Chapter 3: Energy

INTRODUCTION

"Energy is the "oxygen" of the economy and the life-blood of growth … this nexus [of resources]will come under huge stress as global growth in population and prosperity propel underlying demand at a pace that will outstrip the normal capacity to expand supply." Energy for Economic Growth, Energy Vision Update 2012 (World Economic Forum)."

Energy and Sustainability Overview

Energy usage has become indispensable to modern life. It makes homes and businesses comfortable, moves people and goods, fires the machinery of industry, and powers progress in society endeavors. It is the backbone of community activity and the lynchpin to societal advancement.

Energy choices made today will have significant impacts on the economy, environment and quality of life for generations to come. With a comprehensive, complimentary, and consultative approach to decision-making, the Central New York (CNY) region can be placed on a sustainable path.

Communities are made up of complicated, interrelated systems — housing, industry, transportation, natural resources supplies and infrastructure for usage — that provide the necessities needed to thrive. In the past, environmental policy and plans for these systems were created separately. However, smarter growth practices, including sustainability planning at the regional level, enable partnerships between state and federal agencies, municipalities, non-profit organizations, private businesses, and residents to break down barriers and develop a sustainability plan that reflects their community's needs. This partnering not only helps to create more integrated, sustainable solutions, but to accelerate investment and development. At its core, sustainable development strives to enhance environmental, economic, and social well-being without degrading current or future natural, economic, and social resources. Every development decision that is made — what land to build on, what road to construct, what energy source to use —affects the economic and environmental health of the region.

This foundational understanding of some of the drivers for undertaking a comprehensive planning effort informs the planning process and underpins the need for this plan. The process for the development of this plan will assess the current state and the projected future state, catalogue the already-identified plans, identify the potential opportunities

and impediments, make recommendations on the indicators to track, the targets to set, the strategies to be pursued, and the potential projects to be implemented to achieve the desired future state. What follows documents the findings of this process.

INVENTORY OF EXISTING ENERGY MARKET CONDITIONS

State of the Energy Market

New York State's energy picture has been in a state of flux from both the demand and supply perspective[1]. The economic downturn which began in 2008 led to significant declines in electricity use with only minimal rebound effects as the state's economy continues to recover. Statewide electricity consumption totaled 163,330 gigawatt hours (GWh) in 2011 (New York State Independent System Operator (NYISO), 2012). Despite a 3% growth in electrical load in 2010, statewide load has grown only 11% over the last 15 years.

Load projections anticipate modest growth in energy needs statewide. If demand for electricity grows at 0.41% annually as forecasted (NYISO, 2012) and there are no unexpected generation retirements, then NYS should have sufficient resources available through the end of this decade. Currently, NYS carries a much greater maximum supply capacity than its required demand. Figure 1 shows that fossil fuel based generation (52%) dominates the composition of the region's installed generation base as it does statewide. However, nuclear generation dominates in terms of the local energy generated (82%) - nearly doubling its dominance in capacity (46%) (see Figure 1). This nuclear generation comes largely from the three nuclear stations in Oswego, alone generating approximately five times the regions' current electrical need. Further, the five counties consume approximately the equivalent output of just one of those nuclear units, Nine Mile Unit 1. The remaining energy production is largely from natural gas and renewable fuels. In total, oil and coal facilities have a capacity equal to 31% of available capacity, but generate less than 1% of the nearly 25,400 GWh of actual electricity produced in CNY.

From the existing generating facilities in CNY, the NYISO estimates that there is approximately 5,624 megawatts (MW) of capacity that is capable of producing 25,434 GWh of electric energy during summer conditions (NYISO, 2012). On a statewide basis, this accounts for 14.5% of the state's generation capacity. By way of reference, the CNY region is about 4% of the state population.

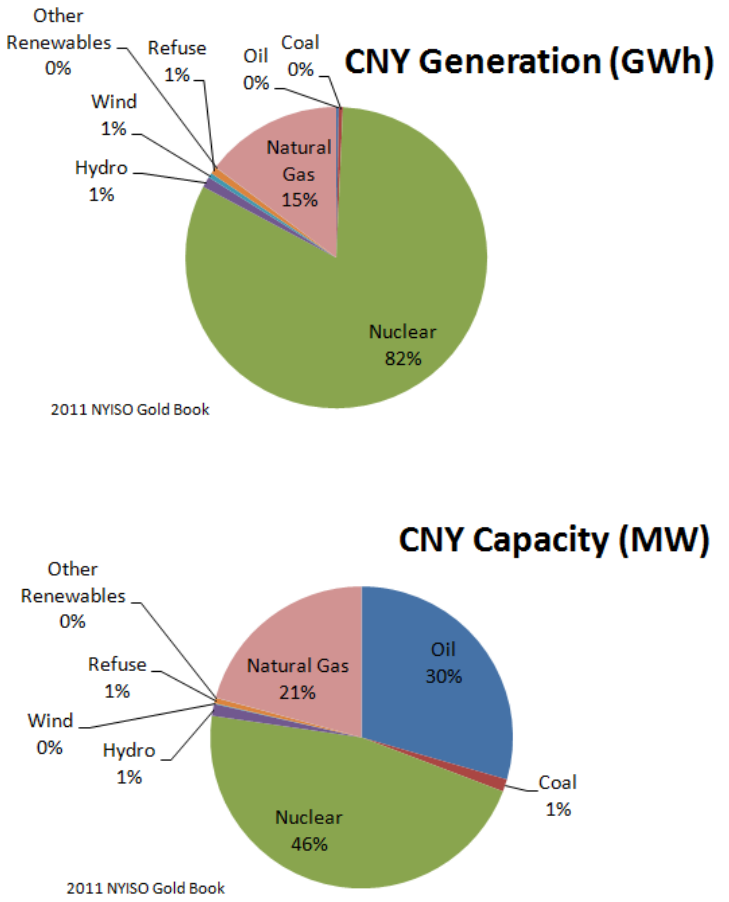

FIGURE 1–Electricity Generation and Capacity in Central New York

1 This chapter addresses energy in the context of its use in stationary (*i.e.*, buildings) versus mobile (*i.e.*, vehicles) sources. All forms of stationary energy use are included. However, the market supply and demand discussion is largely limited to electricity, with discussion of natural gas as it relates to electricity supply and efficiency initiatives.

Energy Supply

As an industry, the nuclear electric generation sector is an essential component to the economic vitality of the region, supporting a large number of highly skilled workers and providing a vehicle for growth regionally and around the state. Oswego County's role in the energy industry is significant.

However, the capacity weighted age of generation in the CNY region is 30.2 years which is significantly skewed since many of the larger capacity additions (nuclear and natural gas) were added in the last 30 to 40 years. Some of the region's oldest generating units, hydroelectric facilities, are reaching a century of service although many have been rehabilitated during relicensing.

Increasing environmental regulations and aging facilities are two of the leading factors in the retirement of existing electric generating facilities. As a result, the need for new generating facilities to meet load requirements must be addressed. For example, NRG Energy Inc. has proposed converting the existing 625 MW coal-fired facility in Dunkirk, NY (Western region) to a modern natural gas-fired combined-cycle plant with the generating capacity of approximately 440 MW — enough to power approximately 350,000 average homes. At the same time, growing interest in alternative energy solutions is resulting in a greater desire to site new generating facilities and conveyances. Additionally, state standards (***e.g.,*** Renewable Portfolio Standard (RPS)) are providing support for the types of generation resources that the marketplace may not otherwise support.

A major feature of the deregulated energy markets in NYS is that private entities own and operate much of the generation that was formerly owned by vertically integrated utility companies. As such, across the five counties within the CNY region, there are three principle groups that energy end-users depend on for system up-keep, development, and reliability: the local distribution companies (LDC), municipal owned utilities (MOU), and major electricity generation companies (MEGC). Many of these entities within CNY are engaged in, and have planned, new energy projects. The drivers for many of these new projects are: needed improvements for reliability and performance, increased energy efficiency, utilization of renewable energy generation, and requests made by end users who seek interconnection and increased generation.

The primary method for determining the status and plans for electric generation expansion or retirement is through the NYISO which manages interconnections and dispatch of generating assets to satisfy loads across NYS. There are six projects currently in the queue for interconnection with the grid in CNY including 5 wind projects totaling 197 MW of generating capacity (see Appendix 10, Table 8). Four of the five are being constructed in Madison County, which further strengthens its already substantial wind capacity, while the fifth wind project is slated for Cortland County making it the first grid connected generation of any kind in that county. The final project is for an efficiency increase to the existing Nine Mile nuclear generation asset in Oswego.

The NYISO also tracks projects that are withdrawn from the interconnection queue (see Appendix 10, Table 9). There exists a wide array of reasons why projects do not succeed, ranging from internal conflicts and funding inadequacy to regulatory change and sunset provisions for incentives. Projects withdrawn from the NYISO indicate a diverse set of technologies from new nuclear and transmission facilities to various renewable solutions like biomass, methane capture, and wind.

The permits and approvals that are required to site a particular generating facility are governed by several factors including the location, type, and size of a facility. As part of the siting process, an environmental review and analysis of the proposed project is needed. For state and local agencies in New York, the environmental review is currently performed under the State Environmental Quality Review Act (SEQRA). For federal agencies, a similar environmental review is performed under the National Environmental Policy Act (NEPA), which is the federal counterpart to SEQRA. Detail on environmental regulations potentially applicable to new and existing generation sources can be found in Appendix 2, Section 5.

Energy Delivery

The electricity generated in CNY above and beyond the region's needs is largely delivered downstate. CNY is located at the transmission crossroads for energy that is not only produced here, but for energy that flows from Western New York as well. The State Transmission Assessment and Reliability (STARS) report released on April 30, 2012, noted that the last major cross-state transmission project was built in the 1980s and that 85% of the state's transmission lines were built before 1980. It also concluded that 4,700 miles of transmission will face end of useful life and may require replacement in the next 30 years. To rebuild and rejuvenate New York State's electric power system and enable the state to meet the needs of a 21st century economy and society, Governor Cuomo proposed the Energy Highway. The New York Energy Highway Blueprint, announced in October 2012, provides a plan for dynamic

public-private partnerships to provide reliable, economical power for the next 50 years. In turn, this program will create new jobs, replace aging infrastructure, decrease congestion on the transmission system, and aid in preparation for new regulations. At the distribution level, each of the LDCs serving customers in CNY has identified projects to improve the networks within their service territories as follows:

+ **National Grid:** National Grid has a significant presence in four of the five CNY counties and a minimal presence in Cayuga County, where it provides electricity to the Town of Niles, and natural gas to the Town of Sennett. Within the CNY counties where National Grid has significant presence, nine projects were reported as planned for implementation between September 2012 and December 2017. These projects, which are detailed in Appendix 10, Table 1, are all driven by improving system reliability to distribution and transmission lines. While improving system reliability is important to existing customers, increasing system growth is also important. More remote users and potential customers who wish to increase or obtain energy use in order to further economic development are dependent on system growth. National Grid offers two specific incentives to address this need: a 3-Phase Power Incentive and a Power Quality Enhancement Program. (See Appendix 10, Section XX for detail on these programs).

+ **New York State Gas and Electric (NYSEG):** NYSEG, operates mainly in Cayuga County, as well as southern Cortland County; central and southern Madison County; and a small presence in western Onondaga County. Every two years, NYSEG compiles a report that is a ten year summary of infrastructure projects, addressing areas of concern based on summer and winter peak loads at specific growth rates. Metrics from the report, as well as problem areas identified and recommended reinforcements for NYSEG Auburn Division, are shown in Appendix 10, Table 2.

+ **Rochester Gas and Electric (RGE):** RGE serves a small service area in northern Cayuga County. Regarding current and future projects for the energy infrastructure, RGE follows the same process as NYSEG for its project planning. Appendix 10, Table 3 provides a summary of RGE projects for the RGE-Lakeshore Area.

The CNY region also includes five MOUs that provide energy services to localized areas (see Table 1). The majority of electric energy for these five municipalities is provided by hydroelectric generation that is allocated by the New York Power Authority (NYPA). The MOUs have developed two associations to address various aspects of their operation: the Municipal Electric Utilities Association (MEUA) of NYS and the Independent Energy Efficiency Program (IEEP). The purpose of the MEUA is to secure energy allocation to the MOUs through NYPA. The IEEP was created as a means to share incentive programs to improve energy efficiency among end users, promote best practices, and attract businesses.

Notable among the MOU projects is the Village of Hamilton pursuit of a natural gas project that will utilize transmission pipelines located

TABLE 1–Municipal Owned Utilities within the CNY Region

MOU	County	Number of Customers	Project Living
Village of Hamilton Municipality Utilities Commission	Madison	1,528	Appendix 10, Table 4
Village of Skaneateles Municipality Utilities Projects	Onondaga	1,499	Appendix 10, Table 5
Auburn Municipal Power Agency Utilities Projects (Cayuga County Public Power Agency)	Cayuga		Appendix 10, Table 6
Solvay Municipal Power Agency Utilities	Onondaga	5,610	Appendix 10, Table 7
Marathon Municipal Power Agency Utilities	Cortland	896	None noted

approximately eight miles away from the village center to offer clean, low cost energy to village residents and businesses. A village-wide natural gas distribution system is planned to be operational by 2017. Not only does a project like this offer clean energy to those currently located within the MOU, but it serves as an attraction to businesses that require natural gas for operation.

Smart Grid: Blurring The Supply-Demand Demarcation

Smart grid is an "intelligent" electricity distribution network that uses advanced sensors and controls, advanced meters, and computers to gather information to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity, as well as to optimize the integration of renewable energy systems. It is also expected to be an important enabler for electric vehicles and plug-in hybrid vehicles, two promising technologies that can help reduce oil consumption, GHG emissions, and other pollutants. Smart grid investment is needed and is called out in the New York Energy Highway Blueprint with plans to invest $250 million to develop Smart Grid technologies to create the most advanced energy management control center in the country.

In the past several years the number of smart grid pilot projects has been increasing. IDC Energy Insights predicts that smart meter installations will

TABLE 2–Performance of Smart Grid Demonstration Projects across the U.S.

