

City of Oswego

Climate Action Plan

NOVEMBER 2014





A MESSAGE FROM THE MAYOR

August 25, 2014

Dear Friends,

Oswego is brimming with sustainability success stories. It's the small steps and the giant leaps made by people like you that help make Oswego a Green City. This Climate Action Plan provides a roadmap for the citizens and staff of the City of Oswego to achieve all our goals to reduce greenhouse gas emissions and make Oswego a model for other small cities across the country to do the right thing, to save energy and taxpayer dollars by investing in green infrastructure and developing ways to become more self sustaining.

Oswego has benchmarked its energy use and has explored ways of reducing its energy costs. With this plan we have set the priorities to achieve these goals and with the help of all of Oswego's employees and citizens we will find new and more efficient ways to thrive and grow our City as one of the greenest communities in the region. We are open to new ideas and new technology to reduce our operational costs while achieving better sustainable systems that make us more self-reliant and able to meet all the challenge that the 21st century will bring to our beautiful waterfront city.

Join with me to make Oswego the emerald city that lights the way to a more sustainable and healthy future.

Sincerely,

Thomas W. Gillen
Mayor, City of Oswego, NY

ACKNOWLEDGEMENTS

The City of Oswego wishes to thank the following community members, organizations, and staff for their contributions to developing this Climate Action Plan.

CITY OF OSWEGO

Thomas W. Gillen, Mayor

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1st ward: Francis Enwright

2nd ward: Michael R. Myers

3rd ward: Michael E. Todd

4th Ward: Shawn Walker

5th Ward: William J. Barlow, Jr.

6th Ward: Eric J. Van Buren

7th Ward: Ronald T. Kaplewicz

Tory DeCaire, Chief of Police

Jeffrey McCrobie, Fire Chief

Rita Tickle, Personnel Director

Anthony Leotta, City Engineer

Gay Williams, City Attorney

Susan Deary, Assessor

Barbara Sugar, City Clerk

Deborah Coad, City Chamberlain

Michael Riley, Purchasing Agent

Michael Smith, Commissioner of Public Works

Gary Hallinan, Superintendent Waste water

Brian Fohlgerrhait, Water Plant Manager

Caroline Anderson, Animal Control Officer

Mary Vanouse, Community Development Director

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A NOTE FROM THE CENTRAL NEW YORK REGIONAL PLANNING AND DEVELOPMENT BOARD

This Climate Action Plan document was prepared for the City of Oswego by the Central New York Regional Planning and Development Board (CNY RPDB), a public agency that was established in 1966 by Cayuga, Cortland, Madison, Onondaga, and Oswego Counties under the provisions of Article 12B of the New York State General Municipal Law. The CNY RPDB provides a comprehensive range of services associated with the growth and development of communities in Central New York with a focus on the following program areas: Energy Management, Community Development, Economic Development, Environmental Management, Information and Research Services, Intergovernmental Coordination, and Transportation Planning. The CNY RPDB provided services to this project under the auspices of the United States Environmental Protection Agency's Climate Showcase Communities Program and the New York State Climate Smart Communities Program.

The purpose of this document is to (1) gather information on emission reduction projects and programs already being undertaken in the City; (2) give public officials, community leaders, and residents the information and support that is needed to advance sustainable programs in their communities; (3) identify opportunities for new emission reduction programs and initiatives; and (4) engage and encourage local participation in greenhouse gas emission reduction strategies.

The City of Oswego Climate Action Plan is not intended to provide precise information about the potential emission reductions that can be achieved by specific recommendations, and cannot be used as a substitute for thorough project or program planning. Instead, this document provides estimates of emission reductions that are meant to help public officials, community leaders, and residents better decide which actions may be worthwhile for the community to pursue in the coming years. As such, this document is not meant to be fixed or prescriptive, but rather fluid and flexible.

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ACRONYMS EXPLAINED

Btu and MMBtu: British Thermal Units and Millions of British Thermal Units. A Btu is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit, and MMBtu represents 1 million Btu.

CAFE: Corporate Average Fuel Economy. CAFE standards have been set by the federal government for the years 2016 and 2025.

CAPPA: Climate and Air Pollution Planning Assistant. CAPPA is a tool provided by ICLEI – Local Governments for Sustainability to help local communities assess the effectiveness of certain emissions reduction strategies in their communities. CAPPA is the tool that was used for all of the calculations in this document.

CNY RPDB: Central New York Regional Planning and Development Board. The CNY RPDB is a public agency that provides a range of services associated with the growth and development of communities in Cayuga, Cortland, Madison, Onondaga, and Oswego Counties.

GHG: Greenhouse Gas. Greenhouse Gases are gases in the Earth's atmosphere, such as water vapor, methane, carbon dioxide, and nitrous oxide, that allow sunlight to enter the atmosphere but also trap heat in the atmosphere, causing rises in Earth's atmospheric temperatures.

ICLEI: ICLEI-Local Governments for Sustainability is a non-profit organization that provides tools to local governments to assist with greenhouse gas inventories and climate action planning.

kW: Kilowatt. kW is a unit of power equal to 1,000 watts.

kWh: Kilowatt hour. A kilowatt-hour (symbolized kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour (1 h) of time.

MTCO₂e: Metric Tons of Carbon Dioxide Equivalent. MTCO₂e converts the warming potential of each greenhouse gas (i.e. carbon dioxide, nitrous oxide, methane, etc.) into one measurement.

NYSERDA: New York State Energy Research and Development Authority. NYSERDA is a public benefit corporation created in 1975. Its goal is to help New York meet its energy goals of reducing energy consumption, promoting the use of renewable energy sources, and protecting the environment. NYSERDA offers a variety of incentive programs to help New York residents achieve these goals.

PV: Photovoltaic. Solar PV systems convert sunlight directly into electricity.

VMT and DVMT: Vehicle Miles Traveled and Daily Vehicle Miles Traveled. Vehicle Miles Traveled (VMT) is the total number of miles driven by all vehicles within a given time period and geographic area. It is used by regional transportation and environmental agencies for planning purposes. VMT is influenced by factors such as population, age distribution, and the number of vehicles per household. However, the greatest factor by far is how land uses are arranged. Daily Vehicle Miles Traveled (DVMT) is the total number of miles driven by all vehicles within a geographic area in one day.

FRAMEWORK FOR LOCAL CLIMATE PROTECTION

Climate Showcase Communities Program

The US Environmental Protection Agency (EPA)'s Climate Showcase Communities Program is designed to assist local governments in creating community-based greenhouse gas reduction projects related to energy production, residential and commercial energy efficiency, waste management, transportation, and land use. The goal of the program is to pilot projects that are replicable and cost-effective so that communities can reduce greenhouse gas emissions while improving environmental, economic, and social conditions. There are currently 50 communities throughout the US that are participating as part of the Climate Showcase Communities Program. CNY RPDB was selected as an awardee of the program, receiving \$497,793 in federal funding for their Climate Change Innovation Program (C2IP).

Central New York Climate Change Innovation Program

Through the Climate Change Innovation Program (C2IP), CNY RPDB is working with 7 municipalities to conduct GHG emission inventories, develop Climate Action Plans, host community engagement events, and implement clean energy demonstration projects. Each municipality was provided \$30,000 in order to implement demonstration projects (Oswego's Crisafulli Rink upgrades) or to complete feasibility studies for clean energy projects. The C2IP began in February 2010 and was completed in December 2013 with the creation of DRAFT Climate Action Plans.

In order to participate in the program, Oswego agreed to:

- + Follow the 5 Milestone Process established by the Cities for Climate Protection campaign administered by ICLEI-Local Governments for Sustainability, which includes completion of a GHG inventory and completion of a Climate Action Plan
- + Adopt the Climate Smart Communities Pledge, which is a voluntary program administered by the NYS Department of Environmental Conservation (DEC) whereby communities pledge to reduce GHG emissions and subsequently receive notification of state and federal assistance to help them adopt technologies and programs by which to do so
- + Become a Pledge Driver for the US EPA's "Change the World, Start with Energy Star" campaign, which challenges people to make energy-efficient choices in their households and communities



Climate Showcase Communities
Local Climate and Energy Program





Introduction

What is Sustainability?

Sustainability is commonly defined as meeting the needs of the present without compromising the needs of future generations.

Sustainability means meeting the needs of present generations without compromising the ability of future generations to meet their own needs. By following the sustainability goals outlined in this document, the City of Oswego strives to become a more sustainable community so that both present and future generations will be able to meet their needs.

Sustainability is based on the principle that water, materials, and resources necessary for survival and well-being are all dependent upon the natural environment. Sustainability allows for the social, economic, and other requirements of present and future generations to be met by creating and maintaining the conditions under which humans and nature can exist in productive harmony.¹

Developing the Plan

Oswego's Climate Action Plan was developed by an advisory committee made up of Oswego community members Stephen Bisch (Oswego Health), Jamie Cullinan (Oswego Health), Meave Gillen (Office of U.S. Congressman Maffei), Kathy

Kintz (CENTRO), Mike Lotito (SUNY Oswego Sustainability Office), Jamie Adams (SUNY Oswego Sustainability Office), and Karen Noyes (Oswego County), as well as Mary Vanouse, Community Development Director of the City of Oswego. The committee was provided technical assistance by the CNY RPDB, who hired interns specifically to analyze energy and emissions reduction strategies for the city utilizing data from the GHG inventory report. CNY RPDB provided information and suggestions to the advisory committee as to which energy efficiency strategies would be most successful in the city, how many MTCO₂e the strategies would prevent, co-benefits of the strategies, and other case studies explaining where the strategies have been implemented successfully. They also provided information about cost of implementation, possible funding sources, and payback period for the strategies. For more information on how the strategies were developed, including assumptions and references, refer to Appendix A: Action Strategy Summary Document.

Thinking Sustainably: New College at Oxford Example

Founded in the late 1300s, New College at Oxford was built with enormous oak beams in the great dining hall. In the late 1800s, the beams were discovered to be infested with beetles. The College Council was concerned when they heard the news; where would they be able to find oak beams of that size and caliber to replace the beetle-infested ones?

They decided to look into what types of trees were growing on the College lands to see if there were any oaks that could be used to replace the beams. Due to sustainable forestry practices, there were.

Planting stands of mixed broadleaf trees, like oak, hazel, and ash, is standard practice for sustainable woodland management. The hazel and ash are harvested every 20-25 years, while the oaks are left for 150 or more years to grow large so they can be used in major construction work, as beams for example.

New College was able to replace their beams using the oaks that had been growing on their lands for over 100 years for that exact purpose. They continue to grow many oaks on their land so that 150 years from now the beams can be replaced again.

¹ <http://epa.gov/sustainability/basicinfo.htm#sustainability>

Implementing the Plan

In order to implement the strategies in this plan and achieve Oswego's sustainability goals, the advisory committee has determined the need for the creation of a permanent sustainability committee for the City. The sustainability committee would be comprised of a group of Oswego's residents who are committed to Oswego's sustainable future and are willing to volunteer their time to help implement the strategies explained in this plan.

The City may choose to first create an exploratory committee of interested community members to gauge their success over the course of a decided time period. Depending upon the success of the exploratory committee, necessary changes and adaptations can be made and additional members can be added to create a permanent sustainability committee. The sustainability committee will ensure that Oswego's sustainability goals noted in this plan will be carried out in the long run by helping to implement the strategies explained.

Progress towards the Climate Action Plan's goals can be measured over time by conducting subsequent GHG emissions inventories. Future inventories can be compared against the baseline year of 2010 to determine progress.



Rock the Locks kayakers,
Oswego

What is climate change?

Global concern with climate change is primarily focused on the amount of greenhouse gases in the atmosphere. Greenhouse gases, such as carbon dioxide, water vapor, and methane, among others, are an essential part of our atmosphere, and they serve a vital role in making our planet warm enough for life.

Greenhouse gases trap energy (in the form of long wave radiation) that is being emitted by the Earth, reflecting it back into the atmosphere to warm the planet. As the amount of carbon dioxide in the atmosphere has increased or decreased over time, the planet's temperature has changed in roughly the same proportion.

Scientists have determined this relationship by studying Antarctic ice core samples that reveal the atmospheric carbon dioxide from 400,000 years ago to present day. Right now there is more carbon dioxide in the atmosphere than at any time in history, as measured by these samples,² and further

2 Visit http://www.antarctica.ac.uk/press/journalists/resources/science/ice_cores_and_cli-

atmospheric testing shows that we have extended to 402ppm atmospheric CO₂³, which is well above any other measure in time.⁴ Scientists expect that this will lead to a gradual warming of the planet in most areas.

Environmental and Cultural Setting

The City of Oswego is located on Lake Ontario and is the county seat of Oswego County. Municipal operations are administered by a Common Council representing seven wards. The city covers an area of 11.2 square miles (29.1 km²), of which, 7.7 square miles (19.8 km²) is land and 3.6 square miles (9.2 km²) is water.⁵

WATER RESOURCES

The City of Oswego is located at the base of the Oswego River. Water flowing along the river originates from a watershed

mate_change_briefing-sep10.pdf to learn more about the Antarctic ice core findings with accompanying graphs for temperature and CO₂.

3 According to the Scripps Institute and NOAA, Mauna Loa Observatory

4 In January 1998, the collaborative ice-drilling project between Russia, the United States, and France at the Russian Vostok station in East Antarctica yielded the deepest ice core ever recovered, reaching a depth of 3,623 m (Petit et al. 1997, 1999). The extension of the Vostok CO₂ record shows the present-day levels of CO₂ are unprecedented during the past 420 kyr. Pre-industrial Holocene levels (~280 ppmv) are found during all interglacials, with the highest values (~300 ppmv) found approximately 323 kyr BP.

5 City Data <http://www.city-data.com/city/Oswego-New-York.html>

encompassing 5,100 square miles and covering three physiographic provinces – the Appalachian Plateau, the Tug Hill Plateau, and the Lake Ontario Plain. The Port of Oswego is a major shipping port on Lake Ontario with a 50,000-ton bulk storage facility, a 10,000 square foot storage shed, and 1,800 feet of wharf. Over 1 million tons of cargo are processed through the Port each year. The Port is situated adjacent to CSX railroad tracks and major highways.

Drinking water supply systems are in place for the City of Oswego and nearby municipalities throughout the county.⁶ The water supply comes from Lake Ontario (considered one of the finest sources available) and the Metropolitan Water Board is responsible for treating the lake water. The Oswego Water Department provides potable water to the City of Oswego and the town of Scriba. The water treatment facility has a capacity greater than 16 million gallons per day with processes consisting of chlorination, coagulation, filtration, and fluoridation.

