Governance

Goal 17: Increase regional collaboration among transportation planning agencies and transit providers; municipal operators (such as airports and municipal water/wastewater facilities); and colleges and universities.

Indicator 17:

No indicator required.

This includes creating long-term partnerships to tackle critical energy/GHG issues, such as transportation efficiencies, water/wastewater best practices and new technology integration into system operations, and cross university collaboration to increase energy innovation and improve workforce competitiveness. While an important goal for the region, an indicator has not been identified for Goal 17 at this time.

Goal 18: Increase fiscal efficiency and effectiveness in local government through energy and waste reduction, coordinated infrastructure investments, and integrated planning for smart growth.

Indicator 18 (Common NYSERDA Indicator):

Number of Climate Smart Communities within region and number of certified Climate Smart Communities.

Baseline (2010): 5 Climate Smart Communities

This includes: green fleet initiatives, green building policies, waste reduction programs, energy conservation, renewables deployment, comprehensive planning for targeted compact development, and energy codes. Governance strategies are also incorporated into other goals.

The indicator addresses greening public investment decisions from a comprehensive perspective across multiple areas related to climate activities. An annual inventory would be easily captured through collaboration with/notification by NYSERDA. **This indicator requires that NYSERDA provide annual data to the**

region. The NYSERDA Indicator Guidance released on September 11, 2012 requires that regions report a common indicator for each topic area. Indicator 18 fulfills this requirement for the Governance topic area.



APPENDIX F:
IMPACT OF INCREASED
NATURAL GAS PRODUCTION

IMPACT OF INCREASED NATURAL GAS PRODUCTION

One of the key differentiators of the Southern Tier, relative to the other regions preparing Plans under the Cleaner, Greener Communities program, is the potential significant increase in natural gas production in the region utilizing high volume hydraulic fracturing (HVHF) and horizontal drilling processes. This issue is being studied and analyzed for the economic, environmental, and other impacts to the region by numerous parties, including the State's formal environmental review process, and such research is not included here. Rather, the purpose of this appendix is to highlight the main impacts an increase in natural gas production using these processes would have on the stated benefits of the Implementation Strategy outlined in the Cleaner Greener Southern Tier Plan.

Four of the most significant areas in which natural gas production increases could influence this Plan include:

- Differential costs and benefits to the Southern Tier relative to other NY regions.
- Impact of the treatment of natural gas supply in the GHG inventory on the region's achievement of GHG reduction goals, relative to other emission sources.
- Impact on specific actions identified in the Implementation Strategy.
- Other impacts indirectly associated with Implementation Strategy actions.

Each of these is explored below.

Differential Costs and Benefits among Regions

One of the primary intended outcomes of the regional sustainability plans is to reduce greenhouse gas (GHG) emissions, working toward the adopted New York State goal to reduce GHG emissions by 80 percent below 1990 levels by 2050, with an interim goal of 40 percent below 1990 levels by 2030. Because the Southern Tier is situated above the most exploitable portion of the Marcellus Shale formation in New York State, and thus has greater natural gas resources that would be more likely targets for production using the HVHF and horizontal drilling processes than other regions, the GHG impact of increased natural gas production would be disproportionately borne by the Southern Tier. As other regions include fuel switching (i.e., moving toward more natural gas use to theoretically reduce GHG emissions), the natural gas needed to feed such efforts may be provided by the Southern Tier. Consequently, GHG reductions in other regions could be obtained through increased use of natural gas, which would in fact increase the GHG emissions in the Southern Tier. Tompkins County, for example, using figures in the New York State Department of Environmental Protection's draft Supplemental Generic Environmental Impact Statement on HVHF, has estimated that the emissions from one eight well pad over its projected 30-year well life would roughly equal one year of GHG emissions from the Tompkins County community. Full development of the Marcellus Shale resource would be likely to overwhelm the emissions reductions achievable for all other sources. In fact, based on the DEC figures, emissions from full exploitation of the Marcellus Shale resource in New York State over the next thirty years would make it impossible to achieve the State's GHG emission reduction goal, no matter how great the reductions in existing emissions from all other sources within the State.

The Southern Tier would be the beneficiary of the economic growth and jobs associated with increased natural gas production in the region. Increased natural gas production would increase revenues in the region, increase local employment, and would likely also increase the sales or development of goods and services to support the employees and visitors to the production area. At the same time, adverse impacts on water quality, air quality, wildlife habitat, infrastructure, affordability of housing, and human health would be disproportionately borne by the Southern Tier. There could be offsetting long-term negative

economic impacts on agriculture and tourism, depending on the pace and scale of the drilling and the regulations established by New York State.

Treatment of Natural Gas Supply in the GHG Inventory

The nature of the GHG inventory calculations plays a role in how increased production of natural gas in the Southern Tier will impact GHG emission reductions of the Plan. According to the New York State protocol used to calculate the inventory, energy use and supply are treated differently from one another. Under current protocol, emissions associated with electricity *production* at individual power plants are not included in a region's inventory. Instead, the inventory includes emissions associated with electricity *consumption*, calculated by multiplying total usage times the average grid emission factor, which accounts for all of the power plants that supply the electricity grid. By contrast, emissions associated with natural gas production are counted at the location of natural gas production.¹ So, while all regions will need to account for emissions associated with electricity consumption and direct emissions from natural gas consumed in the region, the Southern Tier will need to account for those same emissions, plus emissions from production of natural gas, most of which will not be consumed in the region.

Specifically, within the Region's GHG inventory:

- Emissions from grid-supplied electricity are included in the inventory based on the amount of electricity consumed locally.
- Emissions associated with grid-tied electricity production within the Region are not included in the region's emissions totals.
- Emissions associated with natural gas production, including fugitive methane from natural gas wells in the region, are included in the inventory.
- Emissions from energy supply activities are included in the inventory. These include electricity transmission and distribution (T&D) losses, natural gas T&D losses, and sulfur hexafluoride emissions from electricity T&D.

Consequently, because the natural gas production would be concentrated in the Southern Tier, emissions associated with such production would increase GHG emissions in the Southern Tier, even if the natural gas itself was distributed beyond the boundary of the region. Regions claiming emissions reductions for conversion from other fossil fuels to natural gas would not be reflecting the emissions resulting from production of that gas, though they would include transmission and distribution losses. This method of accounting could result in a distorted picture of whether the State is meeting its GHG emission reduction goals, so emissions from natural gas production in New York State should be tracked more carefully to determine the net impact of increased production.²

Impact on Specific Actions

The Southern Tier has significant natural gas resources that have not yet been tapped via HVHF using horizontal drilling, although there is existing production via conventional wells. In addition to the serious implications for Statewide emissions accounting discussed above, the implications of dramatically increasing production via new technologies that are being extensively studied elsewhere, and that are directly relevant to this document, include:

¹ Emissions from natural gas production were included in the New York State protocol as an optional source. The Southern Tier elected to include emissions from this source due to the high level of natural gas production in the region, while other regions in the state have not included this source.

² There is not uniform opinion among agencies and local governments in the Southern Tier about this issue. Some advocate for a more complex calculation of full lifecycle costs for natural gas production and consumption. Others advocate for consideration of potential benefits of increased production, such as lower household heating costs,

- Economic growth, through the jobs associated with natural gas production, the revenues associated with sales, and local purchasing of supplies and equipment.
- Increased energy consumption by the natural gas supply industry.
- Increased VMT for workers commuting to the site and traffic associated with the industry.
- Dramatically increased heavy truck traffic and off-road vehicular energy consumption.
- Increased methane emissions associated with natural gas extraction.

Many of the actions contained within the Implementation Strategy speak directly to the above elements and would be influenced by an increase in natural gas production in the region. While there is not uniform agreement in the region regarding the likely impacts of natural gas drilling activities, the table below indicates those activities where natural gas production might impact the associated benefits of each action.

One element of the impact of additional natural gas production and use is the question of whether, on a life cycle basis, the use of natural gas as an alternative to coal would increase or decrease greenhouse gas emissions. In early 2011, Howarth et al. of Cornell University published a paper³ that asserted that on a life cycle basis, GHG emissions of shale gas are higher than those of coal due to the fugitive and vented emissions of methane during the production and transportation processes. Other studies⁴ have come to different conclusions but this remains an issue of current debate.

Table 1. Estimated GHG Reductions by Implementation Plan Actions

	Action	Estimated CO ₂ e Reduced	Impact of increased Natural Gas Production on Action
9	Explore transitioning existing power and thermal generation facilities to more sustainable fuel	46,000	Fuel switching would increase regional demand for natural gas. Natural gas production in the region could help feed this demand.
14	Expand 'Way2Go' information programs and coordinate and expand transportation demand management (TDM) programs at institutions and major employers	22,000	Increased natural gas production would increase the number of commuters and could counteract the benefits achieved by this action.
17	Encourage green fleet policies and create a region-wide electric vehicle and alternative fuel infrastructure deployment plan	262,000	This action focuses on a switch to electric vehicles and alternative fuel vehicles, which include compressed natural gas (CNG). Demand for CNG may increase the network of CNG filling stations; increased NG production would feed this demand.
24	Assess affordable housing needs and identify target areas for rehabilitation programs	66,000 for 24, 25 and 27	Increased drilling activity in other areas has put a strain on existing housing resources and driven up the cost of housing.
25	Provide financial and technical support to rehabilitate and provide safe, energy efficient housing for low-to-moderate-income households	See 24	Increased drilling activity in other areas has put a strain on existing housing resources and driven up the cost of housing.
27	Provide technical assistance and gap	See 24	Increased drilling activity in other areas has

³ Howarth et al. (2011)

⁴ Hultman et al. (2011), Jiang et al. (2011), Burnham et al. (2011), Stephenson et al. (2011), National Energy Technology Laboratory (2011), Weber and Clavin (2012)

	financing for construction and rehabilitation of energy-efficient affordable housing		put a strain on existing housing resources and driven up the cost of housing.
33	Expand and promote culinary and agri-tourism opportunities	NA	Some tourism professionals fear that extensive gas drilling activity with its impacts on scenic qualities and industrial truck traffic would adversely impact the attractiveness of the region to tourists.
34	Coordinate and market educational and green tourism	NA	Some tourism professionals fear that extensive gas drilling activity with its impacts on scenic qualities and industrial truck traffic would adversely impact the attractiveness of the region to tourists.
42	Coordinate planning and implementation for Southern Tier priority conservation and agricultural protection areas	219,000	Natural gas drilling, associated activities and pipelines will impact undeveloped areas, remove, at least temporarily, land from agricultural production, and fragment forest lands and natural areas.