		Customer Issues					Technological Issues			
Project Name	Lack of Funding or Cost Issues	Health Concerns	Privacy Concerns	Negative Response to Rate Increases	Inadequate Customer Education for Effective System Use	Customer Service Issues	Equipment or Construction Related Problems	Waiting for Technological Advancement	State / Local Regulatory Orders Causing Delays	Observing Other Pilot Projects before Proceeding
BGE Smart Meter Pilot Program	●			○	●			○	○	
CL&P Plan-it Wise Energy Program	●		○	○					○	
Consumers Energy SmartStreet Pilot, Full Scale Smart Meter Project	●							○	○	○
DP&L Customer Conservation and Energy Management Plan	○		○	○				●		○
HECO Smart Meter Pilot Program	○						●		○	
LIPA BPL and Wireless Communications Demonstration	●	○					●			
PG&E SmartMeter Program		●	○		○	○	●		○	
PSE PEM Program	○	○		●	○				○	
Snohomish County PUD Smart Grid Project				○				●		
Xcel Energy SmartGridCity	●		○				○		○	

● Key Driver for Postponement or Cancellation

○ Other Driver for Postponement or Cancellation

exceed 80 million by 2015 in the U.S., a 40 fold increase from 2007(IDC Energy Insights, 2011). This effort has largely been driven by funding supplied as part of $4.5 billion in American Recovery and Reinvestment Act of 2009 (ARRA) program that included smart grid incentives.

A study commissioned for the U.S. Energy Information Administration (USEIA) by SAIC identified and characterized the performance of 23 smart grid projects across the U.S. (SAIC, 2011) Most every pilot project involved advanced metering infrastructure (AMI), automated meter reading (AMR) as well as smart appliances and dynamic pricing. Of the 23 programs, 13 were viewed as successful or progressing while 10 were either cancelled or postponed; none were in CNY. The primary reasons given for the cancellation or postponement were often attributed to either funding issues or equipment issues (see Table 2). Summaries of the observations from this study are provided in Appendix 10, Tables 10 through 12.

Although no smart grid pilots have been conducted in CNY, National Grid did propose (in January 2010) a comprehensive smart grid demonstration project in the Syracuse area. The plan called for a test site of 39,400 homes and businesses that would use new, state-of-the-art equipment to give customers information about their energy use and tools to reduce their carbon footprint and manage their energy costs. Federal stimulus funds to help fund the project were not awarded and, as a result, the pilot project did not advance.

However, National Grid obtained approval in August 2012 from the Massachusetts Department of Public Utilities for a smart grid pilot program for Worcester, MA. The two year pilot will test new technologies to reduce customer outages, improve operational efficiency, and fully integrate renewable energy including electric vehicles into the grid for over 15,000 customers. This pilot will take a holistic approach to deployment of technology and tools. This plan will enable scale up of "end-to-end" solutions. This pilot is consistent with National Grid's vision to "deploy Smart Grid Technology in order to optimize the flow of green energy resources, enhance the performance of the electric distribution grid, and provide customers with the ability to make informed decisions about how they use energy." A conceptual rendering of the program is shown in Appendix 10, Figure XX.

Energy Demand

Introduction

The demand side of energy is the consumer need for both primary and secondary energy. Primary energy refers to a form of energy that is used in its natural state, like coal or oil. Most primary energy undergoes a conversion into forms of energy that are more convenient to handle. These secondary energy sources, which include electricity and gasoline, are the most prominent examples with which consumers may be familiar. The conversion of primary energy to secondary energy leads to conversion losses. In addition, some energy is lost in the transportation of secondary energy (like electricity) from the point of production to the point of use. The losses mean that more energy is produced than is consumed. Thus, the customer measure of reductions from demand side activities is even greater because of the avoided conversion and transportation losses.

Demand side changes are largely, if not exclusively, in the hands of the consumer. Various methods can encourage the behavior changes or investment decisions that will lower energy demand and related energy usage. Energy conservation and efficiency measures, as well as demand response, are reviewed below. Energy demand refers to the maximum needs of consumers that must be met by the energy supplier. Usually, the goal of demand response or demand side management is to encourage the consumer to use less energy during peak hours, or to move the time of energy use to off-peak times, such as nighttime and weekends. While not an issue for CNY, decreasing peak demand can help reduce the need for investments in energy networks and/or power plants that might otherwise impact consumer costs.

Energy Conservation Measures/Energy Efficiency/ Demand Response Conditions

NATIONAL PROGRAMS

On the national stage, notable programs include the U.S. Department of Energy's Better Buildings Initiative and the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED®) green building program.

In February 2011, President Obama announced the Better Buildings Initiative to make commercial and industrial buildings 20% more energy efficient by 2020 and accelerate private sector investment in energy

efficiency. Leading CEOs and executives of U.S. companies, universities, school districts, and state and local government are taking the Better Buildings Challenge and showcasing the solutions they use and the results they achieve to help spur billions in new investment and savings in commercial buildings and industrial plants.

LEED® is a voluntary, consensus-based program that provides third-party verification of green buildings. LEED®Designs, energy savings, and operational practices promoted by LEED® are valuable and have been transforming market practices.

A centerpiece of LEED® is the concept of integrated or whole building design which requires that the members of the design team coordinate their decisions to arrive at a final result that is "greater than the sum of its parts". More than 20 buildings in the CNY region that have achieved a LEED® rating in the new construction, Commercial Interiors, Core Shell, Existing Buildings and LEED® for Homes categories are presented in Appendix 3, Table XX. Additionally, in CNY, Destiny USA tenants are also part of the LEED® program. Tenant spaces within the Destiny USA expansion are required to be designed, constructed, and certified to USGBC LEED® for Commercial Interior standards.

In addition to LEED®, new construction projects that achieve a certain level of energy cost savings are also eligible for a federal tax deduction of up to $1.80 per square foot (sq. ft.) of floor area (DSIRE-Tax, 2006). To qualify for the full deduction, the building owner must use an approved building simulation model[2] to demonstrate that the building uses 50% less energy than a baseline building; for energy savings less than 50%, the credit is prorated. Design teams in the region have taken advantage of this credit for new schools and other government buildings.

STATE PROGRAMS

NYS was one of the first states to implement energy efficiency standards in its building codes. NYS is now moving to implement the national Model Energy Codes, which harmonizes the requirements of the state with code compliance across the U.S. This harmonization was accelerated by stipulations attached to federal funds NYS received under the ARRA.

The building code provides a strong foundation for energy efficient buildings in the region. In addition, the CNY region is served by several state programs intended to promote energy efficiency, reduce GHG emissions, and provide a more reliable electric grid. These programs include incentives offered to residential, commercial, industrial and institutional customers to reduce electricity, and more recently natural gas, use.

Programs offered by NYSERDA, National Grid, and NYSEG are funded largely by systems benefit charges (SBC) on customers' electric and natural gas utility bills. NYSERDA programs are the most well-established and serve the widest range of customers with programs targeted at various sectors. In addition, the Dormitory Authority of the State of New York (DASNY) is empowered to provide financing and construction services to specified not-for-profit institutions. DASNY programs encourage energy efficiency as well as green design and construction practices. Finally, the NYPA provides wholesale power to municipal utilities in the region (***e.g.***, Solvay, Hamilton, Skaneateles) as well as several state-owned institutional buildings. NYPA also offers incentive programs to assist large and small businesses, not-for-profit organizations, community-owned electric systems, rural electric cooperatives and government entities in reducing energy use and cost.

NYSERDA has managed SBC funds through two programs, the New York Energy $mart℠ (NYES) and the Energy Efficiency Portfolio Standard Programs (EEPS). Funding from these programs covers a broad spectrum of energy related projects, all designed to develop competitive markets for energy efficiency; demand management; outreach and education services; research, development, and demonstration; low-income energy assistance; and to provide direct economic and environmental benefits to New Yorkers across all customer classes (NYS SBC, 2011).

According to the NYS SBC Evaluation paper (NYSERDA, 2010), the NYES and the EEPS programs are making good progress toward meeting the overarching public policy goals of NYS. These public policy goals include the following (NYSERDA, 2012):

+ Improve New York's energy system reliability and security by reducing energy demand and increasing energy efficiency, supporting innovative T&D technologies that have broad application, and enabling fuel diversity, including renewable resources.

+ Reduce the energy cost burden of New Yorkers by offering energy users, particularly the State's lowest income households, services that moderate the effects of energy price increases and

2 See http://doe2.com/ for further information on this freely available building simulation model.

EXAMPLE ENERGY CONSERVATION MEASURES

Installation of efficient lighting with occupancy sensors in a manufacturing warehouse resulted in reduction of energy demand and usage with a payback of 1.4 years before incentive.

The installation of variable speed compressors for the air system in a manufacturing facility saved more than 455,000 kWh annually, with a payback of less than two years.

volatility and provide access to cost-effective energy efficiency options.

+ Mitigate the environmental and health impacts of energy use by increasing energy efficiency, encouraging the development of support services for renewable energy resources, and optimizing the energy performance of buildings and products.

+ Create economic opportunity and promote economic well-being by supporting emerging energy technologies, fostering competition, improving productivity, stimulating the growth of New York energy businesses, and helping to meet future energy needs through efficiency and innovation.

+ This progress demonstrates the diversity of NYS specific programs and the comprehensive approach NYS has undertaken to reduce energy use and become more energy efficient. NYS has seen peak demand decrease by 934.2 MW due to 4,346 GWh of energy use reduction brought about through NYSERDA energy efficiency programs, 11.7 MW of newly installed renewable energy capacity, and increased implementation of distributed generation/combined heat and power systems. The goal of reducing the energy cost burden to low-income families of NYS has led to nearly $789 million in energy savings for these participating customers, resulting in $354 per year in average customer energy bill savings.

NYSERDA has also reported on environmental and health impacts, as well as the economic opportunity and economic well being, brought about by energy use reduction and energy efficiency. The decreased energy use across the state has directly led to the reduction in air emissions of nearly 2.0 million tons of carbon dioxide (CO_2), 3,919 tons of sulfur dioxide (SO_2), and 1,962 tons of nitrogen oxides (NO_X). Many thousands of building structures in NYS have undergone some energy optimization (see ***e.g.***, Figure 2), requiring energy professionals to perform studies that have led to the total net job creation of 5,700 jobs through NYSERDA's SBC funded programs.

By the end of 2011, the cumulative annual electricity savings brought about by EEPS and NYES programs through NYSERDA was 5,615 GWh, and nearly 6.3 million British thermal units (MMBtu) of natural gas, fuel oil, and other fuel savings. Further cumulative reductions included a reduction in peak demand by 2,010 MW, with 1,077 MW of permanent demand reduction and 933 MW of callable load reduction. NYSERDA has been effective at achieving savings through funding assistance. Introduction 13 clearly identifies a direct relationship between spending and energy savings, and it also highlights the goals achieved in peak reduction through NYSERDA programs that reduce the need for additional generation build out to accommodate load growth around the state.

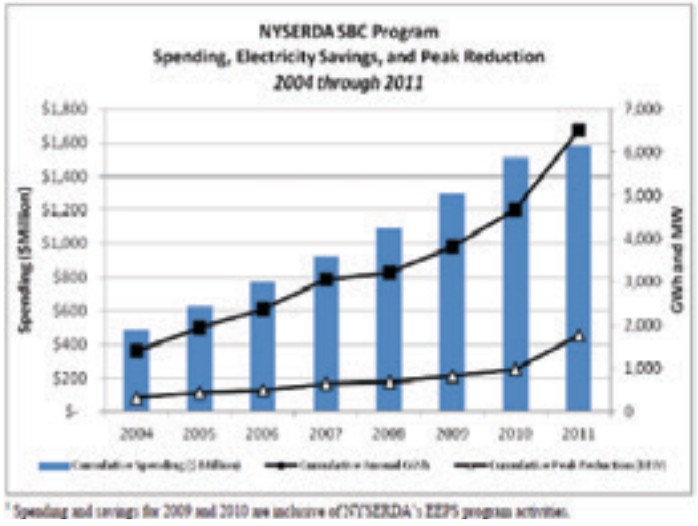

FIGURE 2–NYSERDA SBC Program Spending, Electricity Savings, and Peak Reduction 2004 - 2011

NYSERDA's program effectiveness has varied over the past 7 years, but since the economic recession in 2007-2008, the effectiveness of the programs has increased. The greatest increase was between 2010 and 2011, increasing from 3.13 GWh of energy savings for every million dollars spent, to 4.11 GWh of energy savings for every million dollars spent. It is noted that the performance improvement of NYSERDA is impressive given the fact that much of the easy to install and high return on investment projects were initiated in the early program years leaving more challenging and complex projects to be completed in more recent years. It also may demonstrate the general energy consumer's "energy awareness" that did not exist only a few years ago.

NYSERDA's program participation for the Existing Facilities Program (EFP), New Construction Program (NCP), and the Industrial & Process Efficiency Program (IPE) indicate that for years 2010 and 2011 the CNY region saved more than 39.2 million kilowatt hours (kWh) through nearly 436 individual projects.

REGIONAL RESULTS

Non-residential Programs

NYSERDA's Energy Efficiency Services (EES) group is responsible for three programs focused on commercial and industrial (C&I) and institutional customers. Participation data from the NYSERDA EES programs for the CNY region indicate that 268 commercial, institutional, and industrial customers participated in these programs in 2010, achieving estimated annual energy savings of 24 GWh. Of the total 2010 energy savings, 47% were from industrial sites, 30% from retail and wholesale commercial buildings, and 6% from colleges and universities. This accounts for about 9% of the customers and 7.5% of the energy savings statewide (statewide numbers were 2,953 customers and 318.6 GWh for 2010). This compares to 2011 data for the region which indicate that 167 commercial, institutional, and industrial customers who achieved estimated annual energy savings of 15.2 GWh. The reduction in 2011 may have been due to the rise in utility programs (***i.e.***, National Grid, NYSEG) in that year.

In 2010, the most prevalent source of savings through the EES program was lighting retrofits, accounting for more than half of the savings in the C&I programs. The next largest source of savings was variable frequency drives (VFD) installed as part of the pre-qualified program, followed by industrial process improvements and heating, ventilation and air conditioning (HVAC) replacement projects. New construction efficiency accounted for about 10% of the program savings. In 2011, new construction became a larger portion of overall savings, increasing in absolute terms by a factor of two. VFDs, industrial process improvements, and HVAC also continued playing a large role. The variance in the source of energy savings in 2011 was likely utility programs offered better incentives for lighting in that year.

Figure 14. Spray Foam Applied to Underside of Roof Deck for Increased Insulation and Air Tightness

Current energy efficiency programs in the region are achieving annual electric reductions on the order of 1% per year. Doubling these efforts of implementing efficiency measures to lower electric consumption in commercial buildings in the region by 2% per year over 20 years (from 2010 to 2030) would save more than 626 GWh per year by 2030. This cumulative 40% reduction of electricity use would result in annual GHG reductions of 142,000 $MTCO_{2e}$ equivalent per year by 2030.