Wastewater treatment facilities and systems are located in the City of Oswego. The West Side Wastewater Treatment Plant provides treatment of sewage generated for the West Side of the City of Oswego. In response to long-term problems with unpermitted sewer overflows, Oswego invested approximately \$87 million in improvements to the sewer system in 2010. The Environmental Protection Agency and the NYS Department of Environmental Conservation also partnered

in this agreement. The sewer system serves approximately 10,000 people and is designed to transport the City's sewage to the treatment plant prior to discharge into Lake Ontario. The system includes both combined and sanitary components. It collects and transports household sewage and industrial wastewater, as well as rainwater and street runoff, using the same pipes, whereas the sanitary component uses a separate set of pipes to collect and transport sewage and wastewater only. Overflows from the collection system discharged raw sewage directly to water bodies during periods of extremely high rainfall events. The improvements, implemented under the settlement lodged in federal court in Syracuse, were designed to mitigate sewer overflows.⁷

GREEN GATEWAY PROJECT

A Green Gateway Project was proposed in 2013 for an area located on the west side of the City. The project area is a heavily-traveled area at the intersection of state Rt. 104 and Washington Blvd., near the entrance to the college. The area drains into the Oswego River, a class C waterbody identified on the NYS PWL/WI as stressed due to aesthetics and pathogens. The Green Gateway proposal would complement the sewer separation project by reducing and treating the volume of stormwater entering the new storm sewer system and eventually the Oswego River. It would also act as a gateway to the college and the City as a whole.

The City and NYSDOT would address runoff from 4.58 acres of highly impervious commercial and transportation related land uses by replacing a portion of existing sidewalks with porous concrete sidewalks. The proposal included bioretention swales designed to infiltrate sheet runoff and filter pathogens from stormwater. Additional impervious surfaces would be removed to create new green space that would remove a source of nutrient loading to the river. Curb cuts would be installed to allow street runoff to discharge to the vegetated areas. The proposal included 95 street trees that would be planted to reduce the amount of stormwater runoff, reduce energy demand, and decrease greenhouse gas emissions. The street trees would also sequester carbon dioxide and improve the City's resilience to climate change. An overflow structure would be added to discharge any runoff over the design holding volume and pipe it back into the storm sewer system. The environmental benefits of these ideas were developed to be consistent with the City's Climate Smart Community Pledge, the local Waterfront Revitalization Program and the City of Oswego 2020 Strategic Plan.

THE OSWEGO CANAL

The New York State Canal System is a 524-mile long waterway that extends throughout Upstate New York. The Canal System, operated and maintained by the New York State Canal Corporation, connects the Hudson River with Lake Champlain, Lake Ontario, Cayuga Lake, Seneca Lake, and Lake Erie by means of the Niagara River. The 24-

⁶ Multi-Jurisdictional Hazard Mitigation Plan, Oswego County, New York

⁷ U.S. EPA <http://yosemite.epa.gov/opa/admpress.nsf/0/AD6961FFB1A3D5D78525772200670F1A>

City of Oswego Land Use

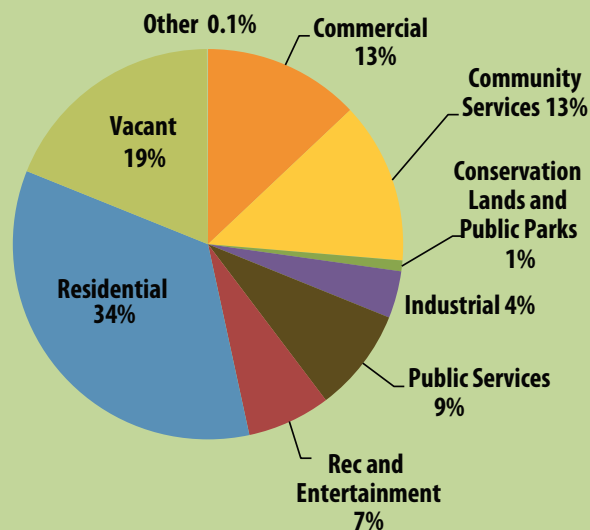


Figure 1- City of Oswego Land Use Breakdown

mile Oswego Canal extends from the City of Oswego to the Erie Canal at the Three Rivers Junction. Three additional canals (the Erie, Champlain, and Cayuga-Seneca) and two river junctions (Waterford and Tonawanda) make up the Canal System. Water quality in the Oswego River is improving. As a significant indicator of this improvement, the Oswego River became the first U.S. Area of Concern to be removed from the Great Lakes Water Quality Agreement list of Great Lakes Areas of Concern in June, 2006.

LAND USE

34.5% of the land in the City of Oswego is classified as residential and 13.0% is classified as commercial. Additional land use categories are summarized in Figures 1 and 2.

NATURAL RESOURCES AND SUSTAINABILITY

The City of Oswego is committed to protecting, preserving and enhancing its natural resources, and community leaders are working to strengthen sustainable development practices, zoning guidelines, and community stewardship. High priority is placed on enhancing shoreline areas along the Oswego River and Lake Ontario because of their environmental protection, aesthetic and recreational benefits.

The objectives presented in the *City of Oswego 2020 Vision Plan Update* are summarized below⁸:

1. Pursue green technologies and energy conservation techniques to minimize the community's environmental footprint.
2. Ensure that future development activities protect and sustain our environment and address coastal erosion.
3. Develop interpretive and educational trails to promote environmental awareness and develop tourist attractions on Oswego County lands.
4. Protect and promote the City's natural resources.
5. Employ safety measures related to nuclear plant operation and storage.
6. Identify, remediate and redevelop brownfield and underutilized properties to expand the tax base and to promote job creation and housing development.

The City has also initiated and supported development of Community Gardens

to help community members grow food locally. The City provided land for the first Community Garden at Fort Ontario and NRG has provided over an acre of land for Community Gardens at the NRG Steam Station.

TRANSPORTATION

The City of Oswego recognizes that the success of the downtown areas requires safe, easy access for pedestrians and motorists. One of the objectives stated in the City's 2020 Vision Plan involves developing a more pedestrian friendly Main Street and downtown area. One of the recommendations in the Plan is to prepare a Corridor Study for Route 104 that addresses safety, pedestrian enhancements, and access management. These and similar efforts to reduce vehicle traffic will help to reduce greenhouse gas emissions and are consistent with the City's Climate Action Plan.

RECREATION AND TOURISM

The Local Waterfront Revitalization Program (LWRP) provided an opportunity for local elected officials, stakeholders, and the NYS Department of State to create a waterfront as the focus of the Oswego downtown region and to boost tourism and recreational interests such as boating and fishing. The City completed the Oswego Esplanade, a 1.5-mile-long walkway along the Oswego River and Canal adjacent to the downtown business district and constructed docks for recreational boaters. Numerous festivals and events are held along the Esplanade each year that attract people to the downtown region. Since its completion, 15 restaurants

and four hotels have opened and the number of vacant commercial properties has decreased.

Each year, the City hosts the Oswego Harborfest, a four-day festival of music, culture and food which concludes with a fireworks display. In addition, year-round recreational trails and facilities are located within the City limits. The percentage of people participating in outdoor recreation activities is increasing within all age groups as more people maintain personal workout and creation goals.

The Great Lakes Seaway Trail is the only state designated bicycle route in Oswego County. The trail is a 518-mile National Scenic Byway in New York and Pennsylvania that consists of designated roads and highways along the Saint Lawrence Seaway—specifically, Lake Erie, the Niagara River, Lake Ontario, and the Saint Lawrence River. It begins at the Ohio state line in rural Erie County, Pennsylvania, and extends through the City of Oswego and several additional municipalities before ending at the Seaway International Bridge in St. Lawrence County. The trail is maintained by a non-profit group called the Seaway Trail, Inc. In New York, the trail was declared a National Scenic Byway in 1996 and the Pennsylvania portion was added in 2005. The Seaway Trail was officially renamed the Great Lakes Seaway Trail in 2010.

The Canalway Trail was first envisioned as part of the 1995 Canal Recreationway Plan. The goal is to establish an end-to-end multi-use trail along the NYS Canal System



Fireworks during Harbor Fest,
Lake Ontario

– more than 500 miles long – making it one of the most important long distance trails in the United States. More than 270 miles of Canalway Trail are now complete. The Canalway Trail program consists of linking the existing segments of completed trail and reconstructing the trail where needed to provide a consistent high-quality resource. Trailhead parking areas with interpretive kiosks, benches, and landscaping are also included in each project. Biker-Hiker-Boater campsites are also being installed at 30-mile increments to better facilitate long distance touring along the trail.⁹

BROWNFIELD OPPORTUNITY AREAS (BOA) PROGRAM

The Brownfield Opportunity Areas (BOA) Program, made possible by the Superfund/Brownfield law in October 2003, provides municipalities and community based organizations with assistance to complete revitalization plans and implementation strategies for areas or communities affected by the presence of Brownfield sites, and site assessments for strategic Brownfield sites. Oswego County received a NYS Brownfield

⁹ NYS Canal website <http://www.canals.ny.gov/about/about.html#canalfacts>

Opportunity Area Grant. The industrial centers along the canal contain underutilized or vacant sites that once housed industrial, energy and transportation businesses. EPA Brownfield Grant funds were used to characterize the Canal Corridor particularly in the City of Oswego and perform environmental assessments on the most critical Brownfield sites within the Corridor.

Primary issues that are being addressed by this project include qualification of environmental liabilities and comprehensive planning, including brownfield redevelopment and building a strategic community vision and a comprehensive revitalization plan. The primary objectives of the Nomination Study of the proposed BOA include the following:

- +Completion of a comprehensive land use assessment and analysis
- +Completion of an economic and market trends analysis
- +Recommendations for future uses and actions to revitalize the City of Oswego; and
- +Identification and description of all brownfield sites and the prioritization of sites based on key community and municipal objectives

Climate Change and the City of Oswego

GLOBAL WEATHER EXTREMES

Many areas throughout the country are experiencing dramatic weather extremes. A

Projected Climate Impacts in the Northeast¹

Temperature: Average temperatures across the Northeast have risen more than 1.5 degrees Fahrenheit since 1970, with even more significant changes in average winter temperatures, rising 4°F between 1970 and 2000.

Precipitation: The Northeast region is projected to see a 20 to 30% increase in winter precipitation, and, due to increases in temperatures, less winter precipitation will fall as snow and more will fall as rain.

Additionally, heavy, damaging rainfall events have already increased measurably across the Northeast in recent decades. For example, Hurricane Irene and Superstorm Sandy brought intense rains to the region in 2011 and 2012, causing widespread flooding.

Drought: Rising summer temperatures coupled with little change in summer rainfall are projected to increase the frequency of short-term (one to three month) droughts in the Northeast, therefore increasing stress on both natural and managed ecosystems.

¹ US EPA

<http://www.epa.gov/climatechange/impacts-adaptation/northeast.html>

primary influence on wind and precipitation variability can be attributed to the natural climate cycles of El Nino and La Nina that originate in the equatorial Pacific region. The cycles influence the direction and characteristics of jet streams, causing them to meander in the northern and southern hemispheres. The heat and water vapor that enter the atmosphere influence weather patterns around the globe.

Another significant influence on weather patterns can be attributed to human activity. The long-term accumulation of greenhouse gases in the atmosphere is trapping heat and increasing temperatures in both terrestrial and water ecosystems. The average surface temperature worldwide has increased approximately one degree Fahrenheit in the past four decades.¹⁰ As a result of this warming trend, Arctic sea ice has lost approximately 40% of its summer sea ice since the 1980s and autumn ocean temperatures have risen 3.6 to 9°F. As the ocean temperature increases, more moisture is released into the atmosphere. During the past twenty five years, scientists have measured a 4% average rise in water vapor in the air column which is increasing the potential for strong storm events.¹¹ The following section presents information on how these global findings impact local climate characteristics in New York State and in the City of Oswego.

¹⁰ National Geographic September 2012, "Weather Gone Wild"

¹¹ National Geographic September 2012, "Weather Gone Wild"

NEW YORK STATE WEATHER CHARACTERISTICS

Central New York's climate is characterized by warm, dry summers and cold, snowy winters. Weather patterns are influenced by topography, prevailing westerly wind direction, and proximity to Lake Ontario. Frost can be expected from early October until late May and the growing season is approximately 18 to 20 weeks long. Although serious droughts are rare, most growing seasons do experience limited periods of low soil moisture.

In 2011, the New York State Energy Research and Development Authority (NYSERDA) released a comprehensive assessment of the projected effects of climate change in New York State's critical systems and natural resources over the next century. *ClimAID: the Integrated Assessment for Effective Climate Change Adaptation Strategies in New York State* was compiled by more than 50 scientists and currently serves as an important tool for planners, policymakers, farmers, local governments and residents. According to this report, the annual average temperature in New York has risen approximately 2.4 °F since 1970, with winter warming exceeding 4.4 °F.¹² Sea level along New York's coastline has risen about a foot since 1900 and intense precipitation and heavy downpours have increased in recent decades.

Flooding is a growing concern throughout New York State, especially with urban

¹² USA.com <http://www.usa.com/oswego-ny-weather.htm#HistoricalTemperature>

development and the increasing frequency of storm events. Although some areas are more prone to flooding than others, there is no area of the State that is exempt from flood hazards altogether. There are over 52,000 miles of river and streams in New York State and along their banks there are 1,480 communities that are designated as flood prone. An estimated 1.5 million people live in these flood prone areas and many more work, travel through, or use recreational facilities located in these areas.

LOCAL CLIMATE CHARACTERISTICS

The City of Oswego experiences seasonable weather patterns that are characteristic of the northeastern U.S. cyclonic system. During the summer and parts of spring and autumn, temperatures rise during the daytime and fall rapidly after sunset. The average temperature in Oswego is 46.6°F, which is lower than the New York average temperature of 48.2°F, and much lower than the national average temperature of 54.4°F. Since 1926, the City of Oswego's average temperatures have followed a gradual warming trend, with greater fluctuating temperature extremes since the 1990s.

The average annual precipitation in Oswego is 39.9 inches, which is slightly lower than the New York State average of 42.9 inches. The City has also experienced a gradual increase in precipitation since 1926. Cold air masses affect the area weather, often resulting in cold, snowy winters. The average annual snowfall in Oswego is 92.0 inches,



Snow Tunnel during 2007 winter, Oswego

substantially higher than New York State's average of 55.3 inches.