Additional Relevant Impacts

Natural gas production in the Southern Tier will have additional impacts that do not directly align with the specific actions contained in the Implementation Strategy, but are relevant to the topic areas of the Plan.

- Energy and GHG emissions:** As discussed above, the primary impacts would be an increase in energy used in the natural gas production industry, including electricity, industrial energy use, and on road and off road energy use and the methane emissions associated with natural gas production and distribution that would increase in the region.
- Transportation:** Increased natural gas production would be associated with increases in commuter VMT, use of construction vehicles, and dramatic increases in heavy trucks to transport products and supplies to and from the production facilities. Secondary transportation impacts would result from multiple activities associated with increased population in a region, and related infrastructure required to support the natural gas production industry itself.
- Livable Communities:** Community impacts from production will depend on the location of the natural gas resources and production sites and proximity to housing and existing communities. There may also be significant impacts on housing availability and price, including rentals and motels, due to the housing needs for out-of-town drilling and production crews (these impacts are being seen already along the Pennsylvania border, with motels frequently fully booked from drilling crews working in the Pennsylvania fields). Overall quality of life could be reduced in many areas due to the environmental, noise, air quality, public health, visual and traffic impacts associated with intensive exploitation of the natural gas resource using HVHF and horizontal drilling.
- Economic Development:** Increased natural gas production would be associated with additional jobs and revenues, and additional economic and consumer activity in the region. However, energy extraction is often subject to “boom and bust” cycles and long-term negative impacts may occur to currently important sustainable economic sectors such as agriculture and tourism.
- Working Lands and Open Space:** Impacts on farm and forest land would be mostly negative. From a landowner’s perspective, however, there may be less pressure for a farmer or rural landowner to sell land to developers if they are receiving payments from gas producers. The

drilling process, and associated production impacts would be likely to degrade the quality of otherwise undeveloped land or affect the existing agricultural (or other) activities on these lands. A report by the Nature Conservancy concluded that impacts on wildlife habitat would almost certainly be negative.⁵

- **Climate Adaptation:** There may be some impacts associated with land being cleared for well pads and pipelines that could result in additional runoff from previously forested sites, thus exacerbating flooding in a future climate scenario where flooding is expected to worsen. Ideally, climate resilience would be considered in building any new infrastructure associated with industrial growth.
- **Water Management:** Since HVHF consumes significant amounts of water (which is injected underground along with chemicals and small particles to fracture the shale and release gas), water consumption would be increased dramatically in the region, with potential impacts to water quality. Since the water byproduct used in the HVHF process will need to be hauled to wastewater treatment plants and processed, there will also be additional costs and energy use to treat the wastewater; there is also risk of contaminating local water resources.
- **Waste Management:** Large amounts of waste products are generated in the drilling process including cuttings from well drilling, some of which may contain contaminants. Managing this waste will be an added burden on the Region's waste management system.
- **Governance:** Just the possibility of HVHF has already strained the capacity of many municipalities in some parts of the Region. Dealing with all of the impacts of the development of this industry will likely absorb significant resources and energy of local municipalities. Also, the impact on emissions from this activity could dwarf the gains that could be made through the actions in this plan. In combination the strain on resources and perceived futility of action could make implementation of this plan less likely.

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**APPENDIX G:
SUPPLEMENTAL ACTIONS**

Appendix G: Supplemental Long-Term Actions

The Implementation Strategy (in the main body of the Regional Sustainability Plan) was the result of an extensive process to identify the most effective implementation actions to help the Southern Tier meet its sustainability goals across the nine topic areas. It was developed over the course of several months, based on extensive community involvement and significant technical analysis.

However, not all potential long-term actions were included in the Implementation Strategy. Over 160 potential actions – policies, programs, or projects – were developed for review by the public; a sub-set of over 60 priority actions were included in a Short-Term Action Strategy.

After working sessions with the Planning Team and a weeklong set of public and stakeholder workshops in October 2012, a set of 65 priority actions were chosen for inclusion in the Implementation Strategy; many of the original actions were combined and strengthened. This appendix lists the 77 remaining actions that were not included in the Implementation Strategy. These supplemental actions all support the relevant project goals, and many contribute to other actions in the Implementation Strategy. Many of them may be more important to individual communities, businesses, institutions, or organizations than those in the Implementation Strategy; project sponsors can move forward on any of these actions just as easily as those included in the final Plan.

Complete List of Supplemental Actions

The following list includes 77 supplemental long-term actions that support the priority actions in the Implementations Strategy.

Goal #1 Reduce building energy use	5
Develop community sustainability centers to promote energy efficiency and renewables	5
Create an energy leadership program	5
Establish an agricultural alternative energy program	5
Ensure new buildings and major renovations meet green building standards	6
Establish a greenhouse gas emissions inventory for government facilities	6
Establish an ongoing energy conservation education and training program for government employees	6
Goal #2: Develop, produce, and deploy local renewable energy and advanced technologies across the Southern Tier	6
Select and repower existing non-powered dams	6
Evaluate potential for biomass district heating	7
Establish a regional biomass consortium to supply biomass to consumers.....	7
Goal #3: Create a regional multimodal transportation system that offers real transportation choice, reduced costs and impacts, and improved health.	8
Analyze barriers to bicycle and pedestrian infrastructure development	8
Develop bicycle shelters and amenities for bike commuters.....	8
Identify and develop connected, on-road bicycle routes	8
Analyze and improve ADA compliance in cities and villages	8
Promote and facilitate development of bikeshare systems in the region's three major cities.....	9
Install bike racks on all public transit.....	9
Integrate fare media across the Southern Tier.....	9
Create multimodal corridor redevelopment plans for aging 'commercial strip' corridors linking downtowns and suburban areas	9
Identify potential transit targets and future stops, and support transit-ready development	10
Implement limited-stop transit service to connect existing and emerging centers and regional destinations..	10
Goal #4: Reduce fossil fuel consumption and GHG emissions from transportation by reducing vehicle miles traveled, increasing efficiency, improving system operations, and transitioning to less carbon intensive fuels and power sources.	10
Develop biofuel infrastructure	10
Encourage purchases of hybrid-electric or alternatively-fueled vehicles.....	10
Create and implement incident management plans coordinated with traveler info systems	10
Promote energy saving driving techniques	11
Undertake regional signal coordination projects	11
Explore increasing use of rail for goods transport.....	11
Implement anti-idling ordinances in areas experiencing truck traffic.....	11
Electrify truck stops and transfer points throughout the region	11
Goal #5: Strengthen and revitalize existing cities, villages, and hamlets	12
Build on the Shovel-Ready Site Development Project to leverage investment in priority redevelopment areas of cities, villages, and hamlets	12
Expand rural health care and village-style communities for seniors	12
Explore the feasibility of establishing a Transfer of Development Rights (TDR) program.....	12

Goal #6: Support development of housing that is energy and location efficient and offers choices to reflect changing demographics	13
Provide favorable financing for upgrades to housing for middle-income households	13
Goal #7: Create and retain more good paying jobs by building on the Southern Tier's regional strengths, including advanced energy and transportation technologies, globally-competitive industry, and workforce development and technology transfer partnerships with educational institutions.....	14
Support the Southern Tier Transportation Industry Cluster.....	14
Create the Regional Health Information Exchange and Electronic Medical Record System	14
Use technology incubators to support new businesses in competitive industries	15
Strengthen university-industry connections to create new enterprises and technology transfer	15
Implement the Health Care Workforce Development Initiative.....	15
Create financial support options for entrepreneurs	16
Provide bootstrap entrepreneurship resources and training	16
Build on Southern Tier East's collaboration with NYS Office of New Americans	16
Support young professionals	16
Support youth engagement in STEM fields.....	17
Goal #8: Support tourism industry development with coordinated marketing, preservation, and enhancement of historic, cultural, educational, and natural resources and events.	17
Enhance and promote foliage, recreational, trails, and waterways tourism	17
Coordinate and promote arts, cultural and heritage tourism	17
Goal #9: Support farming and related businesses to reinvigorate the rural economy, enhance residents' incomes and standards of living, and promote local food and agriculture.	18
Develop regional programs for branding and marketing local food products	18
Develop and expand markets for local food and establish and expand CSA networks	18
Goal #10: Promote best management of fields, forests, and farmland to keep working lands in production, protect natural resources, and increase carbon sequestration.	20
Increase the acreage of certified sustainably managed forests in the Southern Tier.....	20
Extend growing season through the use of hoop houses (high tunnels).....	20
Promote soil carbon sequestration.....	20
Goal #11: Preserve and connect natural resources, open spaces, and access to waterways, to protect regional environment, ecology, habitat and scenic areas, and support outdoor recreation.....	20
Promote and fund purchase of development rights programs to protect farmland from development.....	20
Enhance and expand downtown parks and open space.....	21
Expand and Improve community gardens and urban agriculture sites	21
Market flagship municipal parks as visitor draws	21
Goal #12: Identify and plan for the economic, environmental, and social impacts of climate change.	22
Establish a climate adaptation advisory committee	22
Establish a region-wide consensus on appropriate climate projections	22
Compile regional datasets on weather-related events and impacts.....	22
Seek technical assistance and guidance	22
Develop a database of potential state and federal funding opportunities.....	22
Host a climate change vulnerability assessment and adaptation workshop	23
Seek collaboration beyond the Southern Tier	23
Goal #13: Minimize flood losses by preserving and enhancing floodplains and wetlands, and by limiting development in flood-prone areas	23