Similarly, implementing efficiency measures to lower natural gas consumption in commercial buildings in the region by 1% per year over 20 years (from 2010 to 2030) would save more than 2,500,000 MMBtu per year by 2030. GHG reductions of nearly 131,000 $MTCO_{2e}$ per year by 2030 might be realized.

Combined, these reductions in electrical and natural gas consumption for the commercial buildings sector would reduce GHG emissions by 273,000 $MTCO_{2e}$ per year by 2030.

Residential Programs

NYSERDA's Residential Energy Services (RES) group administers energy efficiency and "weatherization" programs targeted to new construction and existing homes. Generally, the programs support Energy Star® principles and use energy surveys or audits to identify improvement opportunities.

In 2010, NYSERDA received $40 million in funding from the USDOE's ***Better Buildings Neighborhood Program*** to enhance and extend these programs. NYSERDA reported to USDOE that in the 16 month period ending March 2012 accomplishments included: nearly 25,000 residential evaluations (audits) had been completed; more than 8,000 energy improvements were implemented; and more than 1,300 low interest loans, each averaging approximately $10,000, were provided.

Homes in the region generally have more significant heating loads than the average New York home. Analysis of regional data shows that about 65% of residential customers in the CNY region use natural gas for space heating. Fuel oil is the next most common fuel followed by liquid propane gas and then electricity except in Onondaga County where, due to a greater concentration of apartments and lower Solvay Electric rates, there are more electric heat customers.[3] This analysis also unexpectedly identifies that fuel oil use is lower in CNY than in the remainder of NYS.

Energy efficiency programs and other homeowner activities in the region are currently achieving on the order of 1% per year in overall energy reductions. Increasing these efforts to reduce natural gas use and electricity use by 2% and 1% over 20 years (2010-2030), respectively, would result in annual savings of 450 GWh and 6,400,000 MMBtu by the year 2030. The electric savings of 20% after 20 years equate to 102,000 $MTCO_{2e}$ per year by 2030. Similarly, gas savings grow to 40% after twenty years equating to GHG reductions of 345,000 $MTCO_{2e}$ per year by 2030. Combined, these electric and gas savings would reduce GHG emissions by nearly 447,000 $MTCO_{2e}$ per year by 2030 in the residential sector.

LOCAL EFFORTS

Local organizations are in a good position to support energy efficiency and renewable energy options through outreach and education. For instance the CNY RPDB has led the **CNY Energy Challenge** since 2011 and has also directed the **Energy$mart Communities Program** for NYSERDA since 2007. The challenge is designed to increase awareness of energy efficiency and renewable energy options available through NYSERDA, utility, and other programs. It also offers regional initiatives such the **Energy Efficiency Revolving Loan Fund** that makes low interest loans available to businesses in the region.

3 Solvay Electric has 5,300 customers, or serves about 2.6% of the county's population.

Distributed Generation Conditions

Distributed generation, also called on-site or decentralized generation, allows collection of primary energy from smaller and more locally-placed sources and may improve security, and certainly diversity, of supply. The ability to connect these types of distributed generation resources to the grid, called electrical interconnection, has become standardized for all utilities in NYS as per the Standard Interconnection Requirements (SIR) issued by the New York Public Service Commission (NYPSC). Finally, net metering provisions that allow the owner of distributed generation to sell any excess power generated back to the grid at specified rates are also in place.

The CNY region is well-positioned to increase its use of distributed generation resources. Several technologies that achieve these outcomes are already deployed throughout the region and are described in detail in Appendix 4 including current penetration in the CNY region. The success of these installations should provide the impetus to others considering their own responsible energy options.

As illustrated in Table 3, each technology generally lends itself to more complimentary location-based conditions. Geographic conditions naturally lend themselves to wind and hydropower. Wind is favored in the hilly areas of Madison and Cortland Counties, as well as along the Lake Ontario shoreline. Large hydropower works best in the region's larger rivers. Land use is the driver for other distributed generation technologies. For example, district energy has more potential in urban areas whereas anaerobic digestion has the most potential on larger farms in rural areas. CHP and fuel cells also have slightly more potential in urban areas. Other technologies are often adopted when compared to competing energy sources. Solar thermal has the most potential in rural areas where hot water heating is normally performed with electricity while a geothermal source is most cost effective where natural gas is not available. And finally some technologies, like solar electric, have no particular location-based driver to their adoption. Federal and state income tax credits are available for several of the distributed generation technologies are summarized in Appendix 4, Table 17.

THE POLICY LANDSCAPE

Energy and Climate Change

According to the United Nations Framework Convention on Climate Change (UNFCCC), "climate change" is defined as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC, 2012). Naturally occurring gases dispersed in the atmosphere play a critical role in determining the Earth's climate by trapping solar radiation. This phenomenon is known as the greenhouse effect. Overwhelming scientific evidence suggests that human activities - most notably the combustion of fossil fuels in buildings and vehicles– is increasing the concentration of GHGs in the atmosphere. Collectively, these GHGs intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

This nexus between fossil fuel usage and climate change has spawned mandatory and voluntary activity from governments, businesses, universities, and individuals. The efforts occurring through international agreements, national engagement, and regional compacts were reviewed to provide a context for the region's plan.

Scientists expect climate change to have diverse impacts on all geographic scales: increased temperature swings; higher frequency of droughts and floods; increased spread of infectious diseases; more frequent and damaging storms accompanied by flooding and landslides; summer water shortages as a result of reduced snow pack; and disruption of ecosystems, habitats, and agricultural activities. Moreover, the impact of human activities – including activities that release GHG– would shift ecosystems in a sudden, nonlinear, and possibly irreversible manner, with unknown consequences. Finally, because the climate is a unified global system, no geographic location – including CNY – can be thought of as "immune" to the effects of its disruption.

TABLE 3–Technologies with the highest potential by County

Distributed Generation Technology	Cayuga	Cortland	Madison	Onondaga	Oswego
Solar Thermal	•	•	•	•	•
Solar Photovoltaic (PV)	•	•	•	•	•
Wind		•	•		•
CHP		•		•	
Anaerobic digesters	•	•	•		•
Hydropower				•	•
Geothermal	•	•	•	•	•
Fuel Cells				•	
District Energy Systems			•	•	•

Opportunities at the Intersection of Energy and Sustainability

From ICF International's December 2012 GHG inventory report, 87% of the regions emissions result from energy consumption, predominantly from transportation and buildings. Natural resources are drawn upon, goods and services are sold, and governance occurs at national, state, and local levels. Four key indicators demonstrate that energy can be a driver to sustainable progress for CNY.

1. **Interrelated Resource Usage and Consumption Considerations -** Energy often sits at the crux of other resource usage. For example, energy costs typically constitute 25-30% of the operations and maintenance costs at water and wastewater facilities. Many municipalities typically spend about 35% of their energy budget on water pumping and treatment. NYSERDA conducted a statewide energy assessment of the water and wastewater sector in New York State and found that this sector consumes 2.5 to 3 billion kWh/year (approximately 2 billion kWh/year for wastewater treatment and 1 billion/year for drinking water). The sector spends between $250 and $300 million per year, and savings of ten to fifteen percent are easily achievable.

2. **Energy and Security -** According to the National Conference of State Legislatures (NCSL, 2003), "energy security" refers to a "resilient energy system…capable of withstanding threats through a combination of active, direct security measures—such as surveillance and guards—and passive or more indirect measures-such as redundancy, duplication of critical equipment, diversity in fuel, other sources of energy, and reliance on less vulnerable infrastructure". Use of energy efficiency and distributed generation, including through small-scale wind and solar installations, are key pathways to ensuring energy security.

3. **Technology Innovation and Job Creation -** The Climate Prosperity Project, developed by Clean Economy Solutions (CES), is one of several studies that have emphasized the economic benefits of efforts to combat climate change. Its central thesis is that the triple challenges of stiff global competition for high-paying jobs, energy security imperatives to reduce dependence on foreign oil, and the need to address climate change, can all be addressed by promoting energy savings, business opportunities, and job creation.IntroductionFigure 3 shows how steps taken on both sides of the market economy – demand and supply – could facilitate the creation and capture of the benefits of climate prosperity.

FIGURE 3–Climate Prosperity Framework

4. **Energy and Manufacturing Policies -** Finally, governing policies are instrumental in shaping the "demand" and "supply" paths. The World Wildlife Fund (also known as the World Wide Fund for Nature) (WWF, 2012) recently released a report on the relative rankings of countries in the domain of clean energy technology manufacturing. It pointed to three key characteristics for a high-ranking country: (i) a coherent and stable policy environment; (ii) a focus on research and development (R&D) from basic research to applied demonstration projects; and (iii) availability of sufficient capital.

The integrated nature of these issues and the desire to chart a course for meaningful progress dictated that knowledge gaps be addressed by reviewing the energy and sustainability landscape from the borders of nations around the globe to the heart of the CNY region.

Global Landscape

On a global scale, primary energy demand has consistently shown growth and is currently projected to continue growing for the foreseeable future. Multiple energy scenarios have been projected to 2035 by the International Energy Agency (IEA, 2010). Although consumed renewable energy is projected to more than double by 2035, it only gains a 4.2% share of the world's total energy consumption (USEIA, 2011).

Meanwhile, concerns over studies indicating increasing atmospheric GHG emissions led countries to join an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC, 1992) , to cooperatively consider what they could do to limit climate change, and to cope with its impacts. In 1997, countries adopted the Kyoto Protocol, a legally binding set of emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. Successive efforts have yielded agreement that a second commitment period, from 2013 onwards, would seamlessly follow the end of the first commitment period. There are now 195 Parties to the Convention, although the United States is not a signatory. The European Union and Australia, among others, have enacted mandatory mechanisms to address GHG emissions.

National Landscape

Drivers in the Energy Industry

From a national perspective, the United States as a whole has made strides to change its energy source mix, especially in the electric generation arena. States like California and New York have provided leadership in energy trends from conservation to generation. This movement from fossil fuels to cleaner and renewable energy production technologies has been primarily driven in four fundamental areas:

+ ***Regulatory:*** In recent years, federal and state regulations directed at reducing air and/or climate emissions have been increasing. These regulations have targeted large stationary sources, largely electric generation units. As a result, some generators are closing more carbon-intensive facilities and replacing them with facilities that use cleaner or renewable fuels. In addition, RPSs established by individual states have set generation mix targets that prescribe the percentage of renewable energy that must be supplied to utility customers.

+ ***Economic:*** The deregulation of the wholesale electric and natural gas markets in the 1990s, as well as subsequent discoveries of shale gas, have changed the economics of energy production significantly. In the last four years, petroleum and natural gas prices have decoupled and improved the long run economics of cleaner natural gas generation to the point where natural gas is cheaper than coal on an energy-content basis. The result, more electric generation is being produced using natural gas as opposed to coal.

+ ***Incentives:*** Many states, as well as the federal government, have implemented incentives ranging from corporate tax credits and accelerated depreciation to feed-in tariffs and loan programs to encourage investment in renewable technologies. These efforts have also been assisted from both public and private investment in clean technology research to incubate and commercialize energy efficient and clean technologies. These incentives help to make cleaner and renewable technologies more economically competitive with traditional fossil resources.

+ ***Sustainability:*** The elevated consciousness of both corporations and consumers to sustainability has led to a pull strategy for renewable generation and environmentally friendly and energy efficient products. Faced with rising stakeholder interest in and customer demand for these products and services, producers have answered the call with cleaner and renewable product offerings.

The USEIA Annual Energy Outlook 2012 projects that over the next 25 years industrial and commercial sectors will lead growth in energy demand while the residential and transportation sectors remain relatively constant or decline. As mentioned earlier, the energy growth will largely be absorbed through increased renewable supply in the energy sector. Interestingly, this will not come solely in the form of "traditional" renewable technologies of hydroelectric, but in new resources including wind, biomass, solar, and geothermal. Hydroelectric will witness growth through improved capacity upratings at existing sites, but is limited by the availability of optimum water resources.

There are numerous policies and initiatives that are supporting climate protection, energy efficiency, renewable energy, and sustainable community living across the country. A few of the more notable ones include the ARRA, the ***President's Executive Order on CHP (August 30, 2012)*** , the USDOE ***Offshore Wind Development Initiative (announced March 1, 2012)*** and ***SunShot Initiative (established in 2010),*** and the interagency program ***Partnership for Sustainable Communities*** developed and supported by HUD, the USDOT and the USEPA. Additional federal initiatives which support the furtherance of energy efficiency and renewable energy are listed in Appendix 1, Table XX. The federal government also provides a range of financial incentives to individuals as well as entities in support of energy efficiency and renewable energy deployment. These are listed in Appendix 1, Table XX.

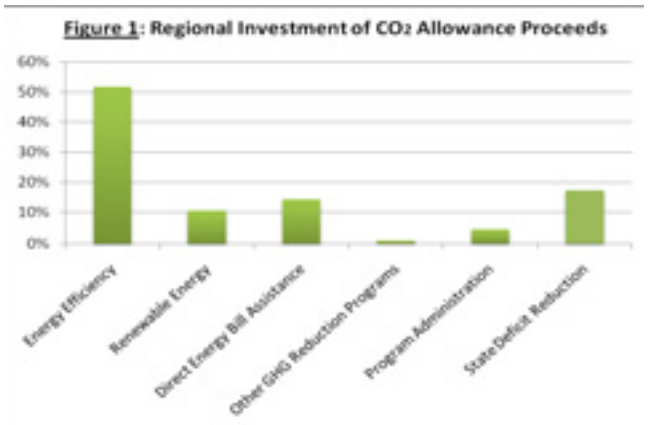

FIGURE 4–RGGI Regional Investement of C0² Allowance Proceeds

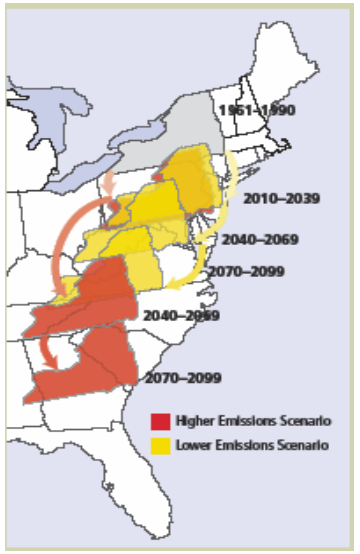

FIGURE 5–Future temperature projections for NYS

Projections from climate models indicate continued impacts for the New York State in terms of temperature increases, sea level rise and increased frequency of extreme weather events, such as the October 2012 arrival in New York City of Hurricane Sandy. By way of a visual example, by the end of this century, the typical summer in upstate New York is projected to feel like the present-day summer of South Carolina – 700 miles to the south.