The amount and duration of ice cover on Lake Ontario and other Great Lakes is variable from year to year. Despite the anomaly of winter weather conditions during 2013 and 2014, scientists have documented an overall decrease in ice extent since the early 1970s. From 1973 to 2010, annual ice coverage on the Great Lakes has declined by 71 percent relative to 1973.¹³ Ice characteristics are important to monitor because of the influence on hydropower generation, commercial shipping, the fishing industry and other societal impacts. Scientists at the Great Lakes Research Laboratory are observing long-term changes in ice cover as a result of global warming, and their research is helping to determine the impacts on climate patterns, lake water levels, water movement patterns, water temperature structure, and

¹³ Great Lakes Environmental Research Laboratory, <http://www.glerl.noaa.gov/data/ice/>

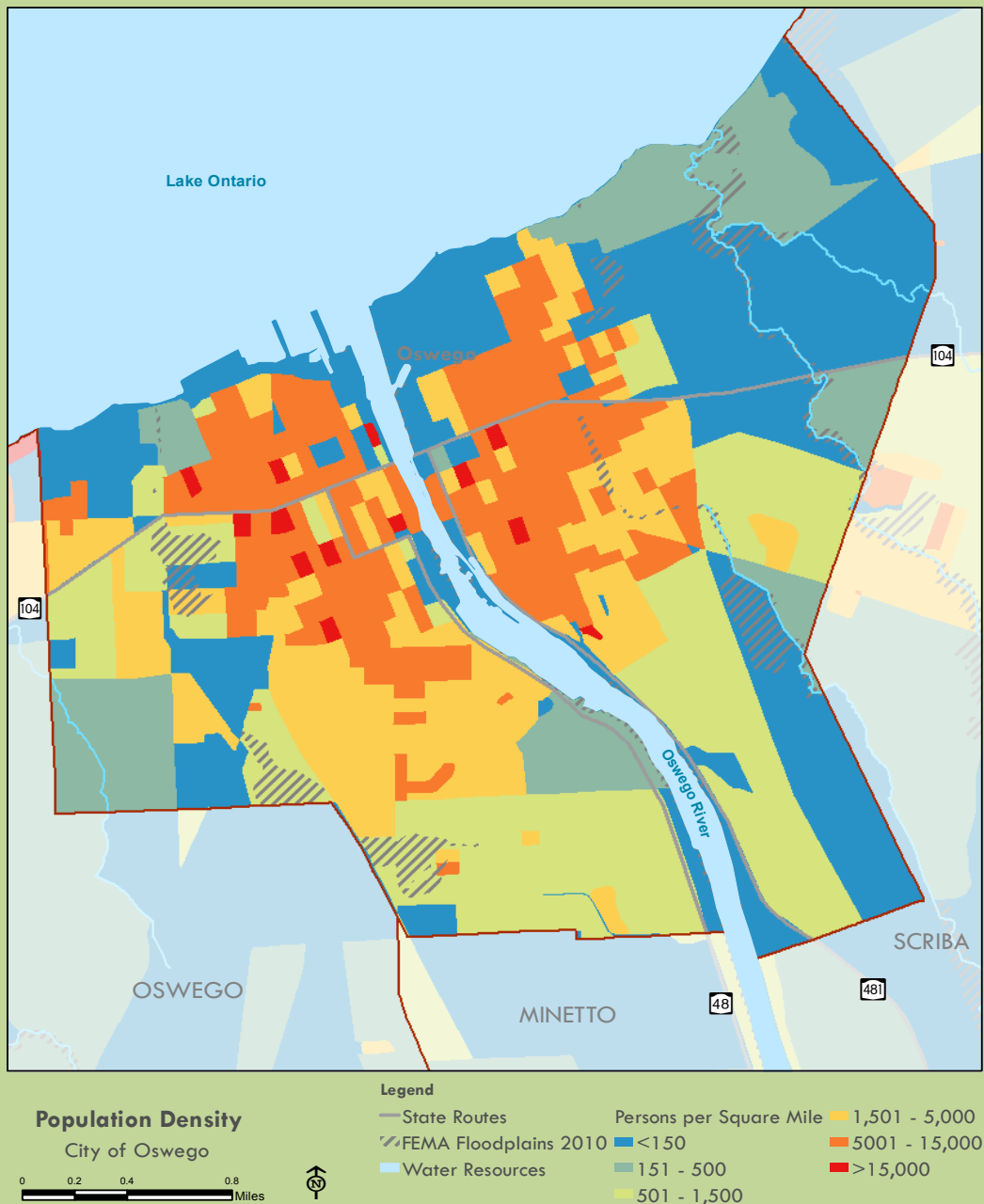
spring plankton blooms. Ice coverage and duration influence water temperature in the Great Lakes, as incoming solar radiation will have to melt the ice before it warms the lake water. However, weather conditions, lake depth, and heat storage capacity in the lakes are also important components that can influence the thermal cycle in the lakes.

EXTREME WEATHER EVENTS

Storm intensity is influenced by air temperature. As the air temperature rises, moisture in the atmosphere increases which contributes to a greater intensity and frequency of precipitation events. Warming air temperatures, as seen throughout New York State, are caused by emissions of heat-trapping gasses in the atmosphere including pollution from fossil fuels. Warming air temperatures cause higher levels of oceanic evaporation which intensifies the water cycle throughout the globe. As a result, storm events in the City of Oswego and around the globe are gradually becoming more extreme with stronger wind and higher levels of rainfall.

According to the ClimAID report, New York State experienced a 64% increase in extreme storm frequency between 1948 and 2011. The increased number of severe storms is expected to gradually continue, with 100-year storms likely to occur every 80 years by the end of the century. Meteorologists report that the total annual amount of precipitation is changing, as well as the distribution and intensity of storm events.

FIGURE 2- CITY OF OSWEGO POPULATION DENSITY



According to records from the NYS Office of Emergency Management (NYSOEM) and the Federal Emergency Management Agency (FEMA), Oswego County experienced six weather-related Presidential Disaster Declarations between 1954 and 2010. They included an ice storm, flooding, Hurricane Eloise in 1975, severe storms, high winds and wave action and Tropical Storm Agnes. In addition, five Emergency Declarations were issued between 1974 and 2010 in the County, including lake effect storms, Hurricane Katrina evacuation, a power outage, and a West Nile virus threat. Strong storm events contribute to localized flooding, stormwater runoff, and soil erosion. These conditions can cause damage to roads, bridges, and other infrastructure in the City of Oswego. The role of agencies such as the Oswego County Soil and Water Conservation District (SWCD) and the Natural Resource Conservation Service (NRCS) will become increasingly important in the coming years, especially in terms of their work with stream bank stabilization, erosion and sediment control, and stormwater management.

FLOODING

Flooding is influenced by weather conditions (primarily the intensity and amount of precipitation), spring snowmelt, groundwater levels, and the level of urban development characterized by impervious surfaces, compacted soils, and fewer vegetated acreage. These conditions limit groundwater recharge and increase surface runoff and flooding. According to the Federal Emergency Management Agency (FEMA), floods have caused a greater loss of

life and property, and have disrupted more people in the United States than the impact of all other natural hazards combined. FEMA reports that floods kill more people than any other form of severe weather with damages exceeding \$3.5 billion annually. Further, with the exception of fire, floods are the most prevalent and widespread of all natural disasters. Approximately 75 percent of all presidentially declared disasters are the result of flooding.

The frequency of localized downpours in Central New York has increased over the past fifty years and this trend is expected to continue. Heavy precipitation events increase the potential for localized flooding and stormwater runoff. Heavy rain events also increase pollution loading to local waterbodies and can decrease the efficiency of wastewater treatment plants.

According to the Oswego County Multi-Jurisdictional Hazard Mitigation Plan, flooding was designated as a moderately low hazard in the county. The greatest potential for flooding in Oswego occurs in the early spring during periods of heavy precipitation, warming temperatures, and rapid snowmelt. Vulnerable regions in the City are located in low elevation areas along the Oswego River shoreline. Land use and population density maps are displayed in Figures 2 and 3. FEMA flood zones are located in areas of moderate population density (1,500 to 15,000 persons per square mile) and high population density (greater than 15,000 persons per square mile).

Flooding is New York State's most consistently damaging natural hazard, but according to the Hazard Mitigation Plan, Oswego County experiences fewer floods than many other Counties in the State. Oswego County has had three Presidential Disaster Declarations issued for flooding events that occurred between 1953 and 2007.

Assessed value refers to the dollar value assigned to a home or property by local government in order to calculate property taxes. According to tax parcel data from 2012, the total assessed value of property located within designated FEMA flood zones in the City of Oswego represents 26% of the total assessed value of parcels throughout the City. Of the 7,120 land parcels in the City, 2.9% are located in FEMA flood zones.

SNOWFALL

The City of Oswego is influenced by lake effect snow which is caused by a differential between cold air temperatures and warmer water temperatures found in Lake Ontario. As cold air flows over the warm water, the bottom layer of air over the surface of the water is heated from below. Since warm air is lighter and less dense than cold air, the heated air rises and cools. As it cools, the moisture from the lake condenses and forms clouds. When enough moisture condenses, snow bands develop over the region downwind of Lake Ontario. The greater the temperature contrast between the cold air and the warm water, the heavier the resulting lake effect snow fall will be.

Because of the increased water temperature and reduced duration of ice cover on Lake Ontario, the City of Oswego and other areas to the east and south of the lake will continue to experience heavier and more frequent lake-effect snowfall events. Oswego is one of the snowiest towns in America, with some winters totaling over 300 inches. In 2007, Oswego received national attention when approximately 130" (nearly 11 feet) of snow fell within a two-week period, breaking a previous record set in 1966. As a result of this storm, the school district closed all facilities for a week and the county opened an Emergency Operations Center for 13 days. Oswego County was declared a State Disaster Area on February 8 and New York State's Transportation Infrastructure Group was recruited to help with snow removal. A Presidential Declaration for a Snow Emergency resulted in an award of \$783,341 in public assistance for the County, its municipalities, and public agencies.¹⁴

The "Blizzard of 1993" impacted the east coast and resulted in a federal declaration of disaster for New York State. During this event nearly five feet of snow fell on the City of Oswego in 48 hours, between March 12 and 13, 1993.

CLIMATE IMPACTS ON TOURISM

Weather has a significant impact on the tourism and recreation sector. Season weather patterns, especially precipitation rates, determine water levels for boating, snow cover for skiing, and waterfowl

¹⁴ Multi-Jurisdictional Hazard Mitigation Plan, Oswego County, New York <http://www.co.oswego.ny.us/emo/hmp%20final%20sept%202012.pdf>

breeding rates for sport hunting. Weather influences the duration and types of outdoor recreation activities that take place and plays a predominant role in determining local economic vitality.

Warming trends have the potential to negatively impact the area's outdoor recreation and may reduce recreational income generated for the local economy.

Fishing, canoeing, and kayaking (especially in Lake Ontario and along the Oswego River and its tributaries) are popular water-based activities in Oswego during the summer months. Higher air temperatures and a shorter duration of winter ice cover may increase surface water temperatures, which will likely cause a gradual shift in coldwater fisheries. According to researchers at Cornell University, warming water temperatures may already be contributing to fish species modifications in Oneida Lake. Climate modification is thought to be causing an increased production of largemouth and smallmouth bass, gizzard shad, and other species near the northern extent of their range. Additionally, at the southern edge of their range, Burbot may be in decline. Brook trout, commonly found in New York State tributaries, are at risk due to changes in habitat resulting from climate change and the presence of invasive species.

The local warming trend is providing a longer growing season for agricultural crops and backyard gardens and is providing a boost to water-based summer recreation



Peace Garden, Oswego

such as boating and swimming. However, the combined effect of warmer air and water temperatures and decreasing ice coverage will likely cause an increase in the growth of nuisance aquatic plants and algae which could cause recreational impairments.

PUBLIC HEALTH

Changes in climate conditions are affecting human health. Health impacts of warming temperatures that have been documented throughout the country include increased illnesses and deaths from heat events, injuries and deaths from extreme weather events, and respiratory illnesses such as asthma due to changes in air quality.

Indirect health impacts of climate change include illnesses and deaths that result from climate related changes in ecosystems and infectious agents. Food, water, and animal-borne diseases affecting humans, livestock, and wildlife are governed by environmental conditions. Anticipated projections of warmer winters, hotter summers, and unpredictable precipitation patterns can

cause increases in certain types of diseases. For example, climate change in the Northeast is expected to result in the increased population rates of mosquitoes and ticks. As the population of these insect increases, it could result in more frequent outbreaks of West Nile Virus and Lyme disease-causing bacteria.

INVASIVE SPECIES

While insects and diseases are a natural part of the aquatic and terrestrial ecosystems, climate change is gradually shifting pest populations of some invasive as well as native species. Some warm-weather species that previously could not survive the cold are now able to establish themselves, threatening populations of native species. This is already occurring with increasing invasive species populations throughout New York State. Early detection and a rapid response of new infestations of invasive species is the most effective way that the City of Oswego can address this problem.

The Hemlock Woolly Adelgid, Asian Longhorn Beetle and Emerald Ash Borer are invasive tree pests that are currently threatening Central New York. They have the potential to damage local tree populations and the communities and industries that rely on them. The destruction of hemlock in New England forests affects recreational activities such as fishing. As pests kill trees adjacent to streams, shade is no longer provided and stream water temperatures increase beyond what is ideal for coldwater fish such as trout.¹⁵

¹⁵ http://www.northeastclimateimpacts.org/pdf/miti/moser_et_al.pdf, page 14

CLIMATE ADAPTATION

According to climate researchers, “Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions.” These are the key conclusions from an assessment

by the Intergovernmental Panel on Climate Change (IPCC) that was released in January 2014. 259 scientists from 39 countries around the world further stated that, “Warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia.”



Lake Ontario, Oswego

The findings discussed above are based on numerous independent scientific analyses and observations of the climate system, paleoclimate archives, theoretical studies of climate processes and simulations using climate models. The Summary for Policymakers of the IPCC Working Group I assessment report was approved in September 2013 by the member governments of the IPCC meeting in Stockholm, Sweden. The U.S. Environmental Protection Agency refers to the term “adaptation” as the adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.¹ A reduction of greenhouse gas emissions can be achieved through an increased understanding and endorsement of climate adaptation strategies. Community responses to extreme weather (early storm warning systems, air-conditioned cooling shelters, and policies that discourage people from building in flood prone areas) will

require comprehensive, community-wide planning that addresses all risk factors.

A primary goal for Central New York, as presented in *Vision CNY: Central New York Regional Sustainability Plan*, is to adapt to a changing climate and improve the resilience of the region’s communities, infrastructure, and natural systems. A gradual increase in high and low temperature extremes, coinciding with an increase in the frequency and intensity of storm events are expected to impact transportation infrastructure, human health, agricultural practices, forest diversity, and migratory patterns of invasive species. Adapting to climate change will provide opportunities for Oswego to improve the health and resilience of the community and will provide long-term protection of the natural environment.

The City of Oswego has been pro-active in preparing for climate change and has taken steps to reduce greenhouse gas emissions. The City is committed to sustainability best

practices and has worked with the Maxwell School at Syracuse University to produce a study called, “The City of Oswego: Toward Municipal Sustainability” that identifies cost-effective ways to reduce energy use through street light removals and upgrades. Oswego is also exploring options to use sustainable energy resources including solar and wind power. The following section provides a summary of several additional steps the City has taken to address climate adaptation.

CLIMATE SMART COMMUNITY

The City of Oswego and Oswego County have shown support for sustainable energy policies and practices by becoming a Climate Smart Communities. Since then, lights and lighting system upgrades have been installed in several buildings and on city streets. This commitment to becoming more sustainable includes many initiatives that help the county and city reduce energy-related expenses while increasing the use of renewable and alternative energy sources. Recognizing the wide range of renewable and alternative

¹ EPA 2012: <http://epa.gov/climatechange/glossary.html>

energy production facilities in the County, Oswego County is one of five counties in Northern New York named the "Energy Valley" of the state by the state Senate. The senate resolution cited the energy production and technological training facilities in the five counties, including biomass, landfill gas-to-energy, methane digesters, hydroelectric, wind, solar and nuclear facilities.

CITY OF OSWEGO 2020 VISION COMPREHENSIVE PLAN

The City adopted the City of Oswego 2020 Vision Comprehensive Plan in 2003. In 2010, City officials hired Bergmann Associates and the Steinmetz Planning Group to update the Plan and to facilitate a community-wide planning process that would involve citizens in redefining their vision for Oswego's future. The project involved meetings and workshops with community stakeholders. In January 2011, City Council adopted the 2020 Strategic Plan, which updated the 2020 Vision Comprehensive Plan.