Develop a tool to “crowd-source” local knowledge and observations of recurring flooding.....	23
Create a stream feature inventory for the watersheds	23
Implement a regional flood and watershed education program	24
Goal #14: Efficiently manage and upgrade existing water, sewer, and other utility infrastructure to support compact development and reduce energy use.....	25
Develop an incentive and reward program for water or wastewater treatment plants that reduce energy use	25
Install biogas use systems in wastewater treatment plants	25
Goal #15: Improve and protect water quality and quantity.....	25
Enhance and expand existing water quality monitoring and data collection programs for Southern Tier watersheds.....	25
Enhance site-specific source water protection strategies on a regional or local scale.....	26
Goal #16: Promote innovative waste reduction and management strategies.....	27
Promote waste prevention measures.....	27
Develop demonstration projects to divert waste from landfills	27
Stimulate regional markets for recovery of additional waste streams	27
Encourage local agencies to lead by example.....	28
Leverage existing waste facilities to test energy recovery processes	28
Implement sustainable procurement strategies in the region.....	28
Adopt local resolutions in support of Extended Producer Responsibility	29
Consider becoming a Life Cycle Community	29
Promote the use of third-party verified eco-labeling for environmentally-preferable products	29
Launch a regional targeted education campaign to address information gaps	29
Develop a Waste Management Community of Practice within the Southern Tier.....	30
Goal #17: Increase collaboration among regional agencies, institutions, and local governments	31
Goal #18: Increase fiscal efficiency and effectiveness in local government through energy and waste reduction, coordinated investments, and integrated planning.	31

Energy and GHG Emissions

Goal #1 Reduce building energy use

Develop community sustainability centers to promote energy efficiency and renewables

Strategically located buildings within communities that already serve as gathering spots could also serve as go-to destinations for sustainable development and energy innovation in the Southern Tier, specifically in areas cited for redevelopment. These “community sustainability centers” would support coordination of activities among various sustainability organizations and the sharing of knowledge and resources across the region.

Create an energy leadership program

An energy leadership program would be a program launched as an arm of the Southern Tier Renewable Energy and Efficiency (STREE) initiative. The objective of this program would be to educate community leaders about the benefits of energy efficiency and renewable energy and to get them to commit to promoting and modeling clean energy implementation.

One example, the Tompkins County Climate Protection Initiative (TCCPI) consists of a network of members including private businesses, non-profit organizations, colleges, institutions, homeowners associations, municipalities, government boards, and agencies. The county’s colleges, government, and Ithaca City and Town governments have already made commitments to reducing greenhouse gas emissions in the county. TCCPI aims to build upon these commitments by working with its members to identify and implement major energy efficiency projects, establish targets and timetables for greenhouse gas reductions, explore financing options, monitor progress through data collection and analysis, and publicize the various accomplishments. The Southern Tier region could create an Energy Business Partnership program that allows participating businesses to receive personalized guidance for energy efficiency investments, share best practices in energy-saving measures, and effectively leverage available community and utility incentives to save money. The creation of this program would greatly improve business participation in energy efficiency measures, sector interest in this issue, and reduction in energy consumption and GHG emissions associated with commercial businesses.

The Tompkins County Energy Conservation Corps is an example of the type of program that can be replicated in communities throughout the Southern Tier. The Corps mentors students, scholars, and volunteers to learn how to conduct energy assessments on the homes of formal and informal community leaders in Tompkins County. The Corps’ mission is to dramatically expand residential energy efficiency, strengthen local self-sufficiency, and reduce carbon emissions – with an innovative approach for social marketing of home energy retrofits. Presently, Chemung and Chenango Counties have partnered with Tompkins County CCE to start their own energy leadership programs.

Establish an agricultural alternative energy program

By effectively engaging farmers and rural residents who live on large tracts of land in the Southern Tier, there is significant potential to deploy renewable energy on farms and rural lands. Wisconsin created an award-winning anaerobic digester program that pooled state resources and fostered partnerships between utilities and agricultural extension groups and supported information exchange among farmers. Providing technical assistance and outreach and presenting case study examples of renewable energy deployment in the region, would assist farmers and rural land owners to consider renewable energy opportunities. In the Southern Tier, outreach would focus on anaerobic digesters, solar photovoltaics (PV) and solar hot water technologies, small rural wind turbines, and if applicable, micro-CHP or geothermal heat pumps.

Ensure new buildings and major renovations meet green building standards

A number of standards exist for new construction and major retrofits, which ensure that the building and building practices are meeting high performance and green building standards. A few options that the Southern Tier could explore: setting envelope standards to exceed New York State Energy Code or policies for new government buildings and major building renovations to achieve LEED or ENERGY STAR certification standards. Specifically, government buildings could be designed to both exceed the code-required R-values, and meet the ENERGY STAR thermal enclosure requirements. The LEED rating system is the standard-bearer for energy efficient design, as well as water efficiency, sustainable materials, site design and environmental quality. Green buildings' energy savings are enhanced through buying energy efficient products, such as ENERGY STAR rated computers, monitors, and light fixtures; installing automatic lighting systems, low flow and/or waterless plumbing fixtures; and establishing automatic temperature controls in buildings. An analysis could be conducted to consider the entire life-cycle of a building with a large emphasis on reduced operating costs over time, when considering new or retrofitted facility design. Government building policies to meet LEED and ENERGY STAR levels are becoming more common across the United States.

Establish a greenhouse gas emissions inventory for government facilities

By establishing and continuing greenhouse gas emissions inventories for government facilities, the region could better track progress toward the greenhouse gas reduction goals for the Southern Tier. Tompkins County, for example, has completed three GHG inventories dating back to 1998 baseline year, for county government operations and for the Tompkins County community. Emissions were estimated using the International Council for Local Environmental Initiative's Clean Air and Climate Protection Software. Results of the inventories were used to gauge progress and set new emissions reduction goals.

Establish an ongoing energy conservation education and training program for government employees

The region may consider training staff in basic energy saving behaviors (such as turning off lights and equipment not in use), as well as training facilities staff in how to use monitoring and controls for mechanical systems. Mechanical system malfunctions can then quickly be identified and corrected, so that energy is not wasted during this time. The training would be most effective if provided on a repeated basis so that information is not gradually lost due to staff turnover and more collective interest is generated. Out-of-the-box training programs are available, some at a cost and others through free federal government resources. One great way is to support green teams in offices, classrooms, and neighborhoods. There is a learning curve that people need to go through to live more sustainably. Education and training can help to address these issues.

Goal #2: Develop, produce, and deploy local renewable energy and advanced technologies across the Southern Tier

Select and repower existing non-powered dams

Three non-powered dams have the potential to be repowered (Cannonsville Dam in Delaware County, and Rockbottom and Whitney Point dams in Broome County) with the capacity potential of 24 MW. An evaluation could be done to prioritize the order of repowering the dams based on ease of permitting, cost, and impact on overall lowering of GHGs. Cornell recently upgraded its hydroelectric facility below Beebe Lake, which is expected to increase that facility's annual production by 20 percent. Modifying one of the existing dams to provide hydroelectric power has the potential to be a valuable and relatively

inexpensive contribution to New York State's renewable energy goals, as much of the construction is already in place.

Evaluate potential for biomass district heating

Biomass can be used to fuel combined heat and power systems on farms, schools and potentially in small municipal districts as well. Successful biomass heating projects have been completed on site at large buildings such as schools and to provide district heating. Dartmouth College recently integrated CHP using biomass into a new 125 unit graduate housing project.

Establish a regional biomass consortium to supply biomass to consumers

If the demonstration projects are successful and biomass harvesting, pelletization, and biofuel and biogas production are in demand, it would be advantageous to establish a regional biomass consortium which would bring together growers, harvesters, processors, and distributors to ensure that Southern Tier resources are managed sustainably and profitably. The consortium could serve to assist entrepreneurs in efforts related to industry development, support forming of professional networks, which would facilitate collaboration and efficient processing and utilization of the region's biomass.

The Arnot Ogden Hospital in Elmira has integrated biomass technology into its facility and is serving as a model for Cayuga Medical Center that is currently investigating transitioning its energy plant

Some initiatives have taken root. The Danby Land Bank Cooperative is providing an organization and infrastructure to allow landowners to utilize their fields and forests for wood and grass pellet production. The Southern Tier East is collaborating with Tioga REAP on their Bioenergy Plan and Cornell Cooperative Extension is providing public outreach on energy issues, as well as working to increase the understanding and production of biomass energy crops. By leveraging initiatives already underway and supporting development of new industries, the Southern Tier region can impact not only alternative energy use but also foster economic development.

Transportation

Goal #3: Create a regional multimodal transportation system that offers real transportation choice, reduced costs and impacts, and improved health.

Analyze barriers to bicycle and pedestrian infrastructure development

As the region looks to improve and expand biking and walking, it could conduct a comprehensive assessment of barriers to non-motorized infrastructure development throughout the region. Understanding the barriers allows the region to work proactively to identify solutions and funding sources, and prevent project delays. Examples of barriers include restrictions on using bikes in roadways, permissions required for striping bike lanes, design standards that preclude bike infrastructure, or similar policy issues at the state, regional, or local level. Additionally, developing trail networks may involve obtaining agreements with private landowners or right-of-way acquisitions.

Develop bicycle shelters and amenities for bike commuters

People are much more likely to bike as a mode of transportation when there are facilities available to leave their bike in a place protected from weather, to shower, and to store clothing or other belongings. Regional nodes within the Southern Tier such as Binghamton, Elmira/Corning, and Ithaca could consider developing public bike shelters in their downtowns. Converting a few parking spaces on the ground floor of existing parking garages into bike storage is an effective strategy. This can also be accomplished by requiring bicycle parking as a condition of development approval, or negotiating as part of a district-wide parking plan. If space is available, additional amenities can be incorporated into such shelters, including lockers to store clothing or other belongings. Showers for commuters can be provided in the office buildings that the garage serves.