The ***U.S. Mayors Climate Protection Agreement (Mayors Climate Protection Center, 2005)*** is an example of a local initiative that is operating across the nation. Finally, the ***Regional Greenhouse Gas Initiative (RGGI, Inc.)*** is the first market-based regulatory program in the U.S. created in 2003 for the purpose of GHG emission reduction. A multi-state initiative which includes NYS, RGGI uses a cap-and-trade framework to target reductions in GHG emissions.Introduction 16 shows that over 50% of proceeds collected through RGGI, amounting to more than $993 million has been directed to energy efficiency. (RGGI, Inc., 2011)

NYS Landscape

NYS and other large states like California have taken a leadership role in energy production and conservation. This is reinforced by this state's

long history in energy production and transmission, originating with some of the very first electric generation and transmission structures built in the world in the Niagara Falls Region, to the thought leadership and innovation developed by Edison and Tesla in the Capital Region. NYS also possesses a mindset for stewardship of this innovation through world class entities that make NYS unique among its peers:

NYSERDA: NYSERDA is often considered a state scale USDOE supplying research and funding assistance to meet New York's energy goals through the reduction of energy consumption and promotion of the use of renewable energy while protecting the environment. Since 1975 this public benefit corporation has been serving consumers of all types and institutions through funding either by grant through the state or ratepayers through the Systems Benefits Charge (SBC).

NYPA: Established in 1931 by Governor Franklin D. Roosevelt, the New York Power Authority (NYPA) is the largest state power organization in the U.S. with 17 generating facilities and 1,400 circuit miles of transmission. Just as NYSERDA, NYPA also serves a diverse base of customers through power allocations like ReCharge NY, energy efficiency programs, and assisting in the development of renewable resources statewide.

Appendix 1, Table XX provides a listing of some of the more significant programs from these organizations, and from the Governor's office that support a vision for sustainable energy in NYS.

Review of installed resource mix for electric generation reveals that fossil fuels dominate the composition of the installed generation base in NYS. Most striking however is the actual output of the units when compared to installed capacity.

NYS has been no exception to the global and national climate change trends. Average atmospheric temperatures have been rising throughout the 20th century, as have sea levels (IPCC, 2007). Projections from climate models indicate continued impacts for the state in terms of temperature increases, sea level rise and increased frequency of extreme weather events, such as the October 2012 arrival in New York City of Hurricane Sandy. By way of a visual example, by the end of this century, the typical summer in upstate New York is projected to feel like the present-day summer of South Carolina – 700 miles to the south (seeIntroductionFigure 5). Additional impacts are expected in the areas of agriculture, coastal zones, ecosystems, energy, public health, telecommunications infrastructure, transportation, and water resources.

In anticipation of and in response to these changes, NYS has been proactively establishing initiatives and policies including:

+ Executive Order 24 (2009) that sets an ambitious climate protection goal to reduce GHG emissions by 80% by 2050

+ The "45 x 15" Initiative (2009) which set a goal to meet 45% of New York's electricity needs through improved energy efficiency (15%) and clean renewable energy (30%) by 2015

+ The 2010 Interim Report for the New York State Climate Action Plan proposes ways for state government and key economic sectors to reduce GHG emissions, adapt as the climate changes and promote a green economy.

+ The 2011 ClimAID Study examines how climate change impacts (***e.g.***, rising temperatures, more precipitation, severe weather conditions, and sea level rise) will affect New York State's economy, environment, communities and human health. The study explores measures to adapt the state to climate change impacts. The Sea Level Rise Task Force Report (2010) examines sea level projections for New York coastlines and offers recommendations for state action.

+ Governor Cuomo's November 15, 2012 announcement of the NYS 2100 Commission who are tasked with finding ways to improve the resilience and strength of the state's infrastructure in the face of natural disasters and other emergencies, and

+ The December 28, 2012 issuance of Executive Order 88 by, Governor Cuomo directing state agencies to increase energy efficiency in state buildings by 20% in seven years. The Governor also launched "Build Smart NY," a plan to strategically implement Executive Order by accelerating priority improvements in energy performance.

Additional state initiatives which support the furtherance of energy efficiency and renewable energy are listed in Appendix 1, Table XX.

CNY Regional Landscape

The CNY RPDB GHG inventory conducted in conjunction with the development of the RESP identified that CNY's 2010 baseline gross GHG emissions were approximately 9.9 $MTCO_{2e}$. Onondaga County had the largest share of emissions, with 55%, while Cortland County had the lowest share of emissions, with 8%. Onondaga is also the most populated county in the region (59% of 2010 population), while Cortland is the least populated (6%). The primary driver of emissions in the region is population. The CNY region as a whole has lower per capita emissions than the United States, primarily a result of the region's electricity grid mix. The CNY electricity emissions reflect a grid mix with high proportions of nuclear, hydropower, and natural gas (with lower carbon intensities) compared to the nationwide average grid mix featuring higher proportions of coal and oil (with higher carbon intensities) (ICF, 2012).

Onondaga County War Memorial LED lighting retrofit.

CNY has seen significant activity in the form of energy and climate initiatives – by way of planning and projects alike – in communities across the region. At the municipal level activities have included the ***Onondaga County Climate Action Plan***, the ***Oswego County*** greenhouse gas inventory, as well as an Energy Efficiency Plan, the ***Syracuse Sustainability Plan,*** and the ***City of Auburn and Cayuga County*** Comprehensive Sustainable Energy and Development Plan. Action is demonstrated through solar PV projects at Dewitt Town Hall, Preble Town Hall, Oswego City Crisafulli Ice Rink and Oswego County Health Complex, as well as Light Emitting Diode (LED) projects at the Onondaga County War Memorial Introduction 18) and for the City of Auburn public streetlights (Figure 19).

Thirteen communities have adopted the New York State Climate Smart Communities pledge, and the CNY RPDB was selected as the Climate Smart Communities Coordinator for CNY (1 of 4 regions selected in the pilot program phase). The CNY RPDB is also designated a Climate Showcase Community by US EPA and seven communities are completing GHG inventories and Climate Action Plans with their assistance, including City of Cortland, Town of Preble, Madison County, City of Syracuse, Town of Dewitt, Village of Skaneateles, and City of Oswego.

Higher education institutions in CNY are also demonstrating leadership in energy efficiency and climate action. Cazenovia College, Colgate University, Onondaga Community College, State University of New York (SUNY) College at Cortland, SUNY College of Environmental Science and Forestry, SUNY Oswego, and Syracuse University are signatories to the American College & University President's Climate Commitment (ACUPCC) where supporters complete GHG inventories, develop Climate Action Plans, and submit progress report, will a goal to achieve carbon neutrality.

Capitalizing on Regional Strengths

In developing this plan, CNY sought to capitalize on the region's strengths, identify a path to overcome the region's challenges, and seize the near-term opportunities and the longer-term potential that can be foreseen on the horizon by anticipating and tracking the trends and drivers of change affecting the region. CNY RPDB began by establishing and engaging an Executive Advisory Committee (EAC) to identify these strengths, challenges, opportunities and drivers of change. They are presented as the foundation upon which to start the journey to achieve the Central New York Regional Sustainability Plan (***VisionCNY***, see http://wwwvisioncny.org/).

The CNY region has significant natural and man-made resources that might best be described as strengths that will support the efforts in developing this RESP. The CNY region has an abundance of natural resources that can be tapped to generate electricity, ***e.g.,*** an excellent wind resource, adequate solar access, and natural gas resources through intrastate pipelines as well as the Marcellus shale. Waste has even been tapped through the Onondaga County Resource Recovery Agency (OCRRA) Waste to Energy Plant. The region has an established and diverse set of electric generation facilities and related infrastructure, ***e.g.,***

small hydro facilities; nuclear power facilities; underutilized CHP plants; biomass facilities, including the efforts at State University of New York College of Environmental Science and Forestry (SUNY-ESF) to expand the use of willow; biorefineries; (Great) lake source cooling; and electric vehicle charging stations. There is available land to support development of renewable or more efficient electric generation, including agricultural acreage dedicated to farms and dairies. The dairies also lend themselves to the possibility for bio-digester projects, solar thermal, and solar PV projects. In addition to available land, there also are vacant or underutilized buildings that provide opportunity for rehabilitation to more energy efficient structures or demonstration opportunities for renewable technologies. Further, the region is home to a wealth of higher education institutions and centers of technology including the Syracuse Center of Excellence, SUNY senior and community colleges, Lockheed Martin, McQuay International, Carrier, Clean Tech Center, among others. There is also a significant presence of high-tech firms owing to a strong regional history of manufacturing. Finally, the region currently has relatively high electrical rates, making investments in energy efficiency and renewable energy more economical due to the likely shorter payback period and higher return on investment.

However, the CNY region does face challenges as it develops this RESP. Some are those that any area might face, such as the resistance that new energy infrastructure projects face in the form of environmental challenges or technology or site-specific resistance. The latter is usually termed "NIMBY" (not in my backyard) and is common for the siting of onshore or offshore wind projects, hydrofracking, and nuclear facilities in the post-Fukishima era, but may apply to any development project (***e.g.***, pipeline, power line, generation facility, pilot facility). The region's rich and long history also means the presence of aging infrastructure – whether in the form of electric generation, transmission and distribution facilities or housing stock that is generally less energy efficient than newer stock.

CNY stands literally at the foothills of tremendous opportunities. Generous rainfall and snowfall combined with reasonable elevation changes provide opportunities for small hydropower development. In fact, it was the availability of water power that was a key driver of initial development in the region. A game-changer in the energy landscape is the high supplies of shale-based natural gas unlocked through hydraulic fracturing in areas such as the Marcellus shale – which incorporates just under half the geographic area of the CNY region (including all of Cortland County, and parts of Cayuga, Onondaga, and Madison Counties (NYSDEC, 2012)) – has led to a dramatic (greater than 50%) drop-off in natural gas prices over the past approximately two years. Since several renewable energy projects are predicated on high fossil energy prices, this is often seen as an unfavorable development. On the other hand, however, it is possible that shale-based natural gas could displace the use of coal in electricity generation, which would lead to a reduction in GHG emissions. In addition to the existing Marcellus shale deposit, there is potential access to the Utica shale natural gas deposits which can complement variable solar and wind power. Some of the CNY municipalities already are increasing their usage of clean fuel vehicles. The availability of meaningful federal, state and local programs (see Appendix X, Table Y and Z) presents a funding source to help CNY capitalize on these opportunities.

The most important global, national, and state-level trends or drivers of change that the CNY needs to respond to include:

+ Economic and population trends that will drive energy needs;
+ Technological innovations and cost reductions for clean energy technologies which are affecting energy production and storage, ***e.g.***, the shift to distributed generation, smart grid, and electric vehicles; and,
+ The dramatic downward impact that access to shale gas, now accessible due to hydrofracking technology, has caused on energy prices which may reduce the competitiveness of renewable resources.

DeWitt Town Hall 51kW solar PV installation.

Identification of Alternative Energy Opportunities

In the following sections, various distributed and renewable energy technologies are reviewed. A screening level analysis was conducted to identify potentially viable projects that could be implemented in the CNY region. The screening level analysis is preliminary. The viability of any individual energy opportunity is driven by a complex relationship between the available energy resource at a given location and the ability to design, build, and operate a system at that site in a cost effective manner. The more prevalent the resource at a given location, the more energy production potential is available; however, several other important variables also play a key role in the decision-making process to site an energy project including location suitability, the cost of energy, and offset of GHG emissions.

As can be seen in the Vision CNY Energy Consumption waterfall chart (Figure 6), the screening efforts of this plan have identified that of the 100,700,000 MMBtu energy consumption of the region, pursuit of energy efficiency in all sectors over the next 40 years could reduce the region's energy demand by nearly 31,000,000 MMBtu, or approximately 40%. In addition, penetration of renewable technologies, at levels matching the potential for such in the region, could provide approximately 8.3% of the current energy need. The combination of the deployment of efficiency and renewable at these levels would result in a cleaner energy infrastructure for CNY. Absent load growth, which is currently below 1% and projected to stay as such (cite), CNY will have a smaller, cleaner energy portfolio to meet CNY's own energy needs. In addition, the "green jobs" created through the deployment of these technologies

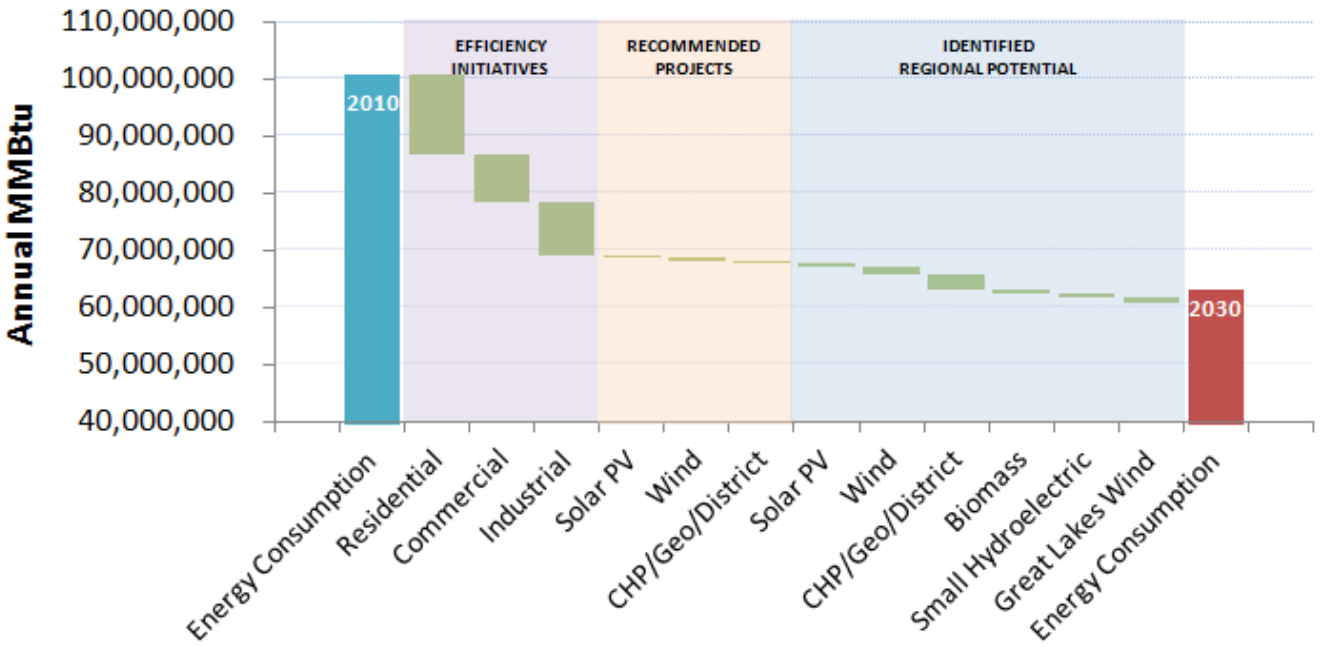

FIGURE 6–VisionCNY Projected Energy Consumption from Regional Projects

will position CNY as a leader in the economically and environmentally responsive energy infrastructure of tomorrow.