OSWEGO COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL

Each year the Oswego County Environmental Management Council (EMC) provides a report called, "State of the Oswego County Environment". The EMC is actively engaged in environmental protection, climate awareness and education, and energy conservation.

LOCAL WATERFRONT REVITALIZATION PROGRAM

The Local Waterfront Revitalization Program (LWRP) has provided an opportunity for local elected officials, stakeholders, and the NYS Department of State to create a waterfront as the focus of the Oswego downtown region and to boost tourism and recreational interests such as boating and fishing.

OSWEGO COUNTY EMERGENCY MANAGEMENT OFFICE

The Oswego County Emergency Management Office (EMO) serves as the disaster services and emergency preparedness center. The EMO maintains and administers an integrated emergency management program designed to ensure life safety, property and environmental protection from all natural, human-caused, and technological hazards through preparedness, prevention/mitigation, response and recovery. The office provides planning and training resources, response and warning coordination, and information distribution through communications to the public, local government officials, and public safety agencies to assist them in emergency management. The EMO coordinates plans for emergency response, including county-wide and local comprehensive emergency management and hazard-specific plans such as radiological, hazardous materials, or multiple-casualty.

HAZARD MITIGATION AND RADIOLOGICAL EMERGENCY PREPAREDNESS

Oswego County updated its vulnerability assessment, the Multi-Jurisdictional Hazard

Mitigation Plan, in 2012 with assistance from national, state and local agencies. By identifying vulnerabilities and assessing local risks, the county increased its capacity for planning for hazard avoidance and mitigation. By updating the plan, the county improved overall understanding of local hazards which led to a more sustainable and disaster-resistant community. Recommendations included in the plan are designed to protect human health and reduce potential impacts on infrastructure.

RADIOLOGICAL EMERGENCY PREPAREDNESS

The Nine Mile Point Nuclear Power Facility is located in the Town of Scriba. Oswego County developed a Radiological Emergency Preparedness Program for the safety of residents living near the facility. In the event of an emergency at Nine Mile, sirens and tone-alert weather radios are in place to alert residents to tune into an Emergency Alert System station via radio or television. These emergency measures are in place to support a 10-mile Emergency Planning Zone that is located in the vicinity of the Nine Mile Point facility. As a backup method to the Emergency Alert System, a reverse notification system called HyperReach is also in place to protect citizens within the Emergency Planning Zone and Oswego County.

OSWEGO COUNTY EMERGENCY COMMUNICATORS/RADIO AMATEUR CIVIL EMERGENCY SERVICE

The Oswego County Emergency Communicators/Radio Amateur Civil

Emergency Service (RACES) is a manpower and equipment communications resource that provides professional skills to the Office of Emergency Management and the government of Oswego County. They offer administrative and logistical communications to the emergency service agencies within the County and to other jurisdictions including the State Emergency Management Office, when needed. Each RACES communicator is licensed by the Federal Communications Commission (FCC). The organization is administered under the guidance of the Oswego County Emergency Management Director. The Emergency Communicators support and train severe weather spotters in the National Weather Service's Skywarn™ program

CRISAFULLI ICE RINK

With financial and technical assistance from the CNY RPDB, the City of Oswego was able to purchase an electric Zamboni for its Crisafulli Ice Rink and make upgrades to the air exchange mechanisms at the facility. Although there was a high upfront cost for the purchase of the machine, the annualized lifetime costs will be lower for an electric model than the traditional diesel model. Additionally, there will be air quality and air handling benefits at the facility. The City also recently installed a 50kW solar PV system on the ice rink that will provide the majority of the rink's electrical power requirements during most of the year.



West Pierhead Lighthouse,
Oswego

OSWEGO COUNTY SOIL AND WATER CONSERVATION DISTRICT

The Oswego County Soil and Water Conservation District (SWCD) develops erosion and sediment control plans, assists with stormwater facility permitting, works on streambank restoration to reduce erosion and sedimentation, and provides assistance in the identification of green infrastructure opportunities in the City of Oswego. Each year the SWCD sponsors erosion and sediment control courses that meet the requirements described by the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity.

OSWEGO COUNTY TRANSPORTATION COALITION

In 2010, the Oswego County Transportation Coalition developed an interactive website (www.forthibus.org) for community riders so that they can obtain transportation information about Oswego County transit

services. More efficient bus schedules were also created to increase access to transit services and several bus routes were restructured to assure schedule compatibility, easy connections and route coverage throughout the county.

POLICY RECOMMENDATIONS

The policy recommendations for climate adaptation that are presented in the following table (pages 22 and 23) are designed to help the Oswego community prepare for current and anticipated changes in climate conditions and to assist decision-makers in identifying opportunities to improve community resilience.

The table provides a summary of actions that the community can take to protect people, homes, buildings and natural systems by reducing risks from environmental hazards such as extreme heat and storm events. The recommendations also provide ways to reduce the City's energy costs and to improve the quality of life for City residents.

Planning for future weather impacts will enable Oswego to be better prepared and resilient. Long-term monitoring and evaluation of adaptation efforts is also important in order to document the efficiency of different strategies and how they can be improved. In addition, the City is encouraged to build climate adaptation into existing planning documents.

CLIMATE ADAPTATION RECOMMENDATIONS FOR THE CITY OF OSWEGO

Focus Areas and Recommendations	Actions
Monitoring, Assessment and Data Collection: Provide for the routine collection of temperature, precipitation, and storm event data and public health information	<ul style="list-style-type: none"> • Assess the condition of local infrastructure and document climate vulnerabilities in the areas of energy, water, transportation, and telecommunications • Support the Oswego County Health Department in efforts to monitor climate impacts on human health such as asthma and heat-related illnesses • Assess the economic impacts of climate change through revenue potential from tourism and recreation • Work with Project Watershed to document invertebrate populations • Identify priority river and tributary segments and promote flood studies in these areas • Develop a database of the elderly and people with special needs and a system to contact them in case of emergency
Infrastructure Design and Maintenance: Protect local infrastructure to facilitate stormwater and flood control	<ul style="list-style-type: none"> • Support stormwater control and climate adaptation initiatives that are included in the Green Gateway Project. The proposed installation of porous pavement, bioretention swales, curb cuts, and trees are designed to reduce stormwater runoff, reduce energy demand, and decrease greenhouse gas emissions • Work with the Oswego County Soil and Water Conservation District to improve the capacity of stormwater collection systems and to maximize soil infiltration and groundwater recharge • Install green infrastructure measures (rain gardens, porous pavement, and rain barrels) • Encourage downspout disconnection, bioinfiltration, and rainwater harvesting in Oswego's residential and business communities to reduce stormwater runoff • Remove paved surfaces in downtown vacant lots and convert the land to public green space with tree plantings to facilitate infiltration and reduce stormwater runoff • Maintain the City's hiking and biking trails to enhance open space preservation, reduce reliance on vehicular modes of transportation, and to cut greenhouse gas emissions
Public Health: Establish mechanisms to reduce or eliminate the negative effects of climate change on public health	<ul style="list-style-type: none"> • Improve local capacity for health preparedness, response, and recovery programs such as extreme-heat response plans that include community centers with air conditioning • Expand the City's capacity for monitoring, disease surveillance, and disease outbreak investigation and control • Provide alerts for the public regarding heat events and other potential health risks
Communications: Ensure that internal emergency operations are current and maintain open lines of communications among local agencies	<ul style="list-style-type: none"> • Update the City's inventory of emergency operations and responsibilities for cleanup crews • Collaborate with national, state, and local agencies to facilitate data collection, sharing, and synthesis of flood and storm event preparedness information • Reconfirm lines of communication with local police and fire departments, the local power utility, and media outlets • Review the potential use of Hyper-Reach with IPAWS, a government partnership between federal and local emergency responders, designed to reach non-residents in the City for more complete coverage during emergencies
Community and Regional Collaboration: Develop and support regional partnerships that promote research, public awareness of climate change issues, and strategies that enhance the resiliency of the region, its residents and its institutions	<ul style="list-style-type: none"> • Establish agency protocols for sharing equipment during emergencies • Update land hazard maps and inventories of infrastructure and at-risk communities in the City • Update the County's Hazard Mitigation Plan every five years and provide public access to the Plan by adding it to municipal and agency websites • Evaluate measures to reduce dependency on individual vehicle use and research opportunities to expand public transit • Establish a road watch program to alert the public of flooded areas and tree damage during storm events

Focus Areas and Recommendations	Actions
Local Laws and Planning: Modify local laws to incorporate measures for adaptation to climate change	<ul style="list-style-type: none"> •Maintain compliance with and good-standing in the NFIP including adoption and enforcement of floodplain management requirements (e.g. regulating all new and substantially improved construction in Special Hazard Flood Areas), floodplain identification and mapping, and flood insurance outreach to the community •Evaluate potential participation in the FEMA Community Rating System to further manage flood risk and reduce flood insurance premiums for NFIP policyholders •Review building and zoning codes to discourage/prevent new development in flood-prone and high hazard areas along the shoreline •Establish/maintain strong building codes regarding energy use, including movement to performance-based codes •Draft landscape ordinances to accommodate the use of heat and drought tolerant plants •Identify and remove local barriers to green infrastructure •Incorporate climate adaptation into planning documents such as the City of Oswego's 2020 Plan
Natural Resources: Ensure the resilience of natural systems and resources through open space conservation and smart growth strategies	<ul style="list-style-type: none"> •Protect open space through conservation land grants, landowner incentives, regulation, fee acquisition, purchase of conservation easements, and support of smart growth principals •Update local maps that display low elevation areas in the City that are susceptible to flooding. Display this information on the City website along with preparedness guidelines; maps should display varying levels of flood hazard potential •Implement response protocols to remove branches, ice jams, and other debris from the Oswego River and tributaries to reduce the potential for flooding
Invasive Species: Protect local trees by controlling the introduction and spread of invasive species	<ul style="list-style-type: none"> •Educate the public and elected officials on the value of prevention and early detection of invasive species •Work with the Oswego Soil and Water Conservation Service and the Natural Resource Conservation Service to monitor the introduction and spread of invasive species •Participate in Cornell Cooperative Extension's Emerald Ash Borer control strategy and in the New York State Invasive Species Task Force
Public Engagement and Education: Implement comprehensive public outreach and stakeholder engagement campaigns to build awareness of climate change impacts	<ul style="list-style-type: none"> •Develop and enhance climate education programs for all grade levels in the Oswego Central School District •Train local building officials, planning boards, and elected official on flood hazards, risk reduction strategies, implementation of floodplain development regulations, post-flood reconstruction, and how to address flood hazards during planning board review •Train local building officials and the construction industry on flood proofing techniques for retrofitting existing flood prone development •Provide topographic maps and information about flood preparedness to the public; distribute brochures, fact sheets, and posters that show ways in which businesses and residents can prepare for and adapt to climate change •Incorporate climate adaptation principals on City and agency websites and local planning documents. This will increase the awareness of severe weather risks, storm preparedness, and safety practices for homes and businesses •Provide emergency preparedness guidelines on the City website. Include recommendations for people living and working in flood prone areas, actions to take if a flash flood warning is issued, relevant emergency websites and information sources, items to include in a disaster/ flood supply kit, how to protect your property from flood damage, and guidelines for developing a Family Disaster Plan •Sponsor workshops to teach homeowners, local planning boards, elected officials, code enforcement officers, federal and state agencies, businesses, citizen associations and real estate agents about local hydrology, storm preparedness, watershed land use influences, and floodplain management

What can be done in Oswego?

The city of Oswego has chosen to adopt the NYS Department of Environmental Conservation (DEC)'s Climate Smart Communities Pledge, and municipal operations have already begun reducing their energy use and GHG emissions.

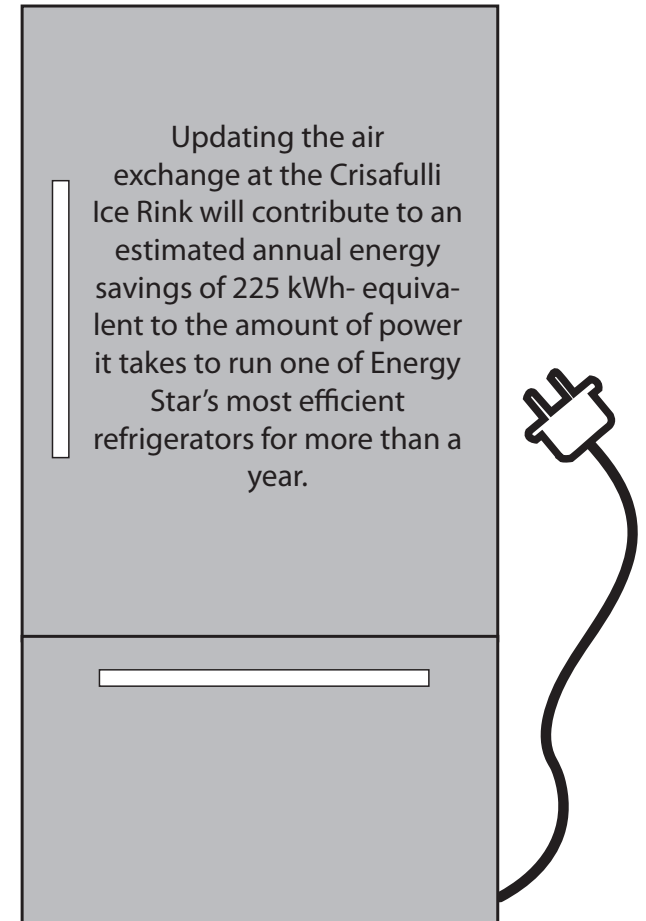
In 2010, the Central New York Regional Planning and Development Board (CNY RPDB) selected the City of Oswego as a participant in the Central New York Climate Change Innovation Program (C2IP) funded through a grant from the US Environmental Protection Agency (EPA)'s Climate Showcase Communities Grant Program.

The CNY RPDB provided the City with \$30,000 of grant funding towards the development of a clean energy demonstration project. With additional technical assistance from the CNY RPDB, Oswego was able to purchase an electric Zamboni for Crisafulli Ice Rink that will save 240 gallons of fuel oil annually and will complete upgrades to the air exchange mechanisms at the facility that will lead to an energy savings of 225 kWh annually. The City also recently installed a 50kW solar PV system on the ice rink that will provide the majority of the rink's electrical power requirements during most months of the year.

While Oswego's actions at the ice rink are commendable, the strategies noted in this document represent further efforts that can be made by the municipality as well as by the community members to reduce energy use and GHG emissions even further.

In 2012, a GHG inventory report was compiled to detail energy use and the sources of emissions in Oswego in 2010. This Climate Action Plan uses the data provided in the GHG inventory report to address strategies that both government operations and community members can take to reduce energy use and GHG emissions by 2030. Specifically, using 2010 as the base year, the emissions reduction target for Oswego is 20% by 2030.

Guided by the strategies explored in this Climate Action Plan, Oswego has the potential to reduce energy use and GHG emissions significantly. By implementing the strategies noted in this document, community members will not only be able to reduce GHG emissions, they will also be able to reduce their overall energy costs, be more comfortable in their own homes, reduce reliance on non-renewable, foreign sources of energy, and conserve Oswego's resources for the future.