Identify and develop connected, on-road bicycle routes

Bicycle networks that connect homes, jobs, schools and other destinations encourage higher levels of bicycling. Efforts to expand bicycling in the Southern Tier can identify and develop comprehensive bicycle routes, employing a combination of trails, bike lanes, shared roads, dedicated bike boulevards, and signage to provide safer routes for bicyclists and make them more visible to drivers. A number of jurisdictions have created bike maps and bicycle plans over the past 10-15 years, which can serve as the foundation to further develop bike infrastructure in most towns.

The Ithaca Neighborhood Greenway Study proposed a network of bike boulevards that would be welcoming to cyclists throughout Ithaca's downtown.

Analyze and improve ADA compliance in cities and villages

Infrastructure that meets requirements under the Americans with Disabilities Act (ADA) typically also improves biking and walking facilities for all users. Cities and villages within the region could conduct assessments of ADA compliance of area sidewalks and transportation facilities to determine where improvements may be needed to provide a welcoming environment for non-motorized transportation – whether for seniors, children, people with disabilities, or the general public.

Promote and facilitate development of bikeshare systems in the region's three major cities

Bikeshare programs offer access to bikes located at stations around a city, village, or compact area such as a university for a relatively small fee for one-time use or a monthly subscription. These programs make it easy for people to bike for shorter trips along frequently-traveled routes (since bikeshare stations are typically located in high traffic areas). Cities and other partners in the Southern Tier could examine the feasibility of an integrated bikeshare service that would allow residents across the region to access bikes in multiple locations using the same system.

Cornell University has a limited bikeshare program where students can check out bikes for up to 24 hours from several campus locations.

Currently, electric bikes are illegal in New York State. However, electric bikes could help overcome difficulties associated with the region's topography and biking up hills. As part of this action, the region could explore how or whether electric bikes might be permitted as part of a bikesharing system.

Install bike racks on all public transit

Bike racks or storage on buses and rail vehicles are an important element in bike-transit integration, and are relatively easy and inexpensive to install. The percentage of buses with bike racks almost tripled in the U.S. in only eight years, from 27 percent in 2000 to 71 percent in 2008.¹ Biking and transit can be complimentary, allowing users to use a combination of both to complete a trip.

Integrate fare media across the Southern Tier

Multipurpose media or farecards are becoming increasingly popular around the country to facilitate a seamless transfer between multiple transit options in the same vicinity or on a common route. The use of integrated circuit ("smart") farecards is driven by transit agencies and financial institutions in an effort to reduce the use of cash for payments and improve customer convenience and speed of operations. The cards allow consumer use the farecards as a "universal ticket" for all transit in the area or surrounding areas, or as an integrated fare media that can be used in transit as well as other transportation modes (e.g., parking, tolls).² This can also provide operators and funders with better system management information. As the Southern Tier develops more regional transit options between town centers, or commuter trains and buses, incorporating multipurpose farecards will become increasingly important.

Create multimodal corridor redevelopment plans for aging 'commercial strip' corridors linking downtowns and suburban areas

Multimodal corridor plans take a complete street approach to integrate roadway improvements, commercial and housing redevelopment, and transit system expansion along heavily used corridors. It can reduce congestion at major choke points and intersections, and improve multimodal choice within and between neighborhoods. Multimodal corridor strategies identify an interconnected system of projects that can be implemented incrementally over time as funding is available. For example, new parallel road networks can be built by developers as part of redeveloping aging shopping centers. Limited public funding can be targeted toward connecting the dots of this private investment, with a transit-ready development approach to support improved transit service over time.

Southern Tier cities and villages have a number of commercial strip areas and malls lining arterial roads that are ripe for redevelopment as multimodal corridors, especially those that link downtowns and

¹ *2008 Public Transportation Fact Book*. Washington: American Public Transportation Association.

² "Multipurpose Far Media: Developments and Issues," Federal Transit Administration, Transit Cooperative Research Program, June 1997, Available online: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rrd_16.pdf

suburban areas. MPOs and local governments could identify key corridors and revitalize them by enhancing transit viability, improving streetscapes, and attracting walkable mixed-use development. Multimodal corridor planning and redevelopment is encouraged by US DOT and NYSDOT, with recommended approaches outlined in several new Federal Highway Administration livability publications.³

Identify potential transit targets and future stops, and support transit-ready development

Transit-ready development principles include compact, walkable mixed use development, well-connected complete street networks and safe crossings for walking, biking and driving, and planning for future transit stops. Municipalities that adopt these principles can support coordinated corridor redevelopment and new development with potential transit service expansion, ensuring that development will support enhanced transit service. Local governments can also designate a set of nodes and redevelopment zones along key corridors, which become targets for transit-ready development.

Implement limited-stop transit service to connect existing and emerging centers and regional destinations

For transit riders, the extra time associated with frequent stops can be a deterrent or source of frustration. Transit operators could enhance transit service by implementing limited-stop bus service between key destinations such as redevelopment areas, downtowns, and area shopping or entertainment venues. Along multimodal corridors, priority lanes could also help to reduce travel time.

Goal #4: Reduce fossil fuel consumption and GHG emissions from transportation by reducing vehicle miles traveled, increasing efficiency, improving system operations, and transitioning to less carbon intensive fuels and power sources.

Develop biofuel infrastructure

Currently the Southern Tier has very few service stations that dispense biofuels, which are required to make these alternative fuels realistic options for the public. Existing service stations can install biofuel dispensing equipment, though they may require financial assistance to do so. A good model is Southern Tier East's promotion of compressed natural gas (CNG) fueling stations at municipal centers.

Encourage purchases of hybrid-electric or alternatively-fueled vehicles

Hybrid and alternative fuel vehicles have been growing in popularity and some tax credits have been made available to individuals who decide to buy them. The region might consider additional incentives, such as preferred parking spots or reduced parking costs for these vehicles in public parking spots. Public outreach will be needed to raise awareness of incentives for purchasing hybrid-electric or alternatively fueled cars.

Create and implement incident management plans coordinated with traveler info systems

As traffic and travel information systems become better integrated under 511NY, it will become increasingly possible to coordinate and manage response to incidents that would otherwise cause congestion and delays. An incident management plan will help emergency response and transportation agencies to manage traffic crashes or other occurrences, and minimize their impact on the transportation

³ Federal Highway Administration Livable Communities resources. <http://www.fhwa.dot.gov/livability/>

network. Improving traffic flow in these cases can reduce emissions and result in a more efficient transportation system overall.

Promote energy saving driving techniques

Driving techniques – starts, stops, acceleration, and speed – affect fuel efficiency and therefore transportation emissions. Educating the public, particularly drivers of public and private fleet vehicles, can help to reduce unnecessary fuel use. The region can implement a public education campaign supplemented with direct outreach to transit agencies or other organizations to teach drivers how to operate their vehicles in the most efficient way possible.

Undertake regional signal coordination projects

Maintaining safe, smooth traffic flows saves time and fuel and reduces emissions. Working with key stakeholders, such as law enforcement and emergency services to examine major sources of traffic surges, transportation agencies can conduct self-assessment and develop a coordination plan. This assessment would be aided by reviewing available data on how signal timings are currently set, which roadways are the highest priorities, and which intersections have the highest crash rates. There are a variety of technologies available for monitoring traffic and adapting traffic signals including signal timing software, but a county may also use existing equipment and yield substantial benefits. The National Traffic Signal Report Card (in which the average U.S. city received a grade of D-) may be a good metric and provide best practices on how to assess the system.⁴

Explore increasing use of rail for goods transport

Though rail transport is more fuel-efficient and produces lower emissions, achieving significant freight mode shift is difficult in the Southern Tier because truck traffic in the region is primarily through traffic. However, the Southern Tier can explore techniques to encourage shippers to use rail for their shipping needs. There may also be opportunities to develop rail infrastructure, particularly around Binghamton. The region could examine the existing freight rail infrastructure to assess possibilities for increasing the proportion of goods transported by rail.

Implement anti-idling ordinances in areas experiencing truck traffic

Reducing truck idling time has direct health and environmental benefits from reduced pollutant emissions. New York State law limits idling to five minutes for heavy duty vehicles, however, ordinances limiting idling to two or three minutes are common. Areas that experience truck traffic may wish to consider implementing more stringent idling ordinances. In places where these ordinances already exist, increasing both awareness and enforcement will likely enhance its impact.

Electrify truck stops and transfer points throughout the region

Trucks at rest stops or truck stops often need to keep their engine running in order to maintain refrigeration and a comfortable temperature in the cab, or to run other appliances. Providing plug-in units at truck stops allows trucks to turn off their engines and avoid burning excess fuel. Regional agencies can work to ensure that all truck rest stops in the region make these amenities available by determining the location of these stops and working with truck stop managers to provide units.

⁴ <http://www.eereblogs.energy.gov/tap/post/A-Green-Light-for-Traffic-Signal-Improvements.aspx>

Livable Communities

Goal #5: Strengthen and revitalize existing cities, villages, and hamlets

Build on the Shovel-Ready Site Development Project to leverage investment in priority redevelopment areas of cities, villages, and hamlets

The Regional Infrastructure Fund for Shovel-ready Sites, outlined in the economic growth plan of the Southern Tier Regional Economic Development Council, will be established and used as matching funding to leverage federal, state, municipal, local development corporations, economic development agencies, and private sector financing to grow and attract businesses to the Southern Tier region. Sites can include existing buildings and former brownfield sites that have been prepared for development. By eliminating barriers to economic development, this project has the potential to bring contaminated, vacant, and/or abandoned properties into productive uses while creating jobs for residents.