Solar - Small Scale and Large Scale

For this plan, a resource assessment and build-out analysis was prepared to understand the viability of small and large scale solar energy ("solar photovoltaic" or "PV") development in the region. The complete report, is provided in Appendix 5. Small and large solar project opportunities are summarized in Table 1. The location of solar project opportunities is identified in Table 1. For the purposes of this assessment, small and large solar are defined as:

+ Small Solar: Behind-the-Meter PV; 250 kW or less
+ Large Solar: Distributed and/or Utility-Scale; greater than 250 kW

For comparison purposes, a 250kW solar system can power approximately 20 residential homes, annually[4]. To identify potential solar sites, a desktop Geographic Information System (GIS) based approach was used to develop a preliminary list of 177 potential small and large sites near potential load centers that could directly benefit from the installed power capacity, such as urban areas, or large manufacturing facilities. The development opportunity for each site was evaluated and preliminary sites were ranked based on site conditions and proximity to electrical load. It is note that the list of preliminary sites was reviewed and a phone survey was attempted to reach site contacts/facility managers in an effort to gather site-specific information related to the structural characteristics of the roof or potential land availability. This outreach effort resulted in minimal direct communication with a site contact.

An advanced site screening was performed on the highest ranking solar sites to estimate the energy production, levelized cost of energy (LCOE) and the offset of GHG emissions. Advanced screening focused on evaluating the factors that could impact site suitability such as adjacent/current land use, drainage patterns, and potential sources of shading such as tree canopy, nearby structures and elevated terrain. For the rooftop sites, the visual assessment focused on evaluating critical site characteristics such as:

+ Shading considerations
+ Roof tilt
+ Roof orientation
+ Building use
+ Roof conditions (damage, resurfacing, worn spots)
+ Prevalence of obstructions (***e.g.***, HVAC, exhaust)
+ Point of electrical interconnection (when visible)

Site reports were completed for three large and fifteen potential solar projects identified through the site screening process. A total of 54 alternate sites were also evaluated for development opportunity. From those alternates, an additional ten solar project sites were examined, for a total of 28 solar project site reports.

In summary, if the eighteen large and small solar projects were developed the net energy output would power 1,071 New York residences and measure 7,857 MWh annually; the annual energy production would result in a total offset of GHG emissions estimated at 1,783 metric tons. If the ten alternate solar sites were developed the net energy output would measure 79,378 MWh annually, power 10,829 New York residential homes, and offset GHG emissions by 18,016 metric tons. Combined, these 28 solar projects would generate 87,235 MWh annually, power approximately 11,901 residential homes and offset 19,799 metric tons of GHG emissions.

Wind – Small and Community

A site screening was performed to identify large and small scale projects that exhibit favorable characteristics suitable for the application of wind turbine generators (WTG). The complete reportis provided in Appendix 5. Wind project opportunities are summarized in Table 1. The location of wind project opportunities are identified in Table 4 of the Executive Summary. Project sizes initially screened were defined as follows:

+ Small Wind: Behind-the-Meter; WTG less than 225kW or mid-range turbine rating (250-850kW)

4 Calculated from US Energy Information Administration data, based on average annual 2010 New York State residential consumption found at: http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3.

+ Large Wind: Community Wind; less than 20MW Plant; WTG greater than 1.0 MW

A wind resource site screening exercise was performed to identify potential high quality sites for small and large land-based wind projects. The screening effort focused on small, single-turbine installations planned for behind-the-meter applications and large community wind projects (up to 20 MW). At the small wind sites, site selection was performed using small (<225 kW) and mid-range (250–850 kW) turbines. A large-scale wind turbine (>1.0 MW) option was evaluated, when site conditions were deemed suitable.

The preliminary screening stage included the application of exclusion areas and identification of suitable wind resource areas. For small wind projects, due to the large number of potential locations, areas exhibiting wind speeds of less than 5.5 m/s were excluded from consideration. In addition, topography is an important variable on the potential constructability of a wind plant. A maximum slope of 15% is typically recommended to help ensure project feasibility and maintain International Electrotechnical Commission (IEC) upflow wind parameters. To avoid eliminating sites that could be suitable with minor load mitigation efforts, a maximum slope exclusion of 20% was applied for this region's screening effort.

The preliminary screening identified fifteen small and twelve large wind project sites in the study area after evaluating the potential buildable area and net capacity factor. The preliminary list of potential projects was visually assessed for site suitability using aerial imagery and topographic maps to identify occupied structures, new developments, road access, overhead transmission lines, surrounding land use, and other topographic features. A number of sites were eliminated due their proximity to occupied structures and/or poor access. Turbine selection was based on the local wind regime and desired installed capacity.

Preliminary Site Selection: Large Wind

In the United States, a wind turbine hub height of 80 m (262 ft.) is most widely used for utility-scale wind projects. However, with the development of larger turbines and rotor diameters suitable for moderate wind regimes, the industry is currently trending toward taller towers (typically up to 100 m, or 324 ft). It is expected that this trend will continue in the future as developers seek to maximize energy production at the higher hub height, while potentially optimizing costs by deploying fewer turbines. Central New York experiences generally moderate average wind speeds that increase with height above ground. Therefore, to maximize energy production potential all large project sites considered in this study were assumed to use a 100 m hub height.

Selecting the appropriate class of turbine models for a proposed project can have a substantial impact on the energy production at that site. The recommended turbine class is determined by climatologic parameters, such as the mean and extreme wind speeds and the turbulence intensity at speeds of 15 m/s. Based on the New York State wind maps and speed-frequency distributions at the targeted 100 m hub height, a Class III turbine was selected for the site screening process to identify large wind sites in Central New York.

Two maps, project area net capacity factor (NCF) and buildable area, which indicate potential areas for optimal Class III wind generation and development, respectively, serve as inputs to a GIS-based site screening algorithm. This program was designed to identify suitable utility-scale sites by achieving three objectives:

+ Minimize the cost of energy, including road and transmission interconnection costs

+ Encompass enough near-contiguous land to support a project of approximately 10 MW while avoiding excluded areas

+ Estimate the expansion potential of each site.

Using this method, twelve preliminary large wind projects were identified in CNY exhibiting the most energetic winds and potentially suitable/available land area (see Appendix 5, Table 8?)

Preliminary Site Selection: Small Wind

Small wind sites are intended to support a behind-the-meter application, therefore the selection process differed from the large sites. Once the region was screened for exclusions and slope, the buildable area was overlaid with parcel data obtained from CNY RPDB. A senior GIS-specialist performed a visual assessment using a desktop screening process to target load centers such as schools, hospitals, large campuses, industrial areas and manufacturing facilities. Non-federal superfund sites and brownfields were also targeted, as indicated from parcel data and data obtained from the U.S. Environmental Protection Agency, New York State GIS Clearinghouse and CNY RPDB. For targeted sites, a visual

assessment was performed to determine if potential land area was available for siting a wind turbine.

Small wind projects often use turbines with lower hub heights than the large-scale models. A range of 50-60 m hub height was used as typical of small/mid-range turbines suitable for behind-the-meter installations.. These hub heights were used to examine sites that were manually selected and apply the standard turbine offsets to determine the maximum potential hub height possible at that location. If standard offsets were violated for the smallest turbine model the site was eliminated from further consideration.

The average annual wind speed at each remaining preliminary site was estimated at a 50 m and 60 m hub height. If observations indicated that a larger-scale turbine could be accommodated on the site, the wind speed at 100 m was also estimated. Using this methodology, 15 preliminary small wind sites in CNY exhibiting the most favorable wind speeds were identified (see Appendix 5, Table 9?).

Advanced Site Screening: Large and Small Wind

Once the small and large wind sites were identified, a desktop review was performed to determine the feasibility of developing wind power at each location. The preliminary list of potential projects was visually assessed for site suitability using aerial imagery and topographic maps to identify occupied structures, new developments, access, overhead transmission lines, surrounding land use, and other topographic features. A number of sites were eliminated due their proximity to occupied structures and/or poor access.

Three top performing prospective community or large wind projects were identified: one each in Cayuga, Onondaga, and Madison counties as shown on Figure 4. Plant capacities range from 9.6 MW to 11.2 MW, for a possible total of 30.4 MW. Net capacity factors range from 43.7 to 45.0%. These plants are capable of generating 118,264 MWh per year from wind power, resulting in a potential offset of 16,134 metric tons of greenhouse gas annually.

Five prospective small wind projects within CNY were identified: three in Oswego County near Lake Ontario, one in Onondaga County, and one in Madison County. Each of these sites can support a single-turbine installation for behind-the-meter application. The turbine models that could be accommodated on the site were evaluated. Potential project capacities range from 100 kW to 1.6 MW depending on the turbine model used. Locations of these sites are shown on the 37 m wind speed map and 65 m wind speed map in Appendix 5 (Figures ? and Figure ?, respectively). Only two of the prospective small wind projects were found suitable for the 100m turbine (Appendix 5, Figure ?).

In summary, if the three large wind projects were developed the net energy output would power 16,134 New York residences and generate 118,264 MWh annually; the annual energy production would result in a total offset of GHG emissions estimated at 17,106 metric tons. If the five small wind sites were developed and the largest turbine considered suitable at each site was installed, the net energy output would measure 16,594 MWh annually, power 2,263 New York residential homes, and offset of GHG emissions by 3,766 metric tons. When considered together these eight sites are capable of generating 134,858 MWh per year from wind power, resulting in a potential offset of 30,606 metric tons of GHG emissions and would power approximately 18,398 residential homes.

Combined Heat and Power (CHP) and Combined Cooling, Heat and Power (CCHP)

Combined Heat and Power (CHP) – also known as combined cooling heating and power (CCHP) or co-generation – uses an on-site power generation source to meet both electrical and thermal loads in a facility simultaneously. The heat produced by the prime mover (***i.e.***, the engine, turbine, or fuel cell) as a consequence of electrical production, can be used on-site to meet facility heating or cooling loads.Introduction Figure 7 on page 48 presents a graphic of a typical CHP facility.

In contrast, central station utility power plants expel this heat to the atmosphere. Thus, CHP systems provide better utilization of fuel and as such, are a form of energy efficiency. CHP systems overall efficiency is in the range of 75% as compared with a central utility plant that is approximately 51% efficient. The economic benefits to the customer and the environmental benefits to society are often closely aligned for CHP systems – so a project that is more cost effective or profitable for a customer should also provide greater environmental benefits.

An issue that can impact the success of CHP systems is utility rate tariffs. Both National Grid and NYSEG have rate structures that include fixed Standby Charges. A decade ago, interconnection with the electric utility was one of the most difficult issues faced by CHP projects. However, in 2003, the NYPSC established the SIR that harmonized the interconnection details for on-site generators among all NYS utilities. In addition, CHP hardware is capital intensive and must be optimally sized to operate the

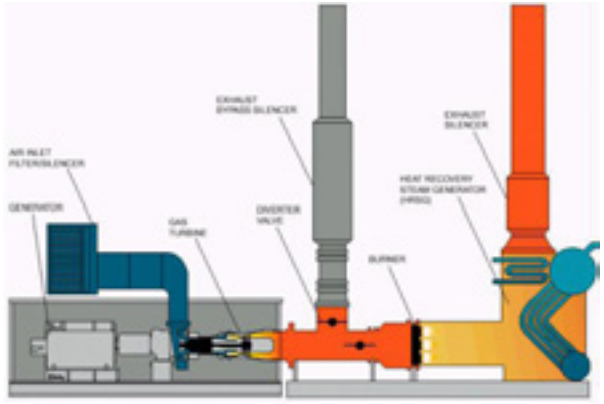

FIGURE 7–Typical CHP Facility

entire day and year to provide greatest return on investment. A more comprehensive listing of potential benefits and challenges associated with developing a CHP project is included at Appendix 6.

The goal of the CHP screening process was to identify potential large-scale CHP project sites and to screen them for technical and economic viability through a process that addressed electrical and thermal loads, order of magnitude costs, benefits, and constraints. Several applications, including large multi-family buildings, hotels, hospitals, nursing homes, assisted living facilities, universities, and certain industrial processes, are especially favorable to CHP. To be cost-effective, thermal and electrical loads must be consistent (or at least well synchronized) across the day, week and year. Generally, CHP systems are sized to meet the thermal loads, not the electrical loads.

TABLE 4–Table 5. Potential CNY CHP Sites

Potential Site	County	City (C), Village (V) or Town (T)	Project Description	Estimated Annual Electrical Savings (kWh/yr)	Estimated Annual Natural Gas Savings (Therms/yr)	Estimated Annual GHG Savings ($MTCO_{2e}$)
Queens borough Farms	Madison	Canastota (V)	Gas engine driven air compressor	575,000	-3,000	115
Oneida Healthcare Center	Madison	Oneida (C)	550 kW Engine Generator	4,600,000	-209,300	(67)
Syracuse University Steam Station (SUSS)	Onondaga	Syracuse (C)	6.5 MW gas turbine generator with heat recovery steam generator. 1.4 MW backpressure steam turbine.	59,000,000	-2,250,000	1,449
St. Joseph's Hospital Health Center	Onondaga	Syracuse (C)	4.5 MW gas turbine with heat recovery steam generator	32,460,000	-2,130,000	(3,884)
Byrne Dairy Yogurt Plant and Visitor Center	Cortland	Cortlandville (T)	Yogurt plant and agritourism center at Finger Lakes East Business Park	Not Constructed	Not Constructed	

The CHP project sites that ranked highest in the screening evaluation are listed in Table 5 along with a brief overview of the cost and benefits of CHP for each.

Like any capital-intensive project, installing a CHP system requires a careful evaluation of the owner's goals, needs, long-term outlook, and of course, the technical and economic feasibility of the project in terms of simple payback and life cycle costs. The detailed feasibility study must understand and consider a wide range of issues including:

1. Thermal and electric loads, current and future, in the facility
2. Gas and electric utility rates, including future projections
3. The physical details such as space and location for equipment, piping and electrical layout details, electrical interconnection details, etc.
4. Electric utility interconnection issues
5. Impact of the system on occupants and neighbors
6. Environmental and regulatory requirements
7. Ability of internal staff to operate and maintain the system.