CRISAFULLI ICE RINK UPGRADES

AT A GLANCE



50 KW SOLAR PV ARRAY
will generate the majority of the building's electrical needs during most months.

ELECTRIC ZAMBONI
reduces emissions from ice cleaning machines and improves air quality inside the building.

AIR EXCHANGE UPDATES
reduce energy used to heat and cool the building.

Updating the air exchange and purchasing an electric zamboni for the Crisafulli Ice Rink will reduce annual emissions by 2.3 MTCO₂e; equivalent to removing over 5 barrels of oil consumed each year.



GHG Inventory Summary

As part of the Climate Change Innovation Program, an inventory of Oswego's municipal and community GHG emissions was conducted in 2012 with the assistance of a student team from the State University of New York College of Environmental Science and Forestry with additional oversight and technical review by CNY RPDB staff. The 2012 inventory report examined emissions generated in Oswego in 2010, which serves as the baseline year for the Climate Action Plan.

The inventory report found that in the 2010 base year, Oswego government operations generated a total of 5,091 metric tons of carbon dioxide equivalent (MTCO₂e), which were broken up into 6 sectors: buildings and facilities (931 MTCO₂e, 19%), streetlights and traffic signals (556 MTCO₂e, 11%), vehicle fleet (1,032 MTCO₂e, 20%), water delivery (1,325 MTCO₂e, 26%), wastewater facilities (777 MTCO₂e, 15%), wastewater treatment processes (470 MTCO₂e, 9%).

Oswego community emissions totaled 147,926 MTCO₂e, which were broken up into 5 sectors: residential energy use (35,172 MTCO₂e, 24%), commercial energy use (29,904 MTCO₂e, 20%), industrial energy use (46,434 MTCO₂e, 32%), transportation (34,463 MTCO₂e, 23%), and waste (1,953 MTCO₂e, 1%).

Oswego's Climate Action Plan uses the data gathered in the 2012 GHG inventory report as a baseline for analyses to determine which energy efficiency strategies will be most effective in the city. The strategies suggested in this document can help Oswego to reduce emissions, energy use, and dollars spent on municipal and community operations further by 2030.

FIGURE 3- OSWEGO MUNICIPAL EMISSIONS BY SECTOR MTCO₂E (2010 BASELINE)

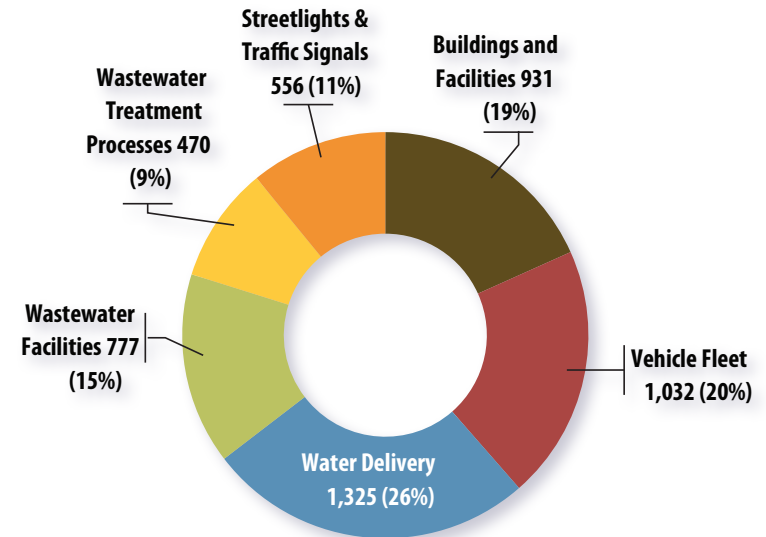
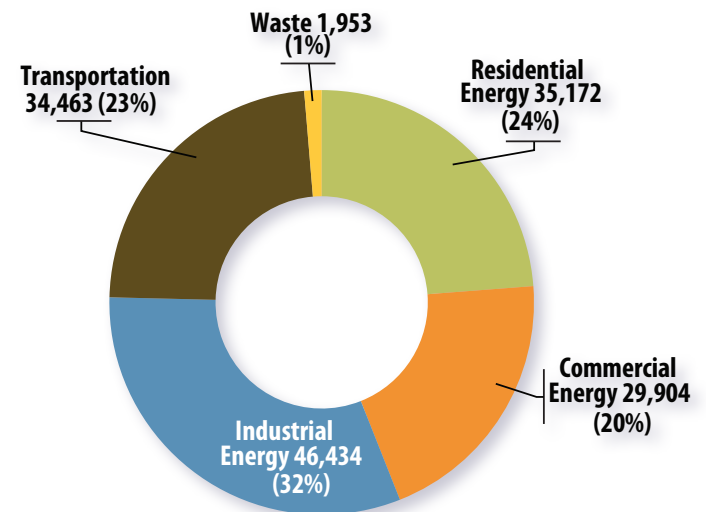


FIGURE 4- OSWEGO COMMUNITY EMISSIONS BY SECTOR MTCO₂E (2010 BASELINE)



1 MTCO₂e =





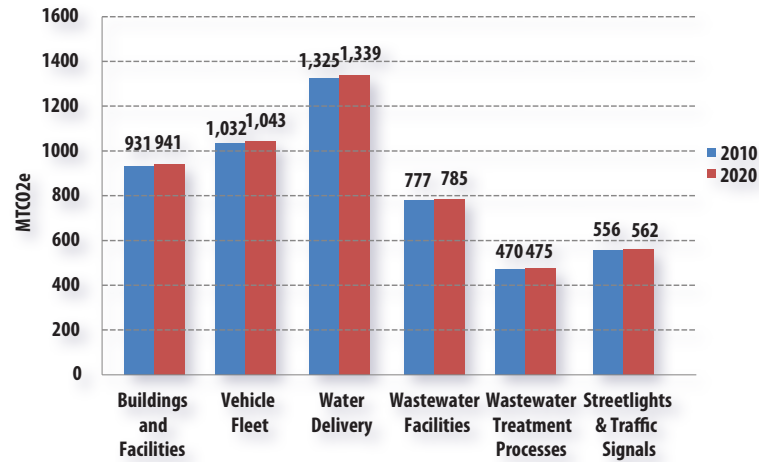
-  CO₂ emissions from 112 gallons of gasoline consumed
-  CO₂ emissions from 2.3 barrels of oil consumed
-  CO₂ emissions from 41.7 propane cylinders used for home barbeques
-  Carbon sequestered by almost 1 acre of U.S. forests in one year

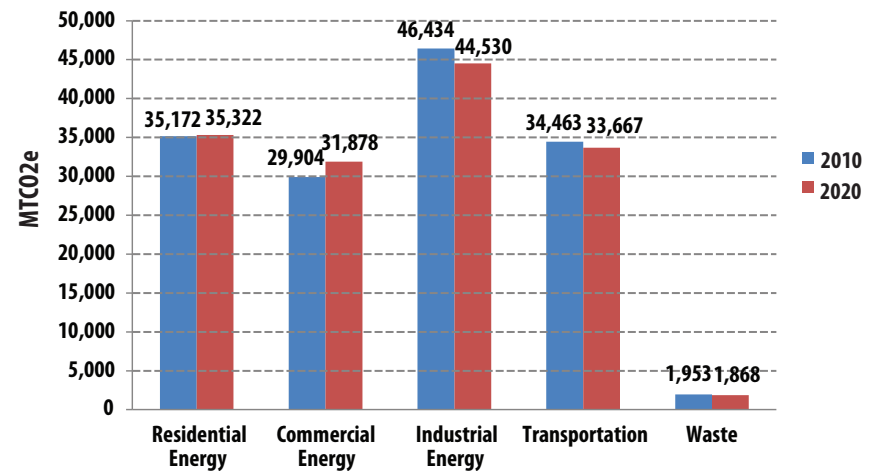
FIGURE 5- EMISSION FORECAST:
MUNICIPAL OPERATIONS



The GHG inventory report also forecasted emissions for Oswego in 2020. The report explained that Oswego government emissions were expected to total 5,145 MTCO₂e in 2020, with 10 MTCO₂e increase in buildings and facilities emissions, 6 MTCO₂e increase in streetlights & traffic signals, 14 MTCO₂e increase in water delivery, 8 MTCO₂e increase in wastewater facilities, 11 MTCO₂e increase in vehicle fleet emissions, and 5 MTCO₂e increase in wastewater treatment processes.

The community forecast showed only slight changes, and were expected to total 147,265 in 2020, with 150 MTCO₂e increase in residential energy use, 4,974 MTCO₂e increase in commercial energy use, 1,904 MTCO₂e decrease in industrial energy use, 796 MTCO₂e decrease in transportation, and 85 MTCO₂e decrease in waste.

FIGURE 6- EMISSION FORECAST:
COMMUNITY



Strategies Overview

CNY RPDB staff worked with a team of interns throughout the spring and summer of 2013 to analyze potential strategies for reducing the City's emissions for both municipal operations as well as at the community-wide scale. The team utilized a software tool developed by ICLEI-Local Governments for Sustainability known as CAPP (Climate and Air Pollution Planning Assistant) version 1.5 to calculate potential GHG reductions as well as cost savings for each strategy. CAPP is an Excel-based decision-support tool designed to help U.S. local governments explore and identify potential opportunities to reduce greenhouse gas emissions and other air pollution emissions. CAPP provides a starting point for two major tasks: determining an achievable emissions reduction target and selecting strategies to include in a local municipal-operations or community-scale emissions-reduction plan, commonly called a climate action plan. CAPP users can compare the relative benefits of a wide variety of emissions reduction and clean air measures, and identify those most likely to be successful for their community based on its priorities and constraints.

Utilizing CAPP, a variety of strategies were identified and analyzed to determine their potential for achieving emissions reductions either at the municipal operations level or the community scale. The analysis team also explored the potential impacts of two external large scale factors on the city's emissions profile: New Federal CAFE Standards that will increase the average fuel economy of vehicles sold in the U.S. through 2025 and changes taking place within the electric generation sector that are leading to overall emissions reductions, including the decommissioning of coal fired power facilities, fuel switching to natural gas, and increased investment in renewable or alternative energy generation (i.e., solar and wind). **The results of these analyses are summarized in Figures 7-9.** In most cases, if there were multiple potential strategies addressing a singular target area (e.g. vehicle fuel sources: electric, diesel, hybrid, natural gas), the strategy that was the most cost effective with the largest emissions reduction impact was chosen to be included in the final summary.



River Walk, Oswego

FIGURE 7- TOTAL POSSIBLE REDUCTIONS BY 2030

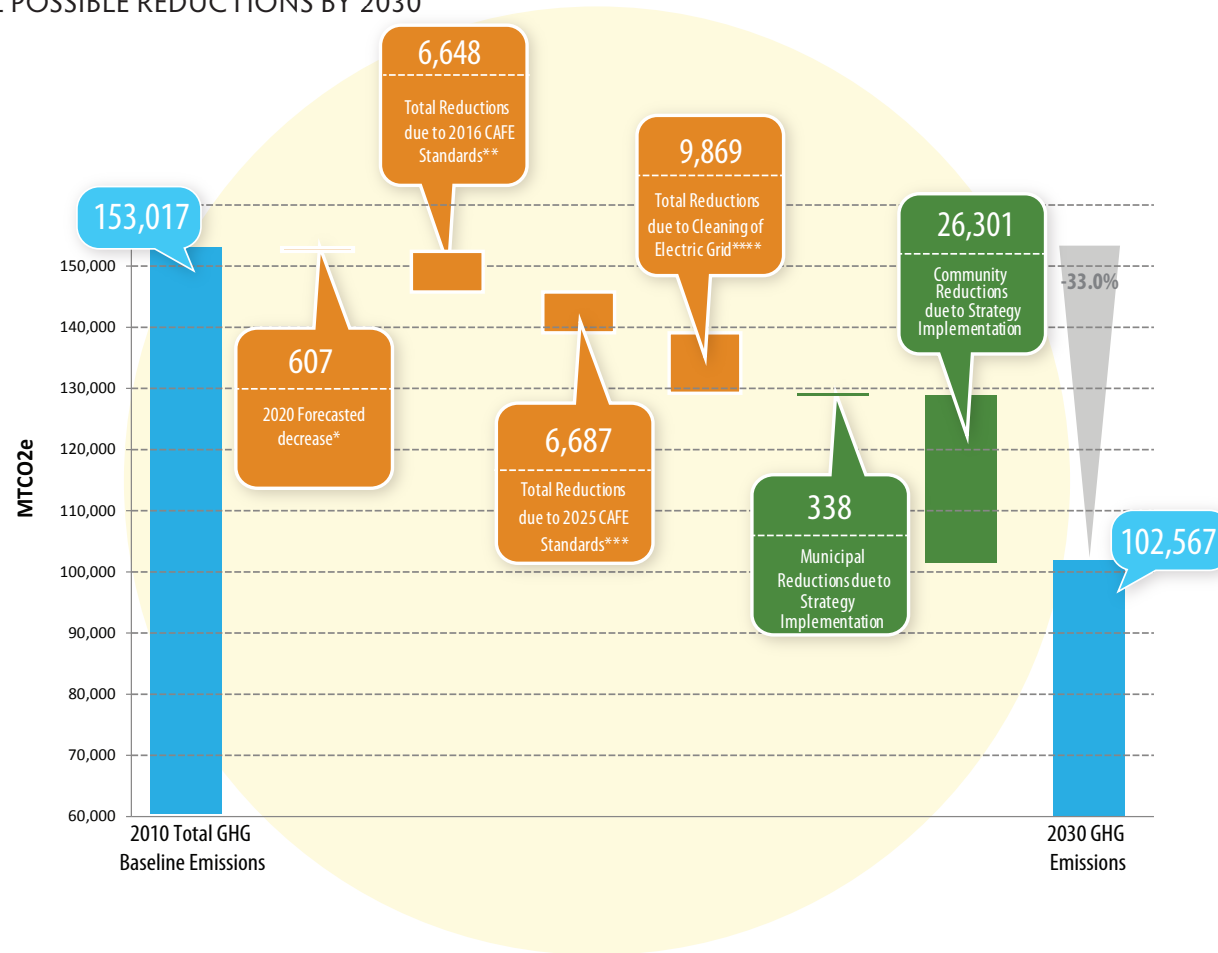


Figure 7 summarizes the results of the Oswego GHG inventory, a 2020 emissions forecast based on current trends, impacts from the strengthening of Federal CAFE standards, the cleaning of the electric grid in Upstate New York, as well as the reductions associated with the Climate Action Strategies that were analyzed for the City separated into community-wide measures as well as municipal operations measures. Reductions due to Oswego actions are shown in green while changes in emissions that will occur regardless of this Plan are shown in orange. It is projected that Oswego's total GHG emissions in 2030 could be reduced by 33.0% if the City implements all of the recommended community-wide and municipal operations measures.