REDC Strategy 5: Shovel Ready Site Development Project. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

Expand rural health care and village-style communities for seniors

The Rural Health Care strategy outlined by the Regional Economic Development Council supports elderly adults, who may become less mobile with age and wish to age in place. This initiative would develop and expand the use of sophisticated diagnostic tools and care methods using telemedicine and mobile health care technology, together with training and deployment of mid-level health care providers and IT personnel, to provide care to persons living in the remote areas of the Southern Tier region, creating a healthier population and workforce. Because approximately 3/4 of all health costs are spent on chronic conditions for which there are standard protocols for care, telemedicine and mobile health care technologies can be strategically employed to enhance access and cut health care costs in the long run.

The initiative will reduce hospitalizations, create Medicare and Medicaid savings, and reduce transportation needs for elderly and low-income populations. In addition to expanding rural health care, the creation of village-style senior living communities can both support and enhance this action.

REDC Strategy 3: Expand Rural Health Care and Senior Living Communities. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

Explore the feasibility of establishing a Transfer of Development Rights (TDR) program

TDR transfers the development rights from a farm or natural area to another area the community wishes to see developed more densely. It protects land while allowing for higher density in appropriate areas. In order to work, there must be well-defined sending and receiving areas and an active market for development. The cost of acquiring development rights from agricultural or natural areas would be recovered from developers that receive density bonuses. A feasibility study would require outreach to municipalities to gauge interest in participating, analysis of municipal land use regulations to determine applicability of the program, and grant writing to support the launch of a TDR program. Conducting a

TDR feasibility study with interested municipalities could help to clarify the opportunities and limits locally for this complex protection and development tool.

Goal #6: Support development of housing that is energy and location efficient and offers choices to reflect changing demographics

Provide favorable financing for upgrades to housing for middle-income households

When focusing on middle-income, owner-occupied or rental housing, communities may consider offering low-interest loans with interest and principal that are forgivable over a period of time. This can provide sufficient incentive for households to commit to energy efficiency upgrades. Energy efficiency standards may also be considered criteria for financing options. For example, the addition of a tankless water heater could decrease the interest rate by a certain percentage.

The Southern Tier Regional Economic Development Council has provided funding for projects to rehabilitate homes for over 200 families across the region. Favorable financing for middle-income households could expand eligibility and, ultimately, the success of this and similar programs.

Economic Development

Goal #7: Create and retain more good paying jobs by building on the Southern Tier's regional strengths, including advanced energy and transportation technologies, globally-competitive industry, and workforce development and technology transfer partnerships with educational institutions.

Support the Southern Tier Transportation Industry Cluster

This action aims to help a wide range of large, existing companies to grow by capturing a larger portion of the mass transportation and aviation manufacturing market, which includes military helicopters. The Southern Tier Transportation Industry Cluster will be a consortium of Southern Tier businesses and academic institutions dedicated to the growth of this industry sector. The cluster will leverage industry and academic collaboration to drive an innovation culture and mitigate the boom and bust cycle that characterizes both the mass transit and aviation industries. It will develop an aggressive marketing strategy to build this niche of the transportation industry while capitalizing on upcoming New York Metropolitan Transit Authority (NYMTA) project spending.⁵

REDC Strategy 2: Southern Tier Transportation Industry Cluster. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

Create the Regional Health Information Exchange and Electronic Medical Record System

This action aims to build on the outstanding work at Cornell University and Binghamton University in information technology to create a comprehensive Regional Health Information Exchange and Electronic Medical Record System to improve care management and expand use of health care technology in the region. A lead agency, Southern Tier Health Link, has been established to work with universities to develop an informatics solution to integrate the electronic medical record applications currently in use at the region's health care systems. This action may require significant funding, which could be obtained by members or grants. The initiative will allow the electronic medical record systems of all the health care providers and service delivery locations throughout the region to communicate, regardless of the IT systems and proprietary electronic medical record applications used by each. The new application will allow caregivers to exchange electronic patient records across the region to improve care coordination and outcomes; reduce redundancy in testing; and develop and implement regional best practices, in particular for patients with chronic conditions and the elderly. The initiative will also support New York State Medicaid reform, which is a looming challenge for medical service suppliers in the state.⁶

REDC Strategy 3: Regional Health Information Exchange and Electronic Medical Record System. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

⁵ Regional Economic Development Council of the Southern Tier, 2011, *Strategic Economic Development Plan: 2011-2016*.

⁶ Regional Economic Development Council of the Southern Tier, 2011, *Strategic Economic Development Plan: 2011-2016*.

Use technology incubators to support new businesses in competitive industries

This action aims to leverage and expand upon several existing or planned incubators to support economic gardening. The Broome County Department of Planning and Economic Development is currently collaborating with Broome County Industrial Development Agency, Binghamton University, and nearby towns and villages to build a high technology transfer incubator. The goal is to have the incubator operational in three years with 100 jobs in new startups.

It would also support the Next Generation Transportation Development Initiative from the REDC plan. This initiative seeks to launch new ventures focused on next generation transportation technologies and a set of directed research and development and engineering efforts to establish new intercity transportation modalities for upstate New York that are faster, more convenient, more energy efficient, and have less environmental impact. The primary objective is to provide existing companies, and new ventures, with the resources needed to move into next generation transportation engineering, design, and construction as quickly as possible.⁷

In 2008, Broome County started the Greater Binghamton Innovation Center, a high-tech incubator housing high value startup companies with a mission to promote job creation and economic growth. In 2010, one of those tenants, White Knight Imaging, experienced such explosive activity that it left the incubator and established its own office in the community.

REDC Strategy 2: Next Generation Transportation Development Initiatives. See the REDC Plan for more information: <http://regionalcouncils.ny.gov/content/southern-tier>

Strengthen university-industry connections to create new enterprises and technology transfer

This action would facilitate use of university research as a beginning for new enterprises, either through incubators noted above or through partnerships focused on regional economic development. One successful local example is e2e Materials, Inc., an award-winning, clean technology company that began at Cornell University. e2e demonstrates that venture-backed startups in the high-tech industries (such as sustainable manufacturing) have great potential to drive economic development.

e2e Materials, Inc. is an award-winning company that develops advanced biocomposite materials for furniture and cabinetry. It began at Cornell University and received state financial support to establish a full-scale production facility in Geneva, New York, which is expected to support up to 200 jobs in the next five years.

Implement the Health Care Workforce Development Initiative

This initiative addresses critical workforce training, retention and development issues in public and private health care, education, and business and industry. It would also create targeted public investment opportunities in health care and higher education collaboration that focus on IT professionals, nursing education and other health care-related faculty positions. The initiative will recruit faculty at community colleges and universities to expand the number of accessible academic programs. Emphasis would be placed on programs that prepare advanced practice or masters prepared nurses and will expand the current programs involving health care systems and academic centers using a practical collaborative model to address workforce training. Expanded workforce training also will address a major increase in demand for

⁷ Regional Economic Development Council of the Southern Tier, 2011, *Strategic Economic Development Plan: 2011-2016*.

health care workers associated with rapid aging and increased incidence of chronic disease in the Southern Tier population.⁸

REDC Strategy 1: Health Care Workforce Development. See the REDC Plan for more information:
<http://regionalcouncils.ny.gov/content/southern-tier>

Create financial support options for entrepreneurs

This initiative would create more opportunities for entrepreneurship by providing low-value financing that leverages local resources. The region could create a formal cost-sharing agreement for new co-op programs between local universities/educational institutions and local employers.⁹

Provide bootstrap entrepreneurship resources and training

This initiative would encourage residents throughout the region to be more entrepreneurial by providing basic training and resources for individuals in the region who might be interested in exploring entrepreneurship. It would include working with local media and newspapers to run an informative news series about how to start a business. It could also organize a series of entrepreneurship training seminars for the general public, hosted by local businesses.¹⁰ The region could create a clearinghouse to address questions and needs of local entrepreneurs and identify other state or regional resources for technical or financial support.¹¹

Build on Southern Tier East's collaboration with NYS Office of New Americans

This action would expand on the work of the Southern Tier East Regional Planning Development Board, which collaborates with the New York State Office of New Americans to support new citizens and residents to build their businesses. Although they might not have strong English skills or familiarity with agricultural or businesses regulations, new Americans often have valuable skills, knowledge, and energy to contribute to economic development in the Southern Tier. Providing business-focused language training, technical assistance, and funding can help new Americans bring new farms or businesses into production, increasing local employment opportunities, meeting local business needs, and reversing out-migration trends.

Support young professionals

This initiative would establish an informal network to encourage the region's younger population to engage in local business and leadership organizations. For example, Green Happy Hours are common in many metro areas. These monthly get-togethers convene young professionals from environmental and technical fields and provide an opportunity for them to socialize. Anecdotally, these interactions have led to business discussions and entrepreneurial ventures. The network could also encourage and advertise shared workspace and technology incubator arrangements.

⁸ Regional Economic Development Council of the Southern Tier, 2011, *Strategic Economic Development Plan: 2011-2016*.

⁹ Broome County, 2002, *Broome County Plan for Sustainable Economic Development*, p. 19.

¹⁰ Broome County, 2002, *Broome County Plan for Sustainable Economic Development*, p. 19.

¹¹ Steuben County IDA. *2011-2013 Steuben County Economic Development Plan*.

Support youth engagement in STEM fields

This strategy would engage youth in the sciences to learn more about opportunities in science, technology engineering, and manufacturing (STEM) fields. High schools, in partnership with local companies across the region, can start a sciences and engineering internship program to give youth an opportunity to build experience in these fields before deciding on a field of study in college.¹²

Goal #8: Support tourism industry development with coordinated marketing, preservation, and enhancement of historic, cultural, educational, and natural resources and events.