When considering CHP, the facility's long term planning, decision-making processes, current purchasing strategy for energy, tolerance for fluctuating utility costs, and concerns about overall environmental costs and benefits must be considered. Many of these issues can be precisely quantified, while others require a more qualitative evaluation.

Geothermal

Geothermal heat pump (GHP) technology, also known as ground source heat pump or geoexchange, is a highly efficient renewable energy technology that is gaining wide acceptance for both residential and commercial buildings. Geothermal heat pumps can be used for space heating and cooling, as well as for domestic water heating.

The technology relies on the fact that the temperature of the earth a few feet beneath the surface remains relatively constant throughout the year, warmer than the air above it during the winter and cooler in the summer. The geothermal heat pump takes advantage of this by transferring heat stored in the earth or in surface water into a building during the winter, and transferring it out of the building and back into the ground or water source during the summer. The ground or water body acts as a heat source in winter and a heat sink in summer. Geothermal systems perform best when these seasonal loads are balanced.

Typically, a closed-loop, ground heat exchanger transfers heat between the system (or building) and the ground. Open loop systems can pull water from a nearby body of water (lake, river, retention pond) or an aquifer (see example in Introduction). Pond loops sink coils of piping into a body of water to provide the benefits of closed loop systems with much lower installed costs.

Similar to district energy systems (see Section 4.6), geothermal energy can be distributed to multiple buildings such that cooling in one building can supply heat required in another building. Unlike district energy, the temperature of the GHP distribution piping does not require insulation; in fact, the pipes actually act as additional heat transfer surface, further enhancing the overall performance. An example of this is the 300 ton Arts Quad Energy Node Project at Skidmore College (Saratoga Springs, NY) where five buildings are being served with a single geothermal loop field, capturing economies of scale as well as the synergies associated with the load diversity between buildings.

GHPs are sometimes used in residential applications, though the availability of low cost heating fuels (such as natural gas) and the relatively high cost of electricity in the region have historically limited the cost effectiveness of these systems. GHPs more often are used in commercial buildings where unitary water source heat pumps provide heating and cooling to each zone. A typical building includes many heat pumps connected on a common water loop. When space conditioning is not needed, the heat pump can be off (compared to other HVAC systems that operate continuously, such as variable air volume systems). The size of the ground loop is usually driven by heat rejection requirements in the cooling season, even in CNY. Buildings that are highly zoned (schools, offices) with modest annual cooling loads (schools) are often the most cost-effective building applications for geothermal technology. Geothermal systems are especially cost effective in locations where natural gas is not available as a heating fuel.

Some additional examples of GHP projects in CNY include Memorial City Hall and the Police and Fire Station in Auburn, Cayuga Community College, the former Barden Homes manufacturing facility in Tully, and Lemoyne College in Syracuse. The largest local project is perhaps the

Richard S. Shineman Center for Science, Engineering and Innovation at SUNY Oswego, which includes 240 500-foot bores with 1-1/4 inch diameter pipe.

The goal of the geothermal screening process was to identify potential large-scale geothermal project sites with a focus on commercial/industrial parks, institutional campuses or neighborhood-based applications. Potential project sites were identified and screened for technical and economic viability through a process that addressed electrical and thermal loads, order of magnitude costs, benefits, and constraints associated with production and distribution of heating and/or cooling energy. Fuel availability and adjacent land uses were also addressed.

The first step involved developing an overall list of building candidates for GHP, utilizing e-mail communication and an on-line survey tool sent out to all clients in the Earth Sensitive Solutions database, as well as many K-12 schools and colleges in the region. Candidates were asked to answer a series of questions related to their building and to GHP. This survey produced nearly 40 responses.

Step two involved reviewing the list and attempting to screen down to a "top ten" list of candidate sites. Contact was made with each survey respondent by email or phone, to gain further familiarization with their buildings and their needs. The following criteria were used to initially identify and rank potential candidate sites.

Characteristics that were seen as unfavorable:

1. Facilities less than 25,000 gross building sq. ft.
2. Utilizing geothermal pipe field water only (no heat pumps) for cooling of chillers or chilling of water for indoor cooling units.

TABLE 5–Potential CNY Geothermal Sites

Potential Site	City (C), Village (V) or Town (T), County), County	Description	Incremental Cost	First Year Energy Cost Savings	Simple Payback Period (years)
SUNY Cortland, Park Center	Cortland (C) Cortland	Retrofit existing ice rink and pool facility with heat pump system that extracts heat from ice making operation and uses the recovered heat to maintain pool water temperature.	$1,104,000	$306,000	3.6
Onondaga Community College, Coulter Library	Onondaga (T) Onondaga	Replace existing dual duct system for 90,000 sq. ft. library with GHP HVAC installation.	$453,000	$33,300	13.6
Empire Brewing Company, Empire Farmstead Brewery	Cazenovia (V) Madison	A GHP system would be a natural complement to the proposed 20,000 sq. ft. brewing operation, where waste heat such as that present in the mash be extracted to heat the building in winter.	$90,200	$9,160	9.8
Syracuse Community Health Center (SCHC)	Syracuse (C), Onondaga	The SCHC is proposing to construct a new 60,000 sq. ft. medical office building on South Salina Street in Syracuse.	$217,000	$17,800	12.2

3. Facility is new or has recently upgraded systems with high efficiency HVAC equipment.

4. Characteristics that were seen as favorable:

5. Currently utilizing fuel oil or propane for heating systems.

6. Existing air conditioning based on chilled water or direct expansion cooling systems.

7. Older boilers or cooling equipment; existing inefficient systems.

8. A large portion of the building requiring air conditioning.

The third step involved reviewing the "top ten" list and gathering additional information through follow-up conversations with the building owners to develop the short list of candidate sites. This included a preliminary selection of what appeared to be the four best candidate sites (see Table 5). Building walkthroughs were conducted, existing drawings were reviewed and recent utility data was collected when available. For proposed new buildings (Empire Farmstead Brewery and SCHC), preliminary design drawings were reviewed. For each of these new or proposed facilities, a thermal envelope model and hourly energy model were created using the Carrier Hourly Analysis Program (HAP). These results were then analyzed, and proprietary software was used to estimate both construction costs and financial results.

District Energy

District energy is the local production and distribution of thermal energy for heating and cooling homes, commercial and institutional buildings and industrial processes. District energy systems are comprised of two main elements:

+ A central energy plant containing equipment that produces thermal energy in the form of steam or hot water for heating and/or chilled water for cooling. The central plant may also incorporate CHP units which produce electricity and useful thermal energy; and

+ A network of insulated pipes to distribute the thermal energy from the central plant to the buildings.

The steam, hot water, and chilled water services that are distributed can satisfy a range of building energy needs including space heating, domestic hot water and cooling. District energy is a proven means of delivering these services that is well-established in most major U.S. cities and is widespread in countries across Europe and Asia. It delivers a range of social, sustainability, environmental and economic benefits by providing reliable, efficient, affordable, and clean thermal energy from locally controlled and highly efficient central plants. In the U.S., most systems are fired by natural gas but, due to their scale, have the flexibility to utilize multiple fuel sources (seeIntroductionFigure 8) and to harness waste heat from industry as well as local renewable resources such as geothermal, large scale solar thermal, woody biomass or other biofuels. A district energy network provides the means for combining the energy demands of many buildings to achieve the economies of scale that can make these renewable resources more practical than they might be in an individual building.

District energy systems are typically used in dense urban settings, such as central business districts of larger cities, university or college campuses,

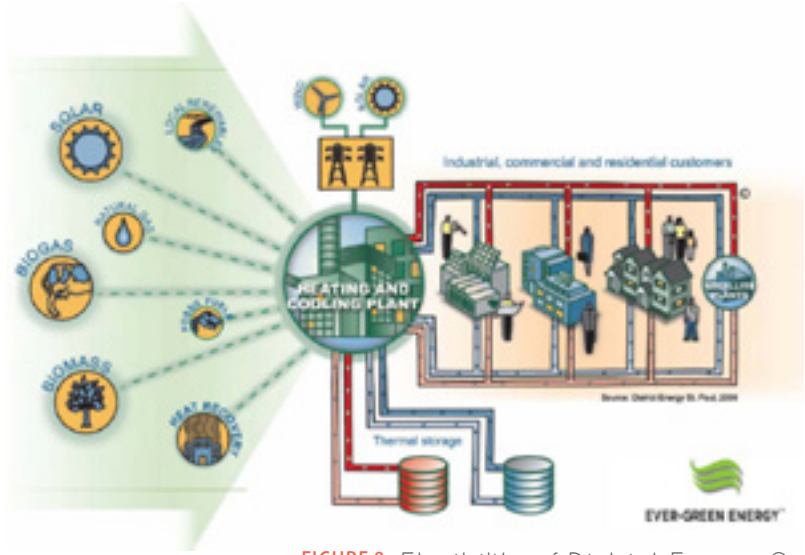

FIGURE 8–Flexibility of District Energy Systems

hospital or research campuses, military bases, and airports. District systems can serve clusters of buildings regardless of whether they have one common owner or separate owners. Typical systems can range from as few as three buildings to as many as 1,800 buildings demonstrating the range of different situations where district energy systems can be applied. District systems take advantage of economies of scale as well as operational benefits of connecting a diverse grouping of customers.

Woody biomass can fuel a district energy heating plant boiler directly, or wood fuel can be converted to low-emission synthetic gas or "syngas." The Dockside Green harbor front community in British Columbia is utilizing this advanced biomass gasification technology to fuel a district energy hot water heating plant that will eventually serve 26 buildings totaling 1.3 million sq. ft. of mixed residential, office, retail and light industrial space. The biomass gasification system serving Dockside Green was developed and built by Vancouver-based Nexterra Systems Corp., which has partnered with General Electric (GE) to develop CHP systems using syngas as a fuel for GE-Jenbacher internal combustion engine generators (District Energy 2009). Nexterra and GE recently announced the opening of a 2 MW biomass CHP system at the University of British Columbia's Vancouver campus (Nexterra 2012).

CNY has a number of district energy systems, including the Onondaga County District Heating and Cooling facility that serves county office buildings, and the Syracuse University (SU) Steam Station that provides chilled water to the campus and steam to several other institutional facilities on University Hill. A number of other college campuses in CNY have district heating and/or district cooling systems, including Colgate University, SUNY Oswego, SUNY Cortland, and SUNY Morrisville, among others.

Incorporating district energy encourages land use planners to shape building development in a way that supports the use of district energy networks. This occurs by locating producers of excess heat near to users of heat or developing buildings with high heat densities in clusters that can be connected to a heating and/or cooling piping system. Appendix 8 provides additional detail on district energy including potential benefits and challenges associated with developing a district energy network.

CNY sites were screened to identify potential large-scale district energy project sites with a focus on commercial/industrial parks, institutional campuses, or neighborhood-based applications. Potential project sites were identified and screened for technical and economic viability through a process that addressed electrical/thermal loads, order of magnitude costs, benefits, and constraints associated with production and distribution of heating and/or cooling energy. Fuel availability and adjacent land uses were also addressed. The following factors affecting the applicability of a district energy solution were used to evaluate potential district energy sites in CNY:

+ Seasonal and daily load characteristics
+ Greenfield versus redevelopment projects
+ Price and availability of electricity, water and fuel
+ Loads have high reliability requirements (***e.g.***, hospitals, computer data centers)
+ Proximity to regional resources
+ Potential use of renewable energy resources
+ Lack of physical constraints (***e.g.***, height, air emissions, noise sensitivity, land use restrictions)
+ Favorable local codes and regulations
+ Favorable underground conditions affecting pipe installation
+ Minimal changes required to existing building infrastructure.

A total of 28 potential district energy sites were identified that have current or projected heating and/or cooling load centers where district energy could be generated and delivered cost effectively. Additionally, sites where regional resources, such as deep lake water, underground aquifers, biomass, biogas or waste thermal energy were located near potential load centers, were included.

The potential sites were scored using screening factors. Based on a ranking of the aggregated scores, the following five projects that ranked highest in the screening evaluation are listed below along with a brief overview of the district energy potential associated with each site:

+ **Syracuse Inner Harbor Redevelopment –** In June, 2012, the Syracuse Common Council awarded COR Development the rights to develop the 28 acre Syracuse Inner Harbor site into a mixed use neighborhood of housing retail and office buildings. Plans call for construction of more than 500 housing units, a satellite college campus, 100 room hotel, office buildings and other amenities. It is recommended that the developer be engaged as early as possible to explore the potential benefits that district energy could bring to the project. Potential technologies that could be considered include geoexchange heating and cooling using the harbor itself or the brine aquifer beneath the site, biomass heating, and high efficiency central heating and cooling plants.

+ **Onondaga County District Heating and Cooling (DH&C) Plant –** The Onondaga County DH&C plant provides steam and chilled water to ten county-owned buildings in downtown Syracuse and the Everson Museum of Art. There is potential for expanding the distribution piping system to serve additional commercial buildings downtown or to provide heating hot water to nearby public housing complexes. There are also long-standing community plans to develop a hotel project near the Oncenter convention center to attract additional conferences and conventions to the site. The vacant Hotel Syracuse is also in need of major renovations. Any or all of these projects could benefit from lower cost district energy provided by the Onondaga County DH&C plant.

+ **Syracuse University Steam Station (SUSS) –** With the decommissioning and demolition of the 79 MW Project Orange combined heat and power facility in 2011, Syracuse University (SU) is developing an energy utility master plan. This plan will address options to upgrade the boilers and chillers that provide chilled water and steam to the SU campus and steam to several other district heating customers, including SUNY-ESF, Crouse Hospital, the Veterans Administration center ant SUNY Upstate Medical University. SU is considering a number of innovative technologies including a biomass steam plant and a gas turbine CHP facility.

+ **SUNY Oswego –** SUNY Oswego's location on the south shore of Lake Ontario makes it an ideal candidate for considering a deep lake water cooling system, similar to the facility at Cornell University in Ithaca New York. Non-contact cooling water from the lake could directly cool a campus chilled water loop, serve as a cooling source for a heat pump chiller system or a combination of both. As a signatory of the American College and University Presidents Climate Commitment (ACUPCC), SUNY Oswego is demonstrating environmental leadership by committing to reduce its GHG emissions significantly in the coming years. In the college's Climate Action Plan (SUNY Oswego, 2009), SUNY Oswego has outlined a strategy for reducing its energy consumption and GHG emissions. As part of the remodeling and expansion of the Richard S. Shineman Center for Science, Engineering and Innovation building, the University installed a geothermal system that consists of 240 vertical wells installed underneath a parking lot. There has also been interest expressed by the City of Oswego in participating in a lake source district cooling project, potentially serving the Oswego Hospital, City buildings or a proposed data center development project.