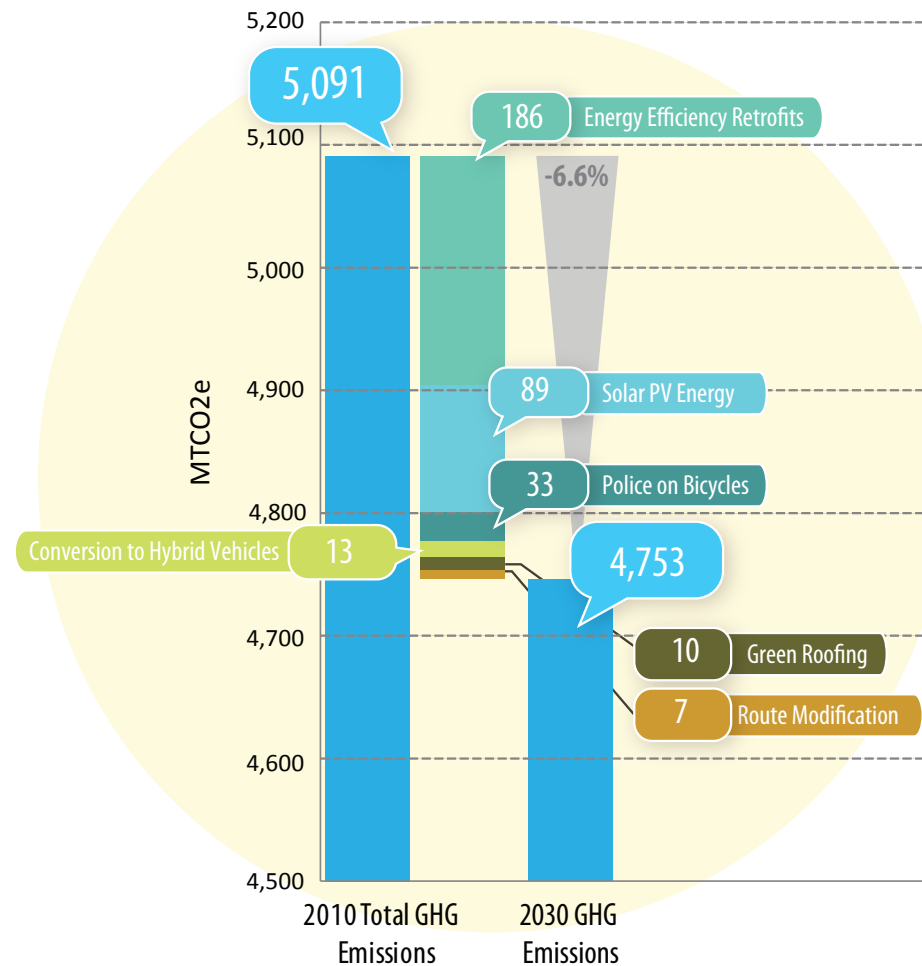
*2010 GHG inventory reported a forecasted decrease of 607 MTCO₂e due to increases in population and commercial energy use.

**2010 Federal CAFE (Corporate Average Fuel Economy) standards have been set at 34.1 miles per gallon by 2016.

***2012 Federal CAFE standards raises average fuel economy to up to 54.5 mpg for the model year 2025.

****Since the 2010 base year, the electric grid for Upstate New York has become cleaner by using a higher percentage of cleaner burning and/or renewable energy sources. Therefore, since 2010, the changes in the electric grid alone have caused reductions of 9,869 MTCO₂e.

FIGURE 8- POTENTIAL MUNICIPAL REDUCTIONS
FROM STRATEGY IMPLEMENTATION



Key:

6,184

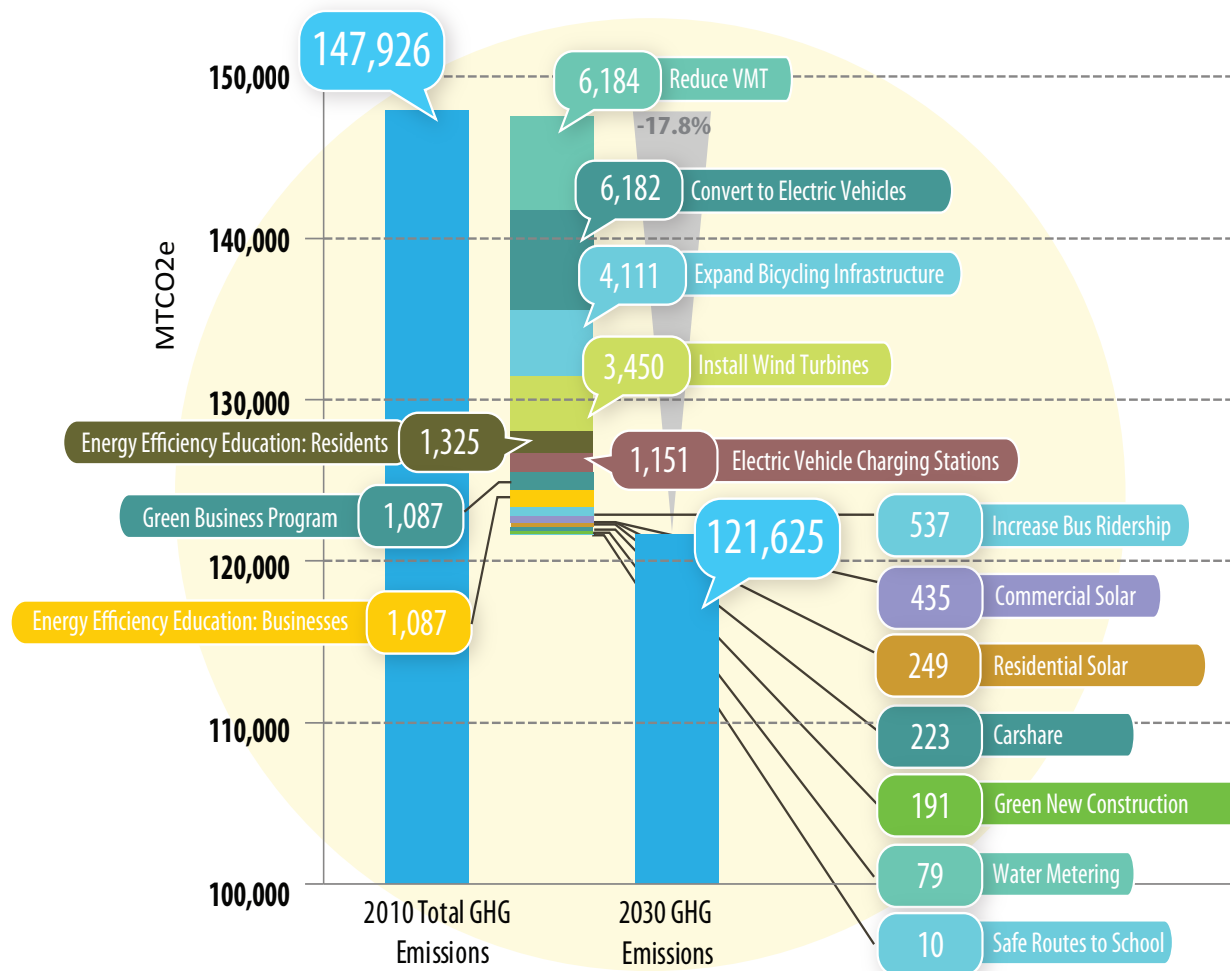
Reduce VMT

Emissions reduction strategy name

Illustrates emissions reductions in MTCO2e

Oswego's 2010 baseline municipal emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2030 should each of the suggested strategies be implemented. It is estimated that there will be a 6.6% reduction in municipal emissions if all suggested strategies are implemented.

FIGURE 9- POTENTIAL COMMUNITY REDUCTIONS
FROM STRATEGY IMPLEMENTATION



Oswego's 2010 baseline community emissions as recorded by the GHG inventory report, potential reductions due to suggested strategies, and potential emissions in 2030 should each of the suggested strategies be implemented. It is estimated that there will be a 17.8% reduction in community emissions if all suggested community reduction strategies are implemented.

TRANSPORTATION

According to Oswego's GHG Inventory Report, transportation accounted for 20% of government emissions and 23% of community emissions in Oswego in 2010. This Climate Action Plan

addresses two main transportation emissions reduction goals: increase options for low-carbon transportation and increase use of alternative fuels.



Centro Bus traveling to SUNY Oswego

Increase Options for Low-Carbon Transportation

Community vehicle miles traveled (VMT) reduction: 6,184 MTCO₂e annual reductions.

This strategy assumes that community VMT is reduced by 20%.

Expand bicycling infrastructure: 4,111 MTCO₂e annual reductions.

This strategy assumes 25% of trips 2 miles or less are converted to bicycling.

Increase bus ridership: 537 MTCO₂e annual reductions.

This strategy assumes a 20% increase from current ridership in Oswego.

Create a car share program: 223 MTCO₂e annual reductions.

This strategy assumes 4% of the community takes advantage of the car share program.

Police on bicycles: 33 MTCO₂e annual reductions.

This strategy assumes half of the police force switches from car to bicycle.

Safe routes to school: 10 MTCO₂e annual reductions.

This strategy assumes 450 students are covered by the program.

Route modification for wastewater sludge: 7 MTCO₂e annual reductions.

This strategy assumes Oswego switches from trucking sludge from Fulton to Minetto, which is 6½ miles closer.

*Complete streets

Increase use of Alternative Fuels

Conversion of community vehicle fleet to electric vehicles: 6,182 MTCO₂e annual reductions.

This strategy assumes 20% of the community vehicle fleet is converted to electric vehicles.

Implement electric vehicle charging stations: 1,151 MTCO₂e annual reductions.

This strategy assumes 200 charging stations are implemented.

Municipal use of hybrid cars in place of used Crown Victorias: 13 MTCO₂e annual reductions.

This strategy assumes 7 government Crown Victorias are switched to hybrids.

*This strategy included as an information item.

Increase Options for Low-Carbon Transportation

Increasing options for low-carbon transportation would reduce the amount of vehicle miles traveled (VMT), reducing gasoline and diesel use which would therefore reduce Oswego's emissions, fuel costs, and reliance on foreign fossil fuels. Encouraging employees to use transit, bicycles, and walking instead of driving will allow municipalities to reduce VMT. E-mail, video conferencing, and telephones can replace face-to-face meetings, eliminating the need to travel and saving valuable work time.

SUNY Oswego has also designed a Permaculture Living Lab which mimics natural systems and creates local food opportunities. These opportunities for local food decrease vehicle miles that food would have otherwise had to travel to get to campus, saving energy and emissions.

The use of the Port of Oswego also presents the opportunity to save emissions through shipping of items instead of trucking, as shipping is a more efficient mode of transport.

Creating a complete streets design will encourage a shift to alternative forms of transportation, including bicycling and walking. Roundabouts can be incorporated into complete streets designs as well to encourage pedestrian activity as well as to reduce emissions from vehicles idling at stop signs or traffic lights. Bicycling as a mode of transportation creates no GHG emissions, and by expanding bicycling infrastructure in the community, community members can better take advantage of this form of transportation. The City could also implement a police on bicycles program whereby police officers use bicycles as modes of transport rather than cars. Not only would this reduce fossil fuel use and therefore GHG emissions, studies have also shown police on bicycles to be more effective than police in cars because police are viewed as more approachable, better able to connect with the public, and better able to observe what is happening. Police on bicycles can also pursue suspects in places where cars can't go.

High quality low-carbon forms of transportation provide multiple co-benefits besides energy savings and emission reductions, including congestion reductions, road and parking facility cost savings, consumer savings and affordability, improved mobility for non-drivers, support for strategic land development objectives (i.e. reducing sprawl), and improved public fitness and health.

Increase use of Alternative Fuels

According to Oswego's GHG Inventory Report, transportation accounted for 20% of government emissions and 24% of community emissions in Oswego in 2010. These fuels are not only non-renewable fossil fuels; they also produce significantly more carbon emissions than alternative fuel options, such as electric and hybrid vehicle technology. Conversion to alternative fuels can therefore be extremely effective when trying to reduce emissions from the transportation sector.

According to EPA's eGRID 2009, electricity in Upstate New York is currently powered by coal (14.5%), oil (0.9%), gas (18.9%), other fossil (0.4%), biomass (1.6%), hydro (30.8%), nuclear (30.6%), and wind (2.4%) powers. Therefore, about 1/3 of the energy coming from the electric grid is considered renewable, with almost 2/3 coming from non-fossil fuel sources, making electricity a much better option in terms of greenhouse gas emissions than gasoline or diesel fuels.

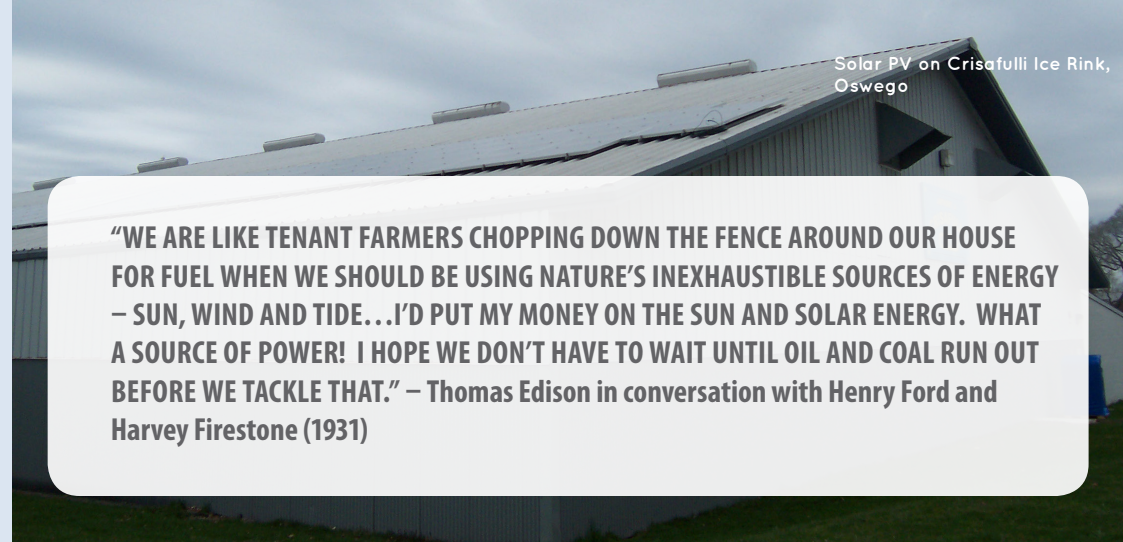
Not only will using alternative fuels reduce greenhouse gas emissions, it will also reduce US dependence on imported fuels and reliance on fossil fuels in general. Electric and hybrid vehicles are also less expensive to operate and have significantly lower fuel costs than conventional gasoline-powered vehicles.

Increasing the use of alternative fuels would greatly reduce Oswego's emissions and provide other benefits to community members as well.

ENERGY EFFICIENCY

According to Oswego's GHG Inventory Report, emissions from municipal buildings/facilities accounted for 18% of total municipal emissions, wastewater facilities accounted for 15%, water delivery accounted for 26%, and streetlights and traffic signals accounted for 11%, while residential energy use accounted for 24% of the community's emissions, commercial energy use accounted for 20% of the

community's emissions, and industrial energy use accounted for 32% of the community's total GHG emissions in Oswego in 2010. Therefore, the largest amount of GHG reductions is possible and necessary in this sector. This Climate Action Plan addresses two main energy/efficiency emissions reduction goals: increase energy efficiency in buildings; and increase use of renewable energy.