Enhance and promote foliage, recreational, trails, and waterways tourism

This initiative would market the region's natural amenities and seasons and promote multi-use trails, recreational and seasonal events. It would focus on completing and advertising multi-use trails that link urban centers and common visitor destinations. One priority project is the Black Diamond Trail, which will link four state parks with downtown Ithaca and the Cayuga Waterfront Trail at the foot of Cayuga Lake. Another example is the partnership between Tompkins County and Seneca and Cayuga Counties, funded by New York State's Local Waterfront Revitalization

The Susquehanna Sojourn is an annual event hosted by the Upper Susquehanna Coalition in which participants paddle 60 miles along the Susquehanna River over four days. The guided paddle ends at Sidney, in Delaware County. Trip guides teach participants about the local history, geology, invasive plants, and sustainable living along the way. The event provides a model of tourism built around a low-cost, low-impact event that highlights the region's natural resource.

Program, to plan the Cayuga Lake Blueway Trail. A blueway trail is a small boat and paddling route that merges recreation with raising environmental awareness. The Cayuga Lake Blueway Trail will connect heritage trails and historic sites to community centers. The project is an excellent example of regional collaboration and initiative in order to promote nature-based tourism.

Coordinate and promote arts, cultural and heritage tourism

Promoting cultural offerings, such as festivals, tours, performances, classes, and museums can highlight the region's unique culture and history. Cultural tourism products can cost very little, are locally sourced, and require minimal training. An example of cultural tourism is Southwest Virginia's Heritage Music Trail, called the Crooked Road, which consists of a series of venues where tourists listen to Bluegrass, Old Time, and Traditional Country music. The Crooked Road website provides a calendar, interactive map, merchandise store, and information about the trail communities.¹³ In the Southern Tier, the Corning Museum of Glass is a world-class facility that houses a glassmaking center and a museum with over 40,000 objects that represent 3,500 years of glassmaking. The museum has several collections and exhibitions and also provides educational tours and programs.¹⁴ Ithaca's Light in Winter Festival combines music, art and science into a unique festival experience. The Discovery Trail in Ithaca is a network of eight museums, libraries, and scientific

The Corning Museum of Glass, a world-renowned museum in Corning, New York, houses a glassmaking center and a museum with over 40,000 objects that represent 3,500 years of glassmaking. The museum provides educational tours and programs.¹

¹² Broome County, 2002, *Broome County Plan for Sustainable Economic Development*, p. 19.

¹³ <http://thecrookedroad.org/>

¹⁴ <http://www.cmog.org/>

centers that provide a wide array of natural, historical, and scientific educational opportunities. The Trail attracts a mix of tourists with varying interests and ages.¹⁵

The Center for Technology & Innovation in Binghamton, assisted by Southern Tier East, is developing a museum called TechWorks! to showcase innovation and industry in Upstate New York.¹⁶ Construction of the museum, primarily using local companies, is expected to begin in spring 2013. The design team will focus on rehabilitation of vintage buildings, green design, and engaging exhibits. The museum objective is to commemorate the tradition of technical creativity in New York. These tourist attractions can serve as a model for developing other festivals, tours, performances, classes, and museums into tourist draws and continue to promote and cross-market the region's cultural offerings.

TechWorks!, in Binghamton, enhances historical buildings and showcases regional achievements in a format that is accessible to visitors and residents, exemplifying low-impact tourism development that remains true to the region's character.

Goal #9: Support farming and related businesses to reinvigorate the rural economy, enhance residents' incomes and standards of living, and promote local food and agriculture.

Develop regional programs for branding and marketing local food products

This initiative would support and expand existing branding and marketing programs for local food products. Branding makes products recognizable and desirable to consumers. It involves designing a product identity and using it consistently in marketing and labeling materials. Increasing demand through product branding will reduce costs associated with transport and handling and encourage job creation.

Markets for local products include Binghamton, Norwich, Corning, Elmira, and other small cities and villages, as well as Rochester (via I-390) and New York City (via I-86). Opportunities for marketing include farmers markets, community supported agriculture groups (CSAs; see next Action), restaurants, and larger educational and health industry institutions. An organization called "Sustainable South Bronx" provides a model for branding locally grown produce, with the goal of creating accessible jobs in food production. It designed a brand identity, drew in financial support (e.g., foundation grants and subsidies from the United States Department of Agriculture), built relationships with institutional buyers, and engaged investors. Other New York examples of local branding include:

- Pure Catskills Buy Local Campaign.
- Hudson Valley Fresh.
- The Pride of New York (see below).
- Capital District Local First.

Develop and expand markets for local food and establish and expand CSA networks

This action would make it easier for consumers and producers to connect by providing farmers markets as forums for interaction. Regular seasonal farmers markets provide a predictable avenue for sale of locally grown fruit and vegetables, value-added products, and locally produced arts and crafts. Ithaca's Farmers Market, with a

The Ithaca Farmers Market is a cooperative with 150 vendors who live within 30 miles of Ithaca, New York. Agricultural vendors grow and offer high quality products.

¹⁵ <http://www.discoverytrail.net/>

¹⁶ Center for Technology & Innovation, Inc. Tech Works! 17 May 2012. Available online: <http://ctandi.org/pdfs/20120-05-17%20%20AE%20Team%20selection.pdf>.

prime waterfront location, has become a huge tourist destination with social, cultural, and economic benefits. Ithaca is considering making the market a year-round event. Ithaca has a thriving farmers market and more than 30 community supported agriculture groups (CSAs), which offer (typically) weekly subscription service for a delivery of a box of that week's seasonal produce. More than 20% of the produce consumed in Tompkins County is grown locally, according to Cornell Cooperative Extension of Tompkins County.¹⁷ This success can be replicated over time in other Southern Tier cities. Similar markets are operating in downtown Elmira, Corning, and many other communities.

Broome County is establishing a Regional Farmers Market where locally produced foods and goods will be available year-round. Funded by New York State, the market will provide a direct connection between farmers and consumers interested in local foods.

¹⁷ TBC

Working Lands and Open Space

Goal #10: Promote best management of fields, forests, and farmland to keep working lands in production, protect natural resources, and increase carbon sequestration.

Increase the acreage of certified sustainably managed forests in the Southern Tier

This action requires landowner education across the extensive rural portion of the region and development of financial incentives to encourage participation. Highlighting the connections between sustainable practices and improved regional environmental health is important, but it will also be critical to develop increased local demand for sustainably managed wood products through market development activities.

Extend growing season through the use of hoop houses (high tunnels)

Hoop houses or high tunnels are low-cost devices that add up to two months or more to the Southern Tier's four to five month growing season with no additional heating. This action would provide education, promotion, and financial incentives to farmers to increase their use.

Promote soil carbon sequestration

Working with county extension agencies, this action would educate landowners about carbon sequestration options and benefits, and encourage them to adopt reduced till and no-till management practices for their cropped land. It would educate landowners on the CRP program and encourage them to convert marginal cropped land to grass/legume pastures. The program would also educate forested landowners about opportunities for forest-based sequestration; this may be dependent on creation of a carbon credit-based marketing system for forested lands.

Goal #11: Preserve and connect natural resources, open spaces, and access to waterways, to protect regional environment, ecology, habitat and scenic areas, and support outdoor recreation.

Promote and fund purchase of development rights programs to protect farmland from development

Purchase of development rights (PDR) programs is a type of conservation easement that pays property owners to protect their land from development. The purchase price is determined by an appraisal that compares the value of the land without the easement's development restrictions and the value with the restrictions. Landowners voluntarily sell agricultural conservation easements to a government agency or private conservation organization. New York State's Farmland Protection Program was enacted in 1992 and encourages counties and towns to work with farmers to promote local initiatives that maintain the economic viability of agriculture and protect the industry's land base. Funds are available to purchase PDR to farmland.

Enhance and expand downtown parks and open space

Open space in cities and villages takes on a variety of forms and functions – from town squares and pocket parks, to large urban parks and linear greenways; from ball fields and golf courses to community gardens and small urban farms. Parks and open space can serve as social gathering spaces, for active recreation, and for quiet reflection. As downtown neighborhoods increase in population and activity, there will be a need to survey existing parks and other amenities and consider upgrades to improve community quality of life. Well-maintained neighborhood parks have been shown to increase property values for properties within several blocks; cities like St Paul, MN have established special taxing districts around each park to pay for their maintenance.

A well-connected parks and greenways system can also serve as green infrastructure, large vegetated areas for groundwater infiltration and recharge, floodplain management areas, constructed wetlands or rain gardens for stormwater treatment, and wildlife habitat preservation zones. Green infrastructure can also reduce operating costs for stormwater and wastewater treatment and flood control facilities, and also help cities comply with urban stormwater regulations.

Expand and Improve community gardens and urban agriculture sites

More city residents can grow their own food or have an opportunity to purchase locally grown produce if more community garden sites are developed, and sites for urban commercial farming are identified. Given the availability of vacant land in many Southern Tier cities, additional sites should be available for food production. Educational campaigns leveraging information from the American Community Garden Association¹⁸ or the American Horticultural Society's Master Gardener Program¹⁹ can provide best practices and lessons learned. As part of the codes and regulations update noted in the Livable Communities actions, it may also be necessary to revise zoning regulations to permit urban farming and more intensive gardening in residential neighborhoods. Municipalities can also consider requiring usable public open space to be included in major development proposals.

Urban parks and community gardens can not only help provide agricultural, stormwater infiltration, and wildlife benefits, but it can also support community development and civic engagement. Community gardens can be built in a variety of urban areas, such as along streets, in neighborhoods, and on rooftops.

Market flagship municipal parks as visitor draws

Many Southern Tier communities have historic, well-located 'flagship' parks; these may be on a lake or river, have a great view, or just have a unique design and landscaping. These parks can be rehabilitated and marketed as regional attractions for tourists interested in enjoying the culture and character of the Southern Tier. The City of Ithaca, Tompkins County Strategic Tourism Planning Board, and Tompkins County Chamber of Commerce Foundation have undertaken an initiative to rehabilitate Stewart Park, the first waterfront public park in Ithaca. The initiative includes developing an action plan for park rehabilitation and enhancement and exploring long-term management strategies for the waterfront.