+ **Trush Business Park –** The Trush Business Park in the Towns of Cazenovia and Nelson (Madison County) consists of 125 acres, municipal sewer, electric, gas and water via wells. Current businesses located at the site include Marquardt Switches, Dielectric Laboratories, GHD (formerly Stearns & Wheler) and Tronser. The existing cluster of mixed use buildings may provide a diverse heating and cooling load profile that might be efficiently served through a central district energy plant. Lower cost heating and cooling sources may also provide additional incentives for other potential entities looking to locate at the Trush Business Park.

Alternative Financing Mechanisms

Electricity customers in NYS can take advantage of a number of funding sources to make the cost of energy efficiency and renewable energy upgrades manageable. These include federal tax credits, state tax incentives, rebates from NYSERDA, and utility-based energy efficiency programs.[5] For certain customers, though, as well as for certain larger-

5 See the DSIRE database of incentives at www.dsireusa.org

scale projects, financing energy efficiency and renewable energy projects is challenging, even when customers have a strong motivation. Non-profit entities, for example, are unable to take advantage of tax credits; multifamily residential buildings may have difficulty obtaining loans for a building-wide improvement; and a municipality wishing to invest in a town-wide renewable project will struggle to find a way to do so. In general, financing mechanisms for energy efficiency and renewable energy projects must address three major challenges:

+ **Uncertainty of Benefits –** There often are doubts about the actual savings that will be realized through energy efficiency improvements, or about the existence of a market for renewable energy generated and the price at which it can be sold. These uncertainties limit the upfront capital or the size of loan payments that individuals, businesses, or facilities managers are willing to commit to.

+ **Alignment of Costs & Benefits –** Financing mechanisms must overcome the misalignment of costs and benefits that would discourage a property owner from investing in energy efficiency if the property might soon be sold, or that prevent non-profit entities from taking advantage of otherwise available tax credits, for example.

+ **Appropriateness of Payment Levels –** Payments must be proportionate to the utility bills of the energy customer for energy efficiency improvements, or must be adequate to justify the investment in a renewable energy system.

In addition, it is important to remember that different types of customers face different challenges in making energy efficiency upgrades or installing renewable energy equipment. Therefore, different financing mechanisms may be appropriate for different types of customers depending on their sophistication, legal status, credit, and the scale of project they are looking to undertake. Some key customer groups and their financing requirements include:

+ **Individual Homeowners –** Improvements to the average single family home are usually very small (less than $20,000) investments. Energy Service Companies (ESCOs) and large organizations typically do not service this segment of the market. In addition, individual homeowners and prospective homeowners are relatively unsophisticated customers. Financing mechanisms that involve complex legal arrangements or in-depth research are not appropriate to this type of customer.

+ **Commercial Enterprises –** Commercial property owners often face split incentives. If the tenant is renting a space, they are not responsible for financing building upgrades. The landlord has to pay the upfront cost for building upgrades, but does not receive any of the benefits if the tenant is paying the utility bill. Commercial buildings also have regular turnover. Building owners are unlikely to invest in energy efficient upgrades to their property if they are likely to sell the property before their initial investment pays off.

+ **Non-Profits, Government Facilities, and Tax-Exempt Institutions –** Many renewable energy systems (solar, wind, geothermal, and others) are supported by federal tax incentives. Organizations that do not pay taxes are unable to take advantage of tax credits that make these systems cost-competitive with conventional energy. Many customers in this segment are mission, rather than profit, driven, and may be unable to take on debt to finance building upgrades. However, non-profits and government organizations often have access to forms of financing that are unavailable to other customers, including foundation grants, or low interest bond sales.

+ **Municipalities or Utilities –** There are entities with an interest in a sustainable, efficient, and secure supply of energy that do not own specific properties on which to advance that interest. Two of the financing mechanisms described below (Community Choice Aggregation and Feed-In Tariff) do not address financing for a specific project. However, they are included because they can influence the overall financial viability of renewable energy in a certain region.

Even when the right funding sources and financing mechanisms exist for a particular customer, it may be difficult for the customer to identify the best path forward. To make energy efficiency and renewable energy projects feasible, CNY needs financing mechanisms that fit its needs and that are clearly spelled out for the region's energy customers. There are a number of financing mechanisms that may benefit the region. They

divided into two groupings: those that rely on private-sector financing, and those that rely on public-sector financing. An overview of these mechanisms, progressing in rough order of complexity, from the simplest to the most complicated financing structures, is provided below. More detail on these mechanisms can be found in Appendix 9.

PRIVATELY-BACKED FINANCING FOR ENERGY EFFICIENCY & RENEWABLE ENERGY FOR BUILDINGS

Privately-backed sources of financing have several advantages over government-backed sources. Most importantly, private developers are able to take advantage of tax credits for renewable energy that tax-exempt organizations need an intermediary to take advantage of. Some of the financial mechanisms are rather "conventional" (including bank loans and energy efficient mortgages). These are included because while many people may be familiar with them, these relatively simple mechanisms should be considered before attempting more complicated legal structures. Traditional financing mechanisms offer low overhead, and may be the most efficient method of financing small energy-related projects.

Other financing mechanisms (engaged offsets and program-related investments) are targeted toward non-profit or community-development organizations that private philanthropy is best equipped to address. These mechanisms are included as examples of how to leverage private philanthropic money toward energy conservation, as well as social good.

Three financing mechanisms (renewable energy leasing arrangements, energy savings performance contracts, and power purchase agreements) are included because they represent typical arrangements between a private company and another organization to reduce energy use or provide renewable energy. These mechanisms are especially important to public or institutional organizations that have a limited ability to take on debt, yet are motivated to reduce their energy use and costs.

Finally, two mechanisms (developing a local energy efficiency corporation or sustainable energy utility), can be seen as intermediary steps to deploying renewable or efficient energy use. These two models have had success elsewhere in the U.S. Creating an organization dedicated to advancing sustainable energy use in CNY is one way of leveraging public and/or private dollars towards achieving the sustainable energy goals of this plan.

GOVERNMENT-BACKED FINANCING OPTIONS FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY

Government-backed financing options for renewable energy or energy efficiency can usually take advantage of low interest public bonds to provide up-front capital for projects. These are also financing mechanisms that CNY RPDB is well-equipped to take advantage of and promote. However, the types of projects that can be funded by public dollars are often constrained. When public agencies provide funding, it is difficult to take advantage of tax incentives. Public agencies also are often constrained by the level of debt they are allowed to take on.

Governments can make use of existing "public goods" financing mechanisms, like a revolving loan fund, to finance energy improvement projects. At other times, enabling legislation (such as for a **Property-Assessed Clean Energy (PACE)** program or a Solid Waste Assessment program) will allow creative use of public dollars to finance energy efficiency measures with appropriate repayment. Beyond financing mechanisms for specific projects, community choice aggregation laws and a feed-in tariff option are included because while they do not finance specific projects, they can significantly affect the finances of renewable energy or energy efficiency projects in the area.

An overview of the mechanisms highlighting the challenges the mechanism overcomes and the investment scale, customer type and partners needed to implement the mechanisms can be found in Appendix 9, Table 3. The funding mechanisms that may be appropriate for the efficiency or renewable projects identified within this plan are listed in Table 6 on page 56.

TABLE 6–Funding mechanisms for implementing efficiency or renewable projects

	Energy Efficiency				Distributed Power Generation							Waste					
Project	Quick Audits	Lighting Upgrades	Boiler Upgrade (incentives for wood, propane, and oil boilers)	Building Envelope Renovations	Photovoltaics	Solar Thermal		Wind	Digester Gas	CHP & Fuel Cells	Geothermal	District Energy	Expand Industrial Symbiosis at ARE Park	Expand Industrial Networks	Improve Data Collection	Landfill Gas System	Convert Trucks to CNG	Increase Organic Waste Recycling
Sectors Targeted in VisionCNY Plan	Commercial Institutional	Commercial Industrial	Commercial Residential	Residential	Institutional	Residential	Institutional	Large Land Owners	Large Farms, WWTPs, Landfills	Institutional, Multi-Family, Industrial	Institutional, Industrial	Institutional, Business Parks	Business Park	Industrial	Industrial	Landfills	Municipal	Industrial
	Privately-Backed Financing																	
Bank Loans		•	•	•	•	•	•	•	•	•	•	•	•			•		
Energy Efficient/ Improvement Mortgages				•		•												
Renewable Energy Leasing Arrangements					•	•	•	•	•		•		•			•		
Program-Related Investments					•		•			•								
Energy Savings Performance Contract	•	•	•							•								
Local Energy Efficiency Corporation	•	•	•				•						•	•	•			
Sustainable Energy Utility	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Engaged Offsets					•		•	•	•	•	•							
Power Purchase Agreements					•		•	•	•							•		
	Government-Backed Financing																	
Revolving Loan Fund		•	•	•			•		•	•			•			•	•	
Community Choice Aggregation					•			•	•								•	
PACE		•	•		•		•			•								
Solid Waste Assessment		•	•	•	•	•	•			•								
On-Bill Recovery Financing				•		•												
Feed-In Tariff					•	•	•	•	•									

STRATEGIES FOR THE FUTURE

Energy Goal

CNY has determined that the goal of this plan with respect to energy management will be to:

Minimize the environmental impact of the region's energy use by increasing the efficiency of energy and fuel consumption, curtailing energy demand and increasing the use of local clean energy sources in place of fossil fuels.

Energy Indicators and Targets

NYSERDA provided guidance on common, measurable indicators for the Cleaner, Greener Communities Regions program to consider as they developed their plans. Following engagement with each region, NYSERDA provided a list of sustainability indicators to each region which it suggested for inclusion in the Cleaner, Greener Communities plans across the state. The indicators were reviewed by subject matter experts who have been working with NYSERDA to ensure the quality and effectiveness of the metrics utilized for this program. The list also indicated which of the indicators selected for CNY were required by NYSERDA.

Indicator selection was guided by the following parameters:

+ Ability to inform policy or investment
+ Ease of gathering data, preferably from existing data sources
+ Replicability so that trends can be assessed on an ongoing basis

Indicators were chosen to provide a set of key indicators that could be tracked across the state and to ensure that the **Cleaner, Greener Communities** program is doing its part to support larger national efforts that are working to promote the use of these types of metrics in state policy decision-making. Regions will not be required to choose additional indicators in these four areas of focus. These indicators will serve as the required common indicator in each of the four areas of focus that they cover.

Energy consumption per capita is an indicator that encompasses all of the energy use within a region on a scale that is highly relatable. Current data for the CNY region is shown in Table 7. 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, data for all sources of energy consumption (***e.g.,*** fuel combustion, electricity, renewables) are needed.

Calculation:

Regional energy consumption per capita =

∑ (regional energy consumption) ÷ regional population, where

∑ (regional energy consumption) =

Residential Energy Consumption + Commercial Energy Consumption + Industrial Energy Consumption + Transportation Energy Consumption

TABLE 7–Indicator 1a: Regional Energy Consumption per capita (MMBtu)

1A: Regional Energy Consumption per capita (MMBtu)		
Region Population:	791,939	
Residential Energy Consumption	45,207,405	26.8%
Commercial Energy Consumption	24,105,866	14.3%
Industrial Energy Consumption	31,363,617	18.6%
Transportation Energy Consumption	68,154,339	40.4%
Total Regional Energy Consumption (MMBtu):	168,831,227	100.0%

NYSERDA also required that each region choose Sustainability Targets for their respective plan. Targets were required to be selected based on the Indicators. CNY has established the following targets for energy and GHG emissions:

+ Reduce regional energy consumption per capita, including electricity and fuels, by 40% (below 2010 levels) by 2030.
+ Reduce regional GHG emissions per capita by 40% (below 2010 levels) by 2030.

Energy Strategies and Project Recommendations

In order to chart a course to effectively and efficiently achieve the energy targets, the CNY region has articulated a series of strategies that will enable energy and related GHG emission reductions. These strategies address the various components that will facilitate change by addressing policies, procedures, education and outreach. They also are aimed at the broad spectrum of sectors that can drive change: government, business and industry, residential, and non-profit. The strategies are supported by programs and projects that the region can implement to make the energy sector more sustainable. The timing of implementation of these recommendations is categorized as short- or long-term.

Energy Strategy #1: Accelerate adoption of energy efficiency measures by promoting access to information and incentives for customers at all income levels, for businesses of all sizes, and for difficult to reach property types.

CNY has existing programs that provide education, financing, and assistance to homeowners and businesses interested in reducing their energy usage. Expansion of these programs combined with enhanced outreach efforts would drive increased penetration rates. In addition, the environmental benefits resulting from energy efficiency programs beyond the value of the energy they save include lower emissions of CO2, SO2, NOX, particulate matter (PM), and mercury.

Recommendations to achieve this strategy include:

1. **CNY Climate Change Innovation Program (C2IP):** The CNY RPDB's program currently assists municipalities to: prepare greenhouse gas inventories and climate action plans; implement clean energy demonstration projects; revise local policies, codes and regulations to stimulate increased investment in energy efficiency and renewable energy; and educate and encourage residents and businesses to take action to reduce energy use and greenhouse gas emissions. The program could be expanded to provide low-cost or free technical consulting service to local municipalities, regional government agencies, local not-for-profits, and mid-sized to large commercial and industrial businesses that are entering into power purchase agreements, energy service/shared savings agreements, and similar arrangements related to distributed generation or energy efficiency projects. Technical services can provide independent confirmation of savings estimates, identify project risks, provide an assessment of the adequacy of monitoring and verification efforts, and substantiate life cycle costing analysis to help the facility staff confirm that agreements are structured to provide the most value to the customer. The program could provide technical and financial assistance such as collaborative procurement of ESCO services, "circuit rider" Energy Manager, or a Regional Quick Audit Team to provide a range of services from walk-through audits to benchmark evaluations. The program would identify projects and applicable incentive programs and could provide enhanced incentives to pay for energy studies and/or energy improvement projects. The program would maintain a clearinghouse to provide fact sheets, technology transfer materials, case studies, best practices, and summary of customer experiences. Possible partners include the U.S. EPA, NYS DEC, NYSERDA, Manufacturer's Association of Central New York, the Industrial Assessment Center at Syracuse University, and the Syracuse Center of Excellence in Energy and Environmental Systems.