"WE ARE LIKE TENANT FARMERS CHOPPING DOWN THE FENCE AROUND OUR HOUSE FOR FUEL WHEN WE SHOULD BE USING NATURE'S INEXHAUSTIBLE SOURCES OF ENERGY – SUN, WIND AND TIDE...I'D PUT MY MONEY ON THE SUN AND SOLAR ENERGY. WHAT A SOURCE OF POWER! I HOPE WE DON'T HAVE TO WAIT UNTIL OIL AND COAL RUN OUT BEFORE WE TACKLE THAT." – Thomas Edison in conversation with Henry Ford and Harvey Firestone (1931)

Increase energy efficiency and reduce emissions from buildings

Promotion of residential energy conservation through CNY Energy Challenge Team program: 1,325 MTCO₂e annual reductions.

This strategy assumes 10% of households participate in the program.

Green business program: 1,087 MTCO₂e annual reductions.

This strategy assumes 20% of businesses in Oswego participate in a green business program, such as an Energy Challenge.

Promotion of business energy conservation through education: 1,087 MTCO₂e annual reductions.

This strategy assumes 20% of businesses in Oswego participate in education about green business practices.

Require green building for new construction of residential buildings: 191 MTCO₂e annual reductions.

This strategy assumes 382,000 square feet of new residential buildings are built using energy efficient measures.

Government building retrofits: 186 MTCO₂e annual reductions.

This strategy assumes 100,000 square feet of government buildings are retrofitted.

Water metering: 79 MTCO₂e annual reductions.

This strategy assumes 50% of the community switches from paying a flat rate to water metering.

Municipal green roof: 10 MTCO₂e annual reductions.

This strategy assumes the planned Visitor Center is built with a green roof.

Increase use of renewable energy

Wind power: 3,450 MTCO₂e annual reductions.

This strategy assumes 10,000 kW capacity of turbines is installed.

Commercial solar: 435 MTCO₂e annual reductions.

This strategy assumes 1,750 kW of solar PV is installed.

Residential solar: 249 MTCO₂e annual reductions.

This strategy assumes 1,000 kW of solar PV is installed.

Municipal solar: 89 MTCO₂e annual reductions.

Increase energy efficiency and reduce emissions from buildings

Energy efficiency education can be crucial in working to reduce emissions from buildings and facilities. Without the knowledge of actions that can be taken to increase building efficiency and reduce emissions, it is less likely that important actions, such as the ones listed above, will be taken. Participating in the Central New York Energy Challenge Team Program is a great way to educate community members on actions they can take at home to reduce energy use and emissions, and businesses can be targeted in a similar educational program and/or energy challenge competition. The City can utilize the Housing Rehabilitation and Affordable Home Ownership Programs as well as local mortgage providers to encourage participation in educational programs and home energy retrofits. Residents can also use the REScheck Program¹ to identify ways to reduce energy use in existing and new homes.

Also in Oswego, currently only 50% of the City has metered water and the other half pays a flat rate. Water metering is a practice by which water use is measured by household and customers are charged according to how much water they use in a given time period. Water metering encourages community members to

¹ <https://www.energycodes.gov/rescheck>

reduce water use to save money, which also causes subsequent reductions in energy and GHG emissions. Therefore, if the 50% of the community that pays a flat rate was changed to water metering, Oswego could see significant reductions in water and energy use and GHG emissions. Pumping water also represents the City's highest energy cost at 21% of their total costs, so converting from a flat rate to water metering could also help save the City money that could be used elsewhere.

Many buildings in Oswego are also not equipped with the most recent energy efficient technologies, causing the City and community members to use more energy than is necessary. Retrofitting existing facilities through measures like replacing appliances and light bulbs with more efficient ones, increasing insulation, and upgrading HVAC systems can greatly improve energy efficiency and therefore reduce emissions from the City's buildings and facilities.

The initial cost of retrofitting heating units may seem daunting; however, the local government, NYSERDA, and the CNY RPDB can offer assistance and support to make retrofits easier by providing educational materials, low-interest loans, and guidance on where to find potential grants or incentives to help cover costs. Improving energy efficiency can help to reduce criteria air pollutants as well as greenhouse gas emissions and increases energy and water cost savings.

Finally, the City of Oswego is discussing creating a green roof on a proposed visitor center along the site of Canal 6. A green roof uses a soil medium and plants on top of an impermeable membrane roof. They reduce building energy use by insulating the roof, and by cooling it through shading and evapotranspiration, the process by which plants draw water from the soil and release it to the air. A green roof also cools the air around surrounding buildings, and green roofs on many buildings through a city can reduce the urban heat island effect. Green roofs also aid in reducing

stormwater runoff. Green roofs can hold 70%-90% of the water from summer storms and 25%-40% of winter storm water. Additionally, they delay runoff and filter the water. Green roofs can help to avoid expensive expansions of wastewater treatment plants to handle stormwater inputs. Green roofs also can help buildings to achieve LEED certification, as well as improve the aesthetic quality of buildings. Depending on the type of roof, the roofs can be open to the public or to employees to provide recreational space, and they have also been used to grow food.

Each of these actions can significantly reduce GHG emissions in the City of Oswego, reducing energy costs, reliance on fossil fuels, and even improving air quality.

Increase use of renewable energy

By installing renewable energies like solar at the local level, Oswego can ensure that their energy is provided by clean and local renewable energy sources, therefore reducing greenhouse gas emissions, energy cost, and reliance on fossil fuels.

Many residents or businesses would like to use renewable energies, but the large up-front cost is an obstacle. The local government can help overcome this barrier by offering low-interest loans or organizing group buying programs to negotiate lower prices, such as the Solarize Madison program in Madison County. These programs are an effective way of combining public and private funds for renewable energy. The New York State Energy Research and Development Authority (NYSERDA) provides incentives for the installation of solar PV based on system size. Additionally, there are state and federal tax credits for residential and commercial solar PV and small wind turbine installations. Educational and technical assistance programs can also promote renewable energies. Local governments can offer information clearinghouses and connect consumers with renewable energy installers.

National DSIRE Database

Because incentives available for renewable energies are constantly changing, it is important to remain familiar with which incentives are currently available. The Database of State Incentives for Renewables & Efficiency, or DSIRE, is a website that offers comprehensive information on incentives and policies that support renewables and energy efficiency in the United States. Established in 1995, DSIRE is currently operated by the N.C. Solar Center at N.C. State University, with support from the Interstate Renewable Energy Council, Inc. DSIRE is funded by the U.S. Department of Energy. Visit dsireusa.org to learn more about current incentive opportunities.

An increasingly popular way for a local government to overcome the financial hurdles of installing a photovoltaic system is through the "solar services model" also known as a Power Purchase Agreement (PPA). Through this type of arrangement the owner of a property can provide the space for a power producer to install the system. The property owner then agrees to buy the power produced from that system at a set rate that is competitive with grid electricity. Since the power producer retains ownership of the equipment, there are no installation and maintenance costs to the consumer of the electricity produced. This is particularly attractive to government entities that are unable to take advantage of tax-based incentives for renewable energy.

Oswego recently installed a 50kW solar PV array on the Crisafulli Ice Rink. The system will generate the majority of the building's electrical needs during most months, reducing energy costs and GHG emissions.

Increasing the use of renewable energy reduces emissions while also providing clean, locally-produced energy that will save money spent on utility bills over time.

LAND USE

There is a growing acknowledgement by scientists and policy analysts that a substantial part of the global warming challenge may be met through the design and development of cities and towns. The form and function of human settlements can either reduce or increase the demand for energy, and can also influence how energy is produced, distributed, and used. Planning and urban design measures can substantially reduce the number and distance of vehicle trips by organizing human activity in compact communities with a range of housing types, providing reliable transit to and from employment, and placing services within easy walking distance of home.



Lake Ontario, Oswego

BACKGROUND

Unprecedented human intervention will be required in the coming decades to reduce the extent of climate change and thereby avoid its worst potential consequences (referred to as mitigation), or make changes to accommodate those effects that are unavoidable (adaptation). Much of the mitigation policy discussion to-date has centered on reducing greenhouse gas (GHG) emissions through fuel substitution and fuel efficiency for vehicles and on energy efficiency for buildings and industries. The scale of intervention required to reduce and adapt to the effects of climate change will require action at all levels of government and society. International accords to limit overall carbon emissions will involve national governments. Setting carbon emission targets and standards by industry or sector, or fuel efficiency standards for vehicles, falls within the traditional purview of federal and state governments. New York State, for example, has set aggressive energy and climate goals, including meeting 30% of the state's electricity needs with renewable

energy sources by 2030, and reducing greenhouse gas emission by 80% below 1990 levels by 2050.

At the same time, there is a growing acknowledgement by scientists and policy analysts that a substantial part of the global warming challenge may be met through the design and development of cities and towns. The form and function of human settlements can either reduce or increase the demand for energy, and can also influence how energy is produced, distributed, and used. Planning and urban design measures can substantially reduce the number and distance of vehicle trips by organizing human activity in compact communities with a range of housing types, providing reliable transit to and from employment, and placing services within easy walking distance of home. For example, research has shown that miles driven are reduced by between 20 and 40 percent in compact urban development compared to miles driven in the auto-dependent suburbs that have predominated in North America since the Second World War.

Transportation activity of all forms contributes about 33 percent of energy-related GHG production in the United States, and single-occupant automobile travel makes up about half of that activity. The vast majority of vehicles now burn carbon fuels and will continue to do so for some time (even with aggressive fuel substitution and efficiency measures), so strategies that reduce travel by limiting low-density development and encouraging more compact, walkable, full-spectrum living and working environments can potentially make a significant contribution to overall climate change mitigation. Studies indicate that a GHG reduction of up to 10 percent may result from a change in land use approach alone, and additional reductions will result from employing other strategies such as investments in transit, encouraging development around transit stops, and parking charges. By one estimate, approximately two-thirds of all development in 2050 will be new or will have been redeveloped since 2007, suggesting that combined land use and transportation

strategies could be quite powerful in mitigating the increases in GHGs.

The way that land uses and transportation infrastructure are arranged within a community has a strong influence on whether residents choose to walk, bike, use public transit, or drive. These travel choices directly affect the amount of transportation-related GHG emissions produced in Oswego.

Single-passenger automobile trips generate substantially more GHG emissions per mile than public transit and carpooling. Walking and biking are GHG-free transportation alternatives. Transportation and land use strategies provide a variety of measures that strive to increase resident use of alternative travel modes and reduce automobile dependence in Oswego.

Additional carbon reductions could come from exploiting other aspects of land use planning and redevelopment. Using the critical mass of buildings and activities at the district scale, it is possible to develop practical and efficient heating and cooling systems (district energy systems). This approach shows great promise in reducing the carbon footprint of urban development. Other energy conservation benefits may result from common-wall and vertical living structures typical of multifamily urban locations. It has been reported that per capita energy consumption and GHG emissions are 2 to 2.5 times higher in low-density developments than in high-density areas.

Urban design also offers the potential for cities to claim some of the attributes now associated primarily with rural living, including green infrastructure, such as natural systems that handle storm water and reduce heating loads, and localized food production and farmers markets that reduces shipping, storage, and packaging needs. These and other strategies that exploit the non-transportation aspects of urban form may contribute significantly to overall GHG mitigation.

LAND USE ANALYSIS AND RECOMMENDATIONS

According to OntheMap, there were 10,739 jobs in Oswego in 2011. According to the American Community Survey 2008-2012 data, 11,804 people worked in the City of Oswego. Of the total number that drove vehicles, approximately 80% drove alone and 8% carpoled. 1% rode public transit, 7% walked, 2% biked or used taxi, motorcycle or other means to work. 2% worked from home. While alternative travel modes make up a notable share of commute trips in Oswego, single-passenger automobile trips constitute the vast majority. Combined commuting and shopping trips constitute the majority of a household's annual vehicle trips and generate a large portion of the community's transportation-related GHG emissions.

Examining Oswego's existing land use pattern and transportation infrastructure provides insight into ways the community can reduce GHG emissions. A variety of land use, transportation, and urban design factors affect travel behavior. By making



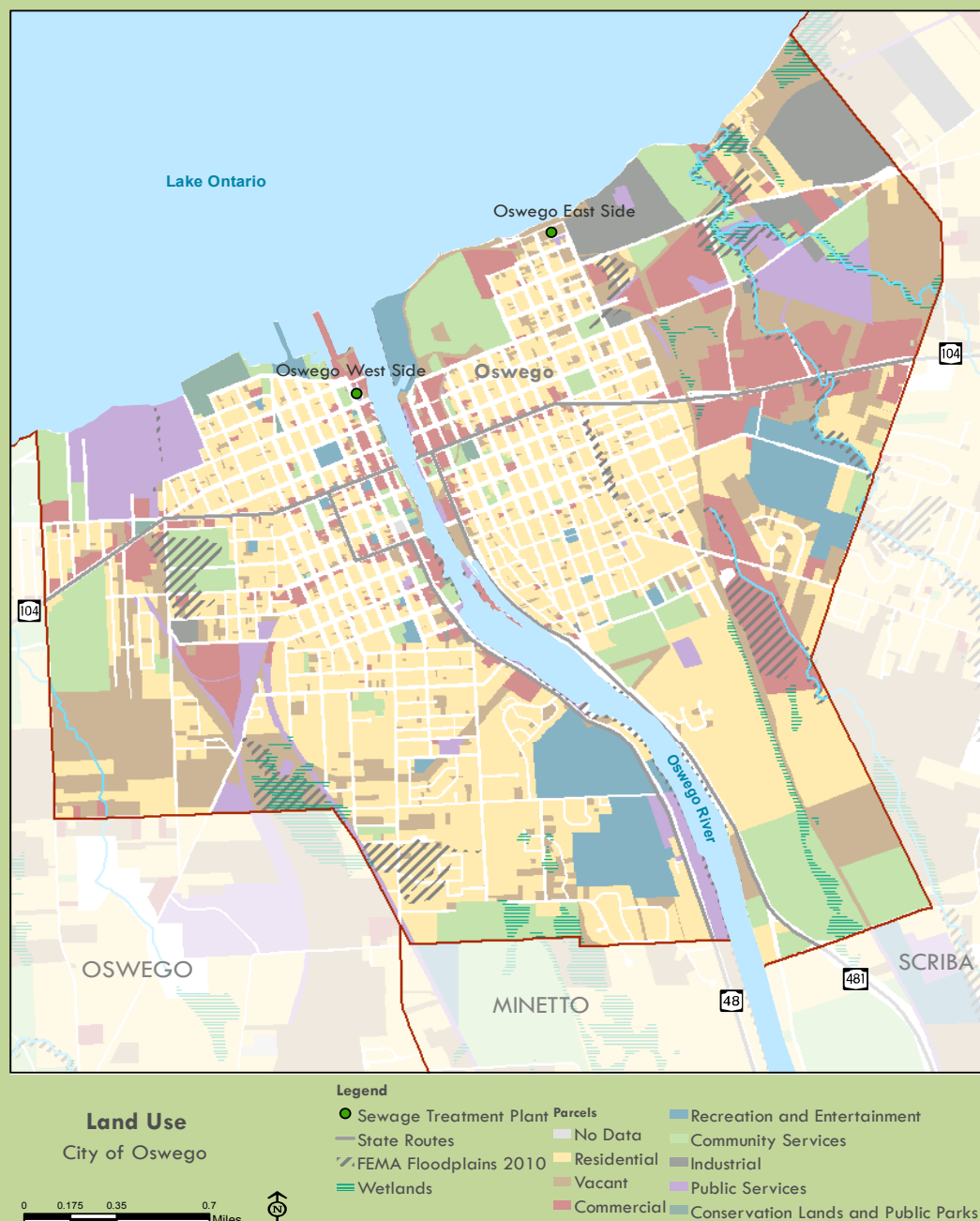
Oswego Harbor

subtle land use changes and improving transportation infrastructure, Oswego can increase walking, bicycling, and transit use. Factors most directly influencing travel behavior in Oswego include: diversity of uses, proximity of uses, density, pedestrian and bicycle conditions, transit accessibility, parking, and streetscape design. Each of these is discussed in detail below.