¹⁸ <http://communitygarden.org/index.php>

¹⁹ http://www.ahs.org/master_gardeners/

Climate Adaptation

Goal #12: Identify and plan for the economic, environmental, and social impacts of climate change.

Establish a climate adaptation advisory committee

The Southern Tier counties, cities, villages, agencies, non-profits, and research institutions could establish an advisory committee (or working group) to encourage collaboration and idea-sharing around the region. The group could drive many of the activities included in achieving this goal (e.g., establishing a consensus on climate projections, collecting regional climate data, developing a database for funding opportunities, hosting a workshop, developing guidance for integrating climate change into long-range planning, etc.). The group would play a key role in educating local elected and appointed officials, municipal employees, business owners, farmers, and the general public through activities mentioned throughout this section.

Establish a region-wide consensus on appropriate climate projections

Since climate change projections are constantly improving, it is important that decisionmakers in the region have clear guidance on the best available science. By establishing a region-wide consensus on appropriate projections, the counties in the region can be united in support of potential legislation to implement adaptation measures. The Southern Tier counties or a climate change advisory committee could establish a set of consistent scenarios and parameters from which local governments, planners, builders, etc., can assess potential local impacts. These climate projections could build upon the ClimAID temperature and precipitation projections for the region. At a minimum, a set of climate projections would include information about projected rainfall and storm patterns, drought, and extreme heat events.

Compile regional datasets on weather-related events and impacts

Regional agencies, counties, cities, and villages can begin compiling integrated datasets to capture information about weather-related events and their impacts on key assets and services. Data collected could include date, nature of impact, including severity and extent, direct costs of disruption, and indirect costs of disruption. The dataset could help answer questions such as:

- What weather-related disturbances are most frequently cited in public complaints (e.g., basement flooding, bridge washouts)?
- What weather-related events have been identified for reimbursement by FEMA?
- What weather-related disruptions have been cited in local press?
- What impacts have these disruptions had on services and assets in the region?

Seek technical assistance and guidance

Municipalities can reach out to FEMA's Strategic Foresight Initiative for technical assistance and guidance on integrating climate change into emergency preparedness, response, recovery and mitigation.

Develop a database of potential state and federal funding opportunities

As the federal government encourages more interagency collaboration, funding for projects related to emergency mitigation, response, and recovery may become available. Opportunities such as FEMA mitigation grant programs should be distributed among the counties. The Southern Tier counties, or a

climate change advisory committee, can develop a database and be a resource for communities that seek such funding.

Host a climate change vulnerability assessment and adaptation workshop

The climate change advisory committee could host a training workshop or series to provide a platform for collaboration and idea-sharing among local governments and planning professionals. Professionals from all sectors that consider climate in decisionmaking could be invited. Participants can review and share successful vulnerability assessment efforts and adaptation strategies used among Southern Tier communities. Presentations could highlight efforts made in communities throughout the country (e.g., the Greenworks program in Philadelphia and the Adaptation section of the Chicago Climate Action Plan). The workshop could be a good place to debut a climate change guidance manual.

Seek collaboration beyond the Southern Tier

The Southern Tier counties can work with regional councils across the state and country to encourage the creation of more useful assessment tools. For instance, FEMA's HAZUS-MH tool is used to estimate potential losses from hazards, but it does not currently incorporate climate change into those projections. The Southern Tier could provide leadership to incorporate future climate projections into tools that are currently used to assess climate-related extreme events.

As with the FEMA HAZUS-MH tool, the National Flood Insurance Program Maps do not include future sea level rise, land-use change, or shifts in precipitation patterns to determine the 100-year floodplain.

Goal #13: Minimize flood losses by preserving and enhancing floodplains and wetlands, and by limiting development in flood-prone areas

Develop a tool to "crowd-source" local knowledge and observations of recurring flooding

Local knowledge can provide useful insight into changes in the characteristic of recurring flooding. Current technology makes it feasible for municipalities to record flooding through field surveys and via citizen engagement. By developing a tool that allows individuals to report local flooding, Southern Tier communities can gather real time information about incidents and begin to build a robust database about the location of recurrent flooding and newly flooded areas. Additionally, an interactive tool provides the added benefit of engaging residents. A smartphone 'app' would be an ideal platform, since it could include geocoded location and pictures of any flooding events. There is a pilot version of an interactive map currently being tested in Virginia.

The process of gathering information from a large group of non-professional sources is commonly called "crowd-sourcing." Well-known examples of this method include Wikipedia and Open Street Map.

Create a stream feature inventory for the watersheds

Counties, cities, villages, agencies, and/or non-profits could develop a stream feature inventory to help define and prioritize issues related to flood protection. This action will help to categorize all streams and flood prone areas in the region making it easier to identify high flood risk areas and support long-term sustainability. The data could be presented in the form of a state-of-the-watershed report with maps that includes information such as:

- water quality monitoring results,
- biological assessments,

- flooding history,
- flood hazard mapping,
- flood studies,
- watershed land use, and
- existing wetlands and riparian forests.

Implement a regional flood and watershed education program

The Southern Tier counties, agencies, or a climate change advisory committee could develop and implement a flood and watershed education program. It could seek to educate citizens about the way that flooding patterns are altered when changes occur to rivers, creeks, and floodplains. Learning about the way water moves through the landscape can help minimize damages from flooding and develop an understanding of the symbiotic relationship that citizens have with watersheds. The education program can build off the work of the Southern Tier Central Regional Flood Mitigation Assistance Program, including the educational fact sheets about private stream crossings, meandering streams, and groundwater flooding problems.²⁰

As part of the Southern Tier Central Regional Flood Mitigation Assistance Program, a full-time Flood Mitigation Specialist provides leadership, technical expertise, assistance with grants, and educational resources for flood damage reduction activities in the region.

²⁰ "Regional Flood Mitigation Assistance Program Serving the Southern Tier Central Region," Southern Tier Central Regional Planning and Development Board, Spring 2001. Available Online: http://www.stcplanning.org/usr/Program_Areas/Flood_Mitigation/Newsletter%20Articles/FSMANews_2001_STC_Program.pdf

Water Management

Goal #14: Efficiently manage and upgrade existing water, sewer, and other utility infrastructure to support compact development and reduce energy use.

Develop an incentive and reward program for water or wastewater treatment plants that reduce energy use

Small changes in a water or wastewater facility can lead to significant decreases in energy use. Incentives and rewards can be provided to operators to advance the efficient use of energy. These can be financial incentives that can be applied to install energy efficient measures.

Install biogas use systems in wastewater treatment plants

Wastewater treatment produces sludge by removing the nutrients from the treated water. This sludge, if kept in an anaerobic digester, will generate methane biogas, which can be burned for energy and/or heat. Performance contracting can be used to perform infrastructure upgrades necessary to install anaerobic digesters in plants. This renewable energy can significantly reuse a waste product to produce energy, reduce operating costs, and diversify a plant's energy mix, increasing grid reliability. NYSERDA has a well-developed water and wastewater energy savings program, which includes a best practices handbook and other information for operators on installing new systems. The program also provides financial assistance for facility evaluations and installation costs.

There are several ways to obtain funding for anaerobic digestion and biogas use systems. One is through performance contracting, which would pay for the desired infrastructure upgrades, and would be reimbursed through savings on energy use. Other sources include grants from state agencies, loans, research and development budgets, and state funds promoting renewable energy sources, such as those available through NYSERDA. Municipalities could provide other funding for biogas projects and improve awareness of the availability of those funds.

Goal #15: Improve and protect water quality and quantity.

Enhance and expand existing water quality monitoring and data collection programs for Southern Tier watersheds

Knowledge about water quality in the region is incomplete, better information about specific contaminants, their source, and changes over time can lead to better management decisions. Monitoring efforts could be strengthened by focusing on specific constituents in specific watersheds. The Susquehanna-Chemung Action Plan outlines several existing monitoring programs in the region and focuses on improving funding opportunities for improvements in monitoring efforts as well as to evaluate the potential expansion of monitoring efforts, such as monitoring and assessments for bacteria and emerging contaminants of concern. Tompkins County Water Resources Council has focused on improvements in water quality monitoring efforts through filling data gaps, promoting water quality monitoring efforts, and data sharing.

Enhance site-specific source water protection strategies on a regional or local scale

The goal of source water protection strategies is to protect the source of public drinking water supplies and takes a watershed-based approach to protection. Source water protection is relatively affordable as compared to expensive water treatment technologies that are mainly corrective. Source protection strategies include stormwater management practices for new development, as well as existing development and rehabilitation projects. Measures can include retention basins to capture stormwater runoff, and industrial and commercial pollution prevention measures. Another low cost option are green infrastructure strategies which treat stormwater and recharge aquifers using low-tech solutions.

The Green City, Clean Waters program that is being implemented in Philadelphia, Pennsylvania replaces a large portion of city's existing impervious cover with porous surfaces that can intercept stormwater, store it, and then release it at a controlled rate.²¹ This strategy encompasses the Low Impact Development (LID) design approach, which involves either directing runoff from impervious surfaces to pervious surfaces (e.g., landscaped areas) or substituting impervious materials with pervious or porous surfaces. LID can be applied to new development, redevelopment, or as retrofits to existing.²² The Chautauqua Institution Storm Water Quality Treatment Program just recently received a grant to redirect existing stormwater flow from the 250-acre Chautauqua Institution and an additional 450 acres of Institution-owned recreational golf course development, into rain gardens and constructed wetlands.²³ The rain gardens and wetlands will remove pollutants and limit the water from flowing to water ways and picking up pollutants and sediment along the way.

²¹ "Green City, Clean Waters: Green Infrastructure Maintenance Manual Development Process Plan," The Philadelphia Water Department, June 1, 2012, Available online: <http://phillywatersheds.org/lcpcu/Green%20Infrastructure%20Maintenance%20Manual%20Development%20Process%20Plan.pdf>

²² "Water: Low Impact Development," U.S. EPA, Available online: <http://water.epa.gov/polwaste/green/>

²³ "Southern Tier West Regional Focus," Southern Tier West Regional Planning and Development Board, Fall/Winter 2011, Available online: <http://www.southerntierwest.org/pdfs/reg%20focus/reginsight.fall.11.pdf>

Waste Management

Goal #16: Promote innovative waste reduction and management strategies.