2. **CNY Green Finance:** Expand the CNY RPDB's existing energy revolving loan program to consider all "behind-the-meter" distributed energy technologies listed in the NYS Renewable Portfolio Standard including CHP, fuel cells, biomass boilers, anaerobic digesters, and geothermal heat pumps. The program should consider larger loans (up to $250,000) with terms up to 10 years in order to better assist with these capital-intensive projects to make them more financially viable for the customer. The loan application should be gauged on the economic viability of the project from the customer perspective as well as the energy and environmental benefits to the region. Useful metrics to gauge

the environmental success of the project could include GHG reductions per dollar of capital invested. The CNY RPDB should explore and create additional financing options for renewable energy and energy efficiency systems such as a commercial or residential PACE program or a regional entity such as the NYC Energy Efficiency Corporation, which would provide gap financing or up-front capital to building owners to leverage existing state and federal incentives. Possible partners include private and not-for-profit lenders and local municipalities.

3. **CNY Universal Green:** Close the program funding and opportunity gap for middle-income families by providing enhanced incentives and technical assistance to support "Green Rehabilitation" (energy and reuse-focused rehabs) of historic homes, major renovations by homeowners, and efficiency improvements in homes and businesses regardless of fuel use (fuel oil and propane). Improvements could include equipment replacements, controls, or building envelope improvements although programs targeted at equipment only might be easier to administer. Possible partners include NYS SHPO, the National Trust for Historic Preservation, the Preservation Association of Central New York, Home Headquarters, local municipalities and private contractors.

Energy Strategy #2: Encourage municipalities to adopt policies, codes and regulations that stimulate increased investment in energy efficiency and renewable energy.

Local governments have the potential to set examples for their residents and to promote cleaner forms of energy through adoption of policies, codes and regulations that facilitate the use of renewable energy technologies such as solar and wind in appropriate areas and that encourage or require energy conservation and efficiency for new construction or major renovation projects. While stricter codes could deter development, due to actual or perceived high cost of construction, widespread adoption by municipalities would level the playing field between communities and some ordinances such as those that require new homes to be built "solar ready" add very little cost to the developer or consumer. Municipalities can take a number of actions that would not hamper economic growth such as: adopt higher energy standards for their own buildings and facilities; purchase "green energy" for their own use; offer incentives for energy-efficient private development through PILOT agreements as has been done by the City of Syracuse and Onondaga County; provide expedited permitting and reduce or eliminate permit fees for the installation of clean energy technology; offer partial or complete local property tax exemption for clean energy investments; eliminate regulatory obstacles such as burdensome height restrictions for wind turbines that inhibit installation of renewable energy technologies; or require energy benchmarking and disclosure for existing privately-owned buildings over 50,000 sq. ft. as New York City's Greener Greater Buildings laws (Local Law 84 and Local Law 87) has done for large commercial buildings or as the City of Austin, Texas has done for residential property through its Energy Conservation Audit and Disclosure (ECAD) ordinance.

Energy Strategy #3: Accelerate energy improvements in major public facilities and infrastructure.

By adopting energy efficient technologies in public facilities, CNY can stake a "lead by example" position. This approach also multiplies the benefits achieved by not only showcasing technologies that can be deployed by others in the region, but also reduces the cost of government operations which saves taxpayers money.

Recommendations to achieve this strategy include:

1. **CNY Green Streets:** Replace all public lighting with energy efficient technology such as light emitting diodes (LED) and implement a regional public LED lighting collaborative procurement program to provide technical and financial assistance for municipalities. Short-term focus should be on municipalities that own their streetlights or that have municipal utility authorities such as Skaneateles, Hamilton and Solvay. Possible partners include private utilities, NYPA, NYSERDA and local municipalities.

2. **CNY Bright Future:** Work with school districts to engage in energy efficiency efforts, waste reduction and recovery, clean air initiatives, water conservation, transportation efficiencies, and other "green" efforts such as gardening and natural habitat rehabilitation, leading toward LEED for Existing Buildings certification at each school. The program will result in direct GHG reductions, as well as also introduce sustainability and conservation issues to the students, faculty and patrons participating in the program. Possible partners include local school districts, NYSERDA and NYPA.

3. **CNY Sustainable Infrastructure:** Complete GHG inventories, perform energy audits, and develop energy efficiency action plans (or Climate Action Plans) at major water and wastewater facilities that address improving

operations, improving pump and motor efficiencies, upgrading lighting, performing equipment retrofits or replacements, incorporating renewable technologies, and establishing equipment purchase policies. Possible partners include local municipalities, NYSERDA, NYS EFC and NYPA.

Energy Strategy #4: Promote deployment of renewable energy.

Renewable energy sources, such as windpower, hydroelectric and photovoltaic solar power, are already present in the CNY region. However, each of these technologies has the potential to contribute at much greater levels to the diversity of energy sources supplying the region. A concentrated effort to identify and deploy these technologies at visible private and public sites in the region can increase penetration while showcasing the technology.

Recommendations to achieve this strategy include:

1. **CNY Solar Ramp Up:** Install at least 200 MW of new solar PV capacity, with a focus on highly visible public and not-for-profit facilities such as Hancock International Airport, the Port of Oswego, municipal facilities, schools, colleges and hospitals. Provide technical assistance through collaborative procurement programs as has been done in Silicon Valley and Washington, DC. Develop an interactive online mapping tool similar to the New York City Solar Map, Renew Boston Solar, San Francisco Solar Map, or LA Solar Map.

2. **Great Lakes Wind:** Install at least 100 MW of offshore wind energy capacity in Lake Ontario.

3. **My Wind:** Install at least 100 MW of new combined "community-based" or mid-scale wind energy capacity for municipal facilities or through community ownership, and provide technical and financial assistance (i.e., free or low-cost access to meteorological towers) to support pre-feasibility studies similar to Massachusetts Clean Energy Center's Community-Scale Wind Initiative.

4. **Home Grown Energy:** Establish sufficient biomass feedstocks such as willow and switchgrass crops on underutilized agricultural lands in the region (i.e., Madison County mucklands) to supply at least 35 MW of power generation. Engage with growers of biomass crops, including the efforts at SUNY-ESF to expand the use of willow and switchgrass, to expand supply. Build a network for biomass resources to connect supply and demand within the region.

5. **CNY Hydro:** Select and repower existing non-powered dams, install at least 1 MW of "micro-hydro" systems by 2014 and install at least 5 small hydro facilities (less than 25 MW each such as the Cazenovia wastewater treatment facility on Chittenango Creek) by 2020.

Energy Strategy #5: Accelerate deployment of distributed alternative and efficient energy resources.

Certain sources of energy are best deployed where there is a confluence of energy supply and demand. Biomass and methane recovery systems convert waste to useable energy. Geothermal energy, derived from the natural heat of the earth, can provide environmentally benign power. Co-generation in the form of CHP and CCHP uses an on-site power generation source to meet both electrical and thermal loads in a facility simultaneously. District energy systems adopt this same approach to meet complimentary energy needs of various users over a broader area. A concentrated effort to identify and deploy these technologies at visible private and public sites in the region can increase penetration while showcasing the technology, creating local jobs, and supporting existing local businesses.

Recommendations to achieve this strategy include:

1. **CHP in CNY:** Install at least 100MW of new CHP plants, at centrally-located government facilities, large nursing homes, industrial facilities, and public schools (particularly those that currently rely on fuel oil in rural areas) and provide technical assistance to streamline CHP project permitting.

2. **CNY Biomass:** Identify public projects – at schools or other government or institutional facilities - that can demonstrate the capability of biomass while also building a market for it.

3. **CNY Green Farms:** Support expanded use of bio-digesters on farms and dairies to handle organic waste. Digesters represent an effective way to use an on-site resource to produce energy while also diverting waste from landfill and minimizing water quality run-off impacts. Additionally, the bio-digester can produce organic fertilizer that can displace the need to buy commercially produced fertilizer products. Provide technical and financial assistance to ramp up deployment of wind power, solar PV, and solar thermal on farms and dairies with a focus on those with high electricity consumption and those that rely on fuel oil, propane or electricity for heat.

4. **CNY Geothermal:** Complete at least 2 large-scale demonstration ground-source heat pump projects by 2014 that have been identified in the VisionCNY plan as having potential such as the SUNY Cortland Park Center and the Coulter Library at Onondaga Community College.

5. **CNY Waste to Watts:** Implement an active methane recovery system including landfill gas to energy technology at the Cortland County landfill, a biogas recovery project at the Cortland County WWTP and solar PV (panel arrays or flexible covers) or wind power projects at every landfill and resource recovery facility in the region with a target of at least 10 MW of installed capacity by 2017.

6. **CNY Green Districts:** Facilitate district or campus-wide "net zero" energy projects with a focus on infill, transit-oriented developments, business parks, and institutions of higher education. In the short-term, focus on project opportunities identified in the VisionCNY plan such as Inner Harbor in Syracuse, Shoppingtown Mall in Dewitt, Midtown Plaza in Oswego, lake source cooling for SUNY Oswego campus and expansion of the existing systems at Syracuse University and the Onondaga County District Heating and Cooling Plant.

7. **Near Westside Demonstration Project:** Engage the City of Syracuse and Syracuse University to support neighborhood revitalization on the city's distressed Near Westside though a highly-visible, targeted, comprehensive application of green and energy-efficiency demonstration projects for neighborhood revitalization in distressed urban environments. The project will re-value a single block or street that is facing vacant or marginalized housing, institutional, and commercial properties in a limited target area. All technologies that will reduce reliance on heating and cooling energy consumption, add energy-efficiency and increase insulation to all existing structures that are occupied, or reasonably can be occupied by businesses or institutions including non-profit and secular structures, will be applied. Stormwater diversion will be made part of the project where rainwater will be allowed to percolate back to below-ground water tables or for use by community gardens. The use of geothermal or CHP/CCHP for heating and cooling of adjoining houses/businesses will be applied where appropriate.

Energy Strategy #6: Increase the use of demand response programs during peak load periods to better manage electricity supply and consumption.

In general, Central New York does not experience the kinds of problems related to peak energy demand as do regions downstate. However, increased use of demand-response programs on peak load days can further help alleviate the need to bring GHG-intensive power supplies online.

Energy Strategy #7: Upgrade power transmission and distribution systems to encourage the development of renewable energy projects, energy storage and smart grid including electric- vehicle-to-grid technologies.

Central New York has a robust energy transmission infrastructure, particularly in Oswego County which could be targeted for additional renewable energy capacity or energy storage. Upgrading the aging transmission infrastructure, as called for in the NYS Energy Highway Program, can relieve congestion, promote distributed generation, and reduce line loss. Local transmission and distribution line improvements, and addressing constraints on the "spot network" in downtown Syracuse, would allow new distributed generation to be connected to the grid. Regional line improvements would allow renewable power to be transmitted downstate, and would be required to facilitate offshore wind development in Lake Ontario.

Energy Strategy #8: Educate and motivate behavior change which minimizes energy usage.

Encouraging individuals and businesses to reduce and change their patterns of energy use will make a significant contribution to energy and environmental gains at little or no cost. By providing information through reporting and feedback systems, users will be armed with the information needs to make meaningful behavior changes that curtail energy consumption. Changes could include actions such as procuring Energy Star appliances, adopting building automation technologies including programmable thermostats and demonstrating efficient energy usage behaviors.

Recommendations to achieve this strategy include:

1. **CNY Energy Challenge:** Expand the CNY RPDB's behavior change program to provide mini-grants up to $1,000 to homeowners who complete the Energy Team curriculum, recruit at least one homeowner to participate in the program, and

complete a home energy upgrade of at least $3,000. Expand the program to achieve workplace energy behavior change by employees of commercial and municipal employees with a focus on the region's 900+ buildings larger than 50,000 sq. ft.

2. **CNY Model Green Home:** Develop model homes in Syracuse, Oswego, Auburn, Cortland and Oneida that would be open to the public to demonstrate strategies and technologies to achieve deep energy savings. Monitoring systems and information displays will be included for educational purposes. Workshops will be held for homeowners, renters and contractors.

Energy Strategy #9: Foster the development of clean energy manufacturing enterprises.

Regions can foster collaboration and public-private partnerships to jump start clean energy economy by growing Cleantech companies, jobs, and incomes through business development, technology transfer and expansion of the markets for products and services that conserve resources and prevent pollution. Regional stakeholders can also spur investment in the fundamental assets of education, research, technological innovation, and modern entrepreneurial and workforce skills. Finally, the region can attract skilled workers and entrepreneurs by promoting sustainable development that features low-impact, mixed-use, resource-efficient design and utilizes multi-modal transportation, sustainable infrastructure, and green energy to protect and enhance the natural and built environment, leading to communities that are more attractive, livable, healthy, vibrant, prosperous, and productive. Central New York can leverage its existing assets and partnerships including the Syracuse Center of Excellence in Energy and Environmental Systems, the Clean Tech Center at the Syracuse Technology Garden, the Syracuse Technology Development Organization, Inc. to implement this strategy.

Energy Strategy #10: Promote innovative projects for clean energy generation, storage and distribution such as hydrogen fuel cells and eco-industrial or agri-business parks that co-locate symbiotic industrial processes.

Central New York has a rich history of innovation and leadership, from the technologies developed by Carrier Corporation to the development of the Fenner Wind Farm in Madison County, the largest of its kind east of the Mississippi River when it was built in 2002. Fuel cells in particular represent an important opportunity for Central New York. The Breakthrough Technologies Institute ranks New York State among the "Top 5 Fuel Cell States," noting the state's supportive funding policies, its share of U.S. fuel cell patents and its high profile and long-running installations including fuel cell vehicles, hydrogen fueling stations, telecom backup systems and stationary systems. The state's innovative policies include approval by the Public Service Commission for sub-metering of residential fuel cells and incentives up to $1 million available from NYSERDA for the purchase, installation, and operation of customer-sited tier fuel cell systems used for electricity production. The New York Hydrogen and Fuel Cell Deployment Plan published in 2012 by the Northeast Electrochemical Energy Storage Cluster (NEESC) states that there is the potential to generate approximately 3.89 million MWh of electricity each year in the state through the development of 494-659 MW of fuel cell generation capacity. In addition, the report notes that New York has more than 180 companies that are part of the hydrogen and fuel cell industry supply chain in the Northeast. Eight of these companies are OEMs of hydrogen and/or fuel cell systems, and were responsible for supplying 808 direct jobs and $119 million in direct revenue and investment in 2010.

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