Diversity of uses – The degree to which residential, commercial, industrial, institutional, and recreational uses are located together.

Increasing the diversity of neighborhood-serving, and specifically job-rich, uses within Oswego could help reduce the community's transportation-related GHG emissions. Increased diversity reduces travel distances, and facilitates more walking and cycling trips. Improving the mix of uses within Oswego can also reduce commute distances, particularly if affordably priced housing is located in areas with a high number of jobs

FIGURE 10- CITY OF OSWEGO LAND USE



and employees can commute to work using alternative modes.

A jobs/housing ratio is commonly used to evaluate the diversity of land uses within a community, by describing the relationship between employment opportunities and housing supply. A ratio of 1.0 describes a balance between jobs and housing. A ratio above 1.0 indicates that there are more jobs than housing, while a ratio below 1.0 describes an undersupply of jobs relative to housing. In 2010, there were approximately 10,739 jobs and 7,439 households in Oswego and the jobs/housing ratio was approximately 1.44. This demonstrates that there were considerably more jobs than housing opportunities within the City, and that many employees commuted to Oswego from other communities for employment.

An improved jobs/housing ratio does not guarantee that residents will work within the City, but it does increase the likelihood that residents will have employment opportunities within the community. Thus, Oswego's employment development efforts should strive to create jobs that match the skills and income needs of the community's labor force. Increasing the diversity of uses and particularly job-rich land uses may help reduce the community's automobile-generated GHG emissions.

Proximity of uses – The distance between neighborhood commercial services and residents' homes.

Urban design research demonstrates that most people will walk to destinations that are within ¼ mile or a 5-minute leisurely

walk. Neighborhoods are considered to be pedestrian-friendly if residents' homes are within ¼ mile of a diverse array of commercial and civic uses. Two methods of spatial analysis were used to evaluate the proximity of residences to commercial uses in Oswego and support the development of CAP measures. The first measured proximity of residences to commercial centers and the second measured proximity of residences to a diversity of uses.

The first method examined how many residential parcels are located within ¼ mile of commercial districts and provides insight into the effectiveness of the City's existing zoning and land use pattern from the pedestrian perspective. Although some residential portions of Oswego are distant from commercial services, overall, the City's existing land use pattern creates many opportunities for pedestrian and bicycle travel. Of the 5,538 total residential parcels, 5,260 (95%) are located within ¼ mile of a commercial district.

The second method of proximity analysis may explain this behavior as it demonstrates that many Oswego residents do not have an adequate number of stores or services within easy walking distance of their homes. The analysis identified eleven categories of neighborhood services (i.e., schools, libraries, drugstores, grocery stores, medical facilities, post offices, nursery schools, parks, nursing homes, hardware stores, and restaurants), mapped all the locations of these services within Oswego and then examined how many of these distinct uses are within a ¼ mile walking distance of individual residential parcels.

This analysis determined that 76% of the residential parcels are located within ¼ mile of three or more amenities. Residents with low levels of pedestrian access to neighborhood-serving uses are more likely to drive to purchase their daily goods and services. City-directed land use and zoning changes, small business loans and other incentives could help improve the proximity to diverse uses. These actions could encourage pedestrian travel and reduce automobile dependence in Oswego.

Density – The number of housing units, people, or jobs in a given area

Higher densities tend to increase the number of services, shops, schools, and public buildings located within a neighborhood and increase the availability of transit and pedestrian infrastructure. These conditions tend to reduce the need for vehicle ownership and increase the use of alternative modes.

Residential Density: Residential density is normally measured in terms of housing units per acre. Oswego has a relatively high/moderate residential density for a predominantly residential suburban community. Of the total number of residential parcels in the City (5,538), there are 4,831 single family residential parcels. The single family residential density (the number of single-family parcels divided by the acreage of all residential parcels) is 3.64.

The average residential density of households per acre is approximately 1.03. There are 674 two and three family (or multiple residential) parcels, with an average density of 7.6 units per acre. Apartment



Fort Ontario Park, Oswego

buildings are located on 132 parcels, with an average density of 2.03 apartment buildings per acre.

Approximately 27% of the City's residential land use is classified as low-density, 62% as medium density, and 11% is classified as high density. The highest population density areas in Oswego are located on the SUNY Oswego campus, as well as some blocks along 1st and 2nd Streets.

Infill development refers to the use of vacant land within a built-up area for additional construction. This term is often associated with community redevelopment or growth management programs or as a component of smart growth. Infill development focuses on the reuse of underutilized buildings and sites where buildings are constructed on vacant property or between existing buildings. Within the City of Oswego, 753 parcels are classified as vacant, comprising 10.6 percent of parcels and 18.6 percent of total parcel area (773 acres). Infill development potential in the City of Oswego exists within the commercial district along the



Oswego Harbor

Route 104 corridor and through the heavily populated areas to the east and west of the Oswego River. The City can consider ways to encourage such development through overlay zoning and other techniques that can be included in an update to the City's Comprehensive Plan and zoning codes.

Commercial Intensity: Commercial building intensity is measured using a floor-area ratio (FAR), which is obtained by dividing a building's floor area by the underlying parcel's area. The City's current zoning codes discourage compact and mixed-use development by requiring large street setbacks for multi-story buildings, which disrupts the streetscape and makes walking and bicycling difficult. The City can consider revising its Comprehensive Plan and zoning codes to allow for greater commercial intensity by establishing a higher floor-area ratio allowances for mixed-use buildings than for other buildings. Such allowances can be provided for targeted

commercial districts along Bridge Street (Rt. 104), Utica Street, and E. and W. 1st Street.

Pedestrian and bicycle conditions – The quantity and quality of sidewalks, crosswalks, paths and bike lanes, and the level of pedestrian security.

The current pedestrian infrastructure in the City of Oswego can be challenging during the winter months due to snow accumulation on the sidewalks. Snowy sidewalks are often difficult to navigate for parents with strollers and create barriers for the physically disabled. Striped crosswalks are present on arterials and streets near schools, but there is little use of traffic calming devices such as curb extensions (known as bulb outs), refuge islands (a small section of pavement where pedestrians can stop before finishing crossing a road), and chokers (build-outs added to a road to narrow it). 100 pedestrian accidents occurred between January 1, 2002 and December 31, 2011. The highest concentration of pedestrian accidents (most incidents at any one point) occurred at two intersections: W. Bridge Street and W. 1st Street, and E. Bridge Street and E. 1st Street.

The Oswego County Recreation Trail is a multi-use rail trail, part of which is located in the City of Oswego. Bike racks can be found in various parts of the City, but shortages exist near civic and commercial areas which may limit residents' desire to bike to these locations. Additionally, bike racks are often not available near bus stops.

Highly connected sidewalks and pedestrian infrastructure could reduce travel distances

between destinations while improving access and safety. An enhanced hiking and biking trail system is currently being considered by City officials in order to provide for alternative, clean and healthy transportation. Improved pedestrian and bicycle infrastructure (such as bike lanes and bike racks) with pedestrian-friendly designs are being considered in order to improve community health for City residents, to reduce greenhouse gas emissions, to attract Canadian tourists, and to support the international marketing of traveling along the Erie Canal trail system.

One consideration for local waterfront development is the creation of a hiking and biking trail along the Oswego Canal that would link the Seaway Trail to the Erie Canal National Heritage Corridor Trail. This recommendation is consistent with recommendations in the City of Oswego 2020 Vision Plan and the Erie Canal National Heritage Corridor report. City leaders are also exploring opportunities for safe bike/pedestrian routes to schools that would promote energy efficiency and health in students. In addition, SUNY Oswego has been implementing climate-smart planning that encourages pedestrian, cycling and mass transit options to improve access to the campus. Extension of the Oswego Harbor Trail to connect the SUNY Campus to Downtown Oswego is also recommended in the Oswego 2020 Strategic Plan adopted in 2011.

Pedestrian Infrastructure: Oswego's pedestrian infrastructure during the winter months is challenging due to snow

accumulation on the sidewalks and a number of City sidewalks are in poor condition. These conditions create difficulties for strollers and the less physically-able and barriers for the physically disabled. Striped crosswalks are present on arterials and streets near schools, but there is little use of traffic calming devices such as curb extensions (known as bulb outs), refuge islands (a small section of pavement where pedestrians can stop before finishing crossing a road), and chokers (build-outs added to a road to narrow it). 100 pedestrian accidents occurred between January 1, 2002 and December 31, 2011. The highest concentration of pedestrian accidents (most incidents at any one point) occurred at two intersections: W. Bridge Street and W. 1st Street (6 accidents total), and E. Bridge Street and E. 1st St. (also 6 accidents). Bridge Street/Highway 104 is the street with the most pedestrian accidents. Accidents span from east of 1st Avenue to E. 10th Street, totaling 45 out of the 100 total pedestrian accidents.

Bicycle Infrastructure: The City of Oswego is working to expand its system of bike trails. This expansion would occur, for example, along the river walks and in areas that would connect the Oswego Harbor Trail, the SUNY Oswego campus, and downtown Oswego along the northern shore of Lake Ontario and the Oswego River. City leaders are also exploring opportunities for safe bike routes to schools that would promote energy efficiency and health. In addition, SUNY Oswego has been implementing climate smart planning to encourage pedestrian, cycling and mass transit options to increase access to the campus.

The Oswego County Recreation Trail is a multi-use rail trail part of which is located in the City. Bike racks can be found in various parts of the City, but shortages exist near civic and commercial uses, which may limit residents' desire to bike to these locations. Additionally, bike racks are often not provided in conjunction with bus stops.

Transit accessibility – The ease with which people can access transit service and the quality of that service.

Residents and employees are more likely to use transit if traveling by bus or train is relatively time-competitive with driving, if transit stations are accessible to pedestrian and cyclists, and if the transit experience is pleasant. People are generally willing to walk ½-mile to a light rail station or ¼-mile to a bus stop. A ¼-mile walk takes the average person around 10 minutes. In Oswego, about 89% of residential parcels are located within ¼ mile of a bus station. There are 13 Centro bus routes that operate in the City, including 1 express route.

Parking – The supply, price, and regulation of parking facilities.

Inexpensive and abundant parking increases automobile ownership and use. Large parking lots also disperse destinations and reduce walking and public transit convenience and use. Limiting the availability of parking spaces and imposing fees can reverse the equation, reducing the number of cars on the road and increasing use of alternative modes of transportation. The Traffic Violations Bureau collects fines on



Oswego Harbor Trail Sign

6,000 to 8,000 parking tickets issued each year in the City of Oswego. Approximately \$100,000 is generated from parking fines and towing charges each year.

Streetscape design – The scale and design of streets, sidewalks, and adjacent uses.

Urban design research demonstrates that people walk more and drive less in pedestrian-oriented commercial districts than in automobile-dominated commercial centers. Street designs that reduce vehicle traffic speeds, improve walking and cycling conditions, and enhance the pedestrian experience encourage use of alternative modes.

Recommended improvements in the City of Oswego would include pedestrian-friendly design features such as wider sidewalks, street trees, benches, decorative street lights, and bulb-out pedestrian crossings. Coordination with NYS Department of Transportation would be required to make such improvements.

STRATEGY IMPLEMENTATION CHART

Issue	Strategy	Ballpark Rankings (see key below)			Possible Implementation Methods				Additional Benefits			
		Costs (1-5)	GHG Reductions (1-5)	Payback (1-5)	Policy	Program	Capital Projects	Education/ Outreach	Green Job creation	Quality of Life	Water Conservation	Other
Transportation: Municipal	1. Use hybrid cars in place of Crown Victorias	1	1	5			x	x		x		x
	2. Police on bicycles	1	1	1		x		x		x		x
	3. Route modification for wastewater sludge	1	1	1	x							x
Transportation: Community	1. Vehicle miles traveled reduction	1	2	1		x		x				x
	2. Safe Routes to School	1	1	2		x		x		x		x
	3. Car share	2	1	4		x	x	x	x	x		x
	4. Conversion of community vehicle fleet to electric	3	2	2				x		x		x
	5. Implement Electric Vehicle Charging Stations	3	1	5		x	x	x	x	x		x
	6. Increase bus ridership	1	1	1		x		x	x	x		x
	7. Expand bicycling infrastructure	1	2	1			x	x	x	x		x
Energy/Efficiency: Municipal	1. Green Roof on planned visitor center	1	1	2			x				x	x
	2. Solar PV electricity	2	1	3			x		x	x		x
	3. Government building retrofit	2	2	3			x		x	x	x	x

Key to Ballpark Rankings		
Est. Total Costs	Est. Total GHG Impact	Est. Payback
1 = Less than \$250,000	1 = 0-9.9% of goal	1 = Less than 1 year
2 = \$250,000-\$999,999	2 = 10-24.9% of goal	2 = 1-4.9 years
3 = \$1 million-\$24,999,999	3 = 25-49.9% of goal	3 = 5-9.9 years
4 = \$25 million-\$99,999,999	4 = 50-74.9% of goal	4 = 10-19.9 years
5 = \$100 million or more	5 = 75-100% of goal	5 = 20 years or more

Issue	Strategy	Ballpark Rankings (see key below)			Possible Implementation Methods				Additional Benefits			
		Costs (1-5)	GHG Reductions (1-5)	Payback (1-5)	Policy	Program	Capital Projects	Education/ Outreach	Green Job creation	Quality of Life	Water Conservation	Other
Energy/Efficiency: Residential	1. Promotion of CNY Energy Challenge Team program	1	1	1		x		x		x		x
	2. Community Wind	2	2	1		x	x		x	x		x
	3. Residential green building	1	1	1		x		x		x		x
	4. Water Metering	1	1	1	x	x		x		x	x	x
	5. Residential solar PV	3	1	4		x	x	x	x	x		x
Energy/Efficiency: Commercial	1. Commercial solar PV	3	1	4		x	x		x	x		x
	2. Promotion of business energy conservation through education	1	1	1		x		x		x	x	x
	3. Green business program	1	1	1		x		x		x	x	x



CITY OF OSWEGO
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