Promote waste prevention measures

A public campaign is needed to promote waste prevention measures for food waste and construction and demolition materials across the region. Examples of waste prevention measures include fostering public-private partnerships between municipal or county governments and local businesses, public schools, and institutions, as well as material-specific initiatives, such as encouraging compost use in place of manufactured fertilizer. Additionally, promotion of low-impact materials, such as cellulose insulation which has a high percentage of post-consumer recycled content, could advance waste prevention goals in the construction and demolition waste streams.

Develop demonstration projects to divert waste from landfills

New methods and strategies are needed to divert waste streams. Successful demonstration pilot projects can positively influence the development of new technologies for managing waste. Opportunities include:

- Strategies that reduce the costs to municipalities from collecting recyclable materials include recycling incentive programs such as RecycleBank,²⁴ single-stream recycling systems, and replacing weekly waste and recycling collection with alternate-week waste and recycling collection schedules.
- Innovative recovery processes for additional waste streams. This could include trial programs to collect and recycle additional materials such as plastics #3-#7 and electronics.
- Trial collection services at commercial, institutional, industrial, and multi-family sites to identify and overcome barriers.

Stimulate regional markets for recovery of additional waste streams

Recovery of mixed-color glass, plastic film, certain plastics (i.e., #3-7), tires, construction and demolition materials, and organic waste is challenged by a lack of secondary markets for sale of these recyclable materials.²⁵ Counties in the Southern Tier could play a role in addressing these barriers. For example, the Northeast Recycling Council provides recycling market development resources to assist businesses with directing economically-valuable waste streams to viable markets.²⁶

Development of resource recovery parks could also provide a centralized collection point for difficult-to-recycle materials to facilitate economies of scale. Counties can consider expanding recycled items, increasing bottle deposit costs or items, mandatory recycling laws, disposal bans, which can stimulate recycling markets. For example, Tompkins County law requires residents and business to

Municipalities could adopt programs similar to Tompkins County's ReBusiness Partnership Program, through which the County works directly with local businesses, public schools, and institutions to analyze waste streams and provide tailored strategies to reduce waste, adopt green purchasing practices, and increase recycling.

²⁴ "RecycleBank," Accessed online August 2012. <https://www.recyclebank.com/>

²⁵ Beyond Waste," NYS Department of Environmental Conservation, 2010, pp. 4. Note that Tompkins County now accepts #1 through #7 plastic containers; for more information, see: <http://www.recycletompkins.org/site/view/841>.

²⁶ "Recycling Market Development", NERC, 2012. http://www.nerc.org/topic_areas/recycling_market_development.html

recycle certain commonly recycled materials such as newspaper, food and beverage containers, and cardboard.

Encourage local agencies to lead by example

Local governments could set an example and implement waste diversion strategies of their own, as well as to reduce their own GHG emissions. For example, this could involve the adoption of a mandatory recycling rule for local agencies.

Leverage existing waste facilities to test energy recovery processes

Demonstration projects that leverage existing equipment and facilities for piloting innovative energy recovery processes are an efficient, economical means of testing the potential of new processes. In order to develop innovative waste-to-energy projects, counties could explore partnering with local agricultural or wastewater stakeholders to leverage their experience with anaerobic digestion technologies for waste-to-energy. For example, Broome County's Solid Waste Management Plan update determined that a "scalable approach," which leveraged the County's existing capital investments and experience in yard waste composting, was the best option for advancing alternative technologies for diverting wastes from the county's landfill. This scalable approach would involve incrementally expanding the yard waste program to include pre-consumer food waste (i.e., food waste generated from institutions and commercial facilities) and biosolids.

The Ithaca Wastewater Treatment Plant accepts outside feedstocks, such as animal carcass digester waste and grease trap waste, for anaerobic digestion. The facility collects biogas to generate boiler heat and electricity for two 100 kW generators, accounting for 44% of facility electricity annually.

Anaerobic digestion, gasification, and pyrolysis systems have not yet been applied on a commercial scale.²⁷ These technologies are instead being tested on an experimental- and demonstration-level in municipalities. Broome County's Solid Waste Management Plan evaluated some technologies and conducted a preliminary cost evaluation of each platform based on a representative facility size.

Counties could consider coordinating with large generators of candidate feedstocks (e.g., in the agricultural or industrial sectors) to explore opportunities for demonstrating innovative waste-to-energy technologies. This would encourage mutually beneficial relationships and facilitate opportunities for large feedstock generators to divert their waste from landfills. For example, dairy farmers can implement anaerobic digestion to generate power to sell back to the grid.

Implement sustainable procurement strategies in the region

Implementing a sustainable procurement strategy in the Southern Tier could both drive demand for sustainable products and build awareness of sustainable alternatives to common products or pathways. This typically involves requiring local government operations to source a certain share of products or services that have been certified by third parties according to rigorous, transparent, and reputable standards, usually through eco-labels. Tompkins County has created an Environmentally Preferred Procurement (EPP) sub-committee that works in conjunction with the Finger Lakes EPP Consortium to use collective purchasing power to purchase environmentally-conscious products in bulk, at lower prices.

The Tompkins County Environmentally Preferred Procurement (EPP) committee has also created a resource guide to facilitate "green" purchasing practices and expand purchases of products with recycled content and other environmentally preferred attributes.

²⁷ Anaerobic digestion, however, is used for management of manure and biosolids in many jurisdictions.

Adopt local resolutions in support of Extended Producer Responsibility

Counties in the Southern Tier can adopt resolutions in support of Extended Producer Responsibility (EPR) or Product Stewardship principles and legislation. EPR is a material management framework in which the manufacturers of products are responsible for their products across the full life cycle—including their collection, recycling, and management at end-of-life. The State of New York has enacted an EPR policy for the collection of electronic waste. Counties, including Broome, have adopted resolutions that encourage the transfer of responsibility for waste management to producers and the adoption of EPR legislation.

Consider becoming a Life Cycle Community

At the policy level, cities, municipalities, communities, and counties in the Southern Tier can consider resolutions in their jurisdictions to become a Life Cycle Community. This involves incorporating the principles of life-cycle thinking into a jurisdiction's operations, reporting life-cycle information, and working with employees, educational institutions, and industry to raise awareness and evaluate the life-cycle performance of products.

Promote the use of third-party verified eco-labeling for environmentally-preferable products

Counties can promote the use of third-party verified, credible ecolabeling for environmentally preferable products, and assist in increasing consumer awareness in ecolabels. Ecolabels²⁸ are typically placed on products that communicate the environmental performance of the product to the end user. For example, the New York State's Green Cleaning Program—which provides green cleaning resources to facility managers, school administrators, educators, parents, and citizens—recognizes products with Ecologo and Green Seal ecolabels as environmentally-preferred “green cleaning products.”²⁹

Successful ecolabels include: ENERGY STAR, EPEAT, the Green Seal, and Ecologo. Sustainable Jersey is an innovative program launched in New Jersey that certifies municipalities in the state that implement concrete sustainability actions, including recycling and waste reduction activities.

Launch a regional targeted education campaign to address information gaps

Counties can coordinate their outreach efforts through public education or targeted outreach campaigns. Campaigns can be used to develop and disseminate targeted messages on specific information gaps. Priority topics could include:

- information and resources on composting practices,
- information to address asbestos contamination concerns in construction and demolition wastes, which are a barrier to reuse and recycling,³⁰
- proper practices for on-site composting,
- the time and location of local household hazardous waste and electronics recycling events, and
- the location and acceptance policies of recycling drop-off site.

²⁸ For more information, see: <http://www.energystar.gov/>, <http://www.epeat.net/>, <http://www.greenseal.org/>, <http://www.ecologo.org/en/>.

²⁹ For more information, see: <https://greencleaning.ny.gov/faq.aspx>

³⁰ “Beyond Waste,” NYS Department of Environmental Conservation, 2010, p. 13
http://www.dec.ny.gov/docs/materials_minerals_pdf/frptbeyondwaste.pdf

Develop a Waste Management Community of Practice within the Southern Tier

Counties can consider establishing a Community of Practice within the Southern Tier. A Community of Practice is a group of people who share a profession and who meet to gain knowledge in their field; they may evolve naturally or purposefully. A Waste Management Community of Practice would consist of representatives from local governments, industry, educational institutions, public interest groups, and private citizens. The mission of the Community would be to promote best practices, case studies, and lessons learned on waste management activities, outreach efforts, and the application of Sustainable Materials Management principles, and to disseminate this information to the public and key stakeholders. A useful model is the Northeast Recycling Council, which seeks to advance recycling, toxicity reduction, and environmentally-preferable purchasing in the Northeast.

Potential partners may include sister municipalities or county waste managers from outside New York State, academic groups such as the Cornell Waste Management Institute and Resource and Environmental Management Program at Ithaca College, and commercial and industrial stakeholders. Priority industrial sectors in the region include construction, agriculture, food processing, pulp and paper, and manufacturing. The community could consider joining relevant organizations such as the New York Product Stewardship Council,³¹ engaging with the state government to develop resources that can support Sustainable Materials Management activities in counties and municipalities, and working with industry to apply tools such as Life Cycle Assessment that can help producers evaluate the environmental impacts of their products and services.

³¹ New York State Product Stewardship Council, 2012, <http://www.nypsc.org/>

Governance

Goal #17: Increase collaboration among regional agencies, institutions, and local governments

All actions under Goal 17 were included in the Implementation Strategy.

Goal #18: Increase fiscal efficiency and effectiveness in local government through energy and waste reduction, coordinated investments, and integrated planning.

All actions under Goal 18 were included in the Implementation Strategy.