Broome County
Community Energy Action Plan

December 2024

BROOME COUNTY NEW YORK

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Executive Summary

The Broome County Energy Action Plan ("Plan") was developed to evaluate the impacts of climate change on energy infrastructure and demand, profile existing and projected energy demand within Broome County, and provide strategic, actionable recommendations for sustainable energy development.

Plan Structure

This Plan has been organized to analyze how existing and future hazard magnitude and frequency will affect energy infrastructure and consumption, document existing energy infrastructure and consumption habits in Broome County and analyze how the New York State Climate Leadership and Community Protection Act (CLCPA) will affect energy transmission and consumption habits through 2050. Recommendations provided were developed by analyzing:

- CLCPA goals and scaling these to develop Broome County target values
- Anticipated effects that climate change will have on transmission and distribution infrastructure as well as on energy demand;
- Existing energy infrastructure, energy demand, and greenhouse gas emissions in the County, broken down by economic sector; and
- Projected energy transmission and distribution system upgrades and projected energy demands across the State and County through 2050.

Recommendations were then tailored to meet the specific needs of the residents of Broome County and position the County as a leader in renewable energy and zero-emissions energy production.

Broome County's Status Relative to NYS CLCPA Goals

New York State's CLCPA has established ambitious targets to combat climate change, including a 60% reduction in greenhouse gas emissions by 2030 (relative to 1990 levels) and carbon neutrality by 2050. The Plan evaluates where Broome County currently stands in terms of CLCPA goals:

- **Greenhouse Gas Emissions**: Broome County is close to meeting its 2030 greenhouse gas (GHG) emissions target. The County has achieved approximately 98.8% of its reduction goal for 2030, meaning only a 1.1% reduction in overall GHG emissions is needed by 2030. However, achieving the 2050 goal is a more formidable challenge, as the County will need to reduce emissions by approximately 75.3% from current levels to meet the long-term target of 15% of 1990 emissions.
- **Renewable Energy**: Currently, 141 MW of renewable energy is generated within the boundaries of Broome County, which includes contributions from solar, wind, and landfill gas combustion. This output surpasses the County's specific CLCPA target for renewable energy generation by 2025 by approximately 157%. However, energy storage capacity remains low with only 0.19 MW in operation (representing 0.63% of the 2030 CLCPA target for energy storage).
- **Zero-Emissions Vehicles (ZEVs)**: Currently there are 602 registered ZEVs in Broome County, amounting to 4.98% of the total vehicles registered in the County. This will need to increase substantially to meet New York State's goal of approximately 30% ZEVs in service by 2030.
- **Building Electrification**: There are challenges in retrofitting older buildings with electric heating systems, given that most structures were originally designed for fossil fuel heating. Retrofitting these buildings with electric alternatives, such as heat pumps, is complex and costly. Heat pumps also face efficiency issues during Broome County's cold winters, which

may require backup systems to ensure reliable heating. Progress toward CLCPA's building electrification goals will likely rely on incentives and programs to offset the costs associated with this transition.

Current Broome County Energy Usage

The EAP provides a comprehensive overview of Broome County's current energy consumption across sectors:

- **Residential Energy Use**: Residential consumption accounts for roughly 20.6% of total energy usage in the County, with natural gas being the primary heating source. Residential electricity consumption is expected to grow as building electrification begins to replace traditional natural gas heating systems.
- **Commercial and Industrial Usage**: The commercial and industrial sector represents a smaller share of overall energy consumption but will require upgrades in efficiency and renewable energy adoption to meet upcoming mandates.
- **Transportation Energy Demand**: Currently dominated by fossil fuels, the transportation sector's transition to electric vehicles will increase electricity demand significantly. This shift, along with building electrification, will be a major driver of the County's future energy needs.

Projected Broome County Energy Usage

Broome County's energy landscape is expected to change significantly by 2050 due to climate mandates and shifts to renewable energy sources:

- **Electricity Demand Growth**: As fossil fuels are phased out, the demand for electricity is projected to increase substantially. Residential electricity consumption alone may rise by 75.7% by 2050 as homes adopt electric heating and appliances.
- **Fossil Fuel Decline**: The County anticipates a sharp reduction in natural gas and gasoline usage as electrification mandates take effect, including a ban on natural gas heating in new construction starting in 2027. This shift will require increased capacity and resilience in the electric grid to handle new demand peaks during extreme temperatures.
- **Renewable Energy Production**: With the goal of achieving net-zero emissions by 2050, Broome County must expand its renewable energy generation capacity, potentially increasing its role in the production and storage of renewable energy, including solar and hydrogen fuel production.

Priority Recommendations for Broome County

To address climate impacts and meet future energy demands, the Plan has outlined several recommendations:

1. **Renewable Energy Production**
    - *Recommendation 1: Continue Investment into Battery NY* – Encourage partnership between the County and Battery NY at Binghamton University.
    - *Recommendation 2: Develop as a Renewable Energy Production Hub* – Establish aggressive renewable energy and energy storage capacity goals for the County through 2050.
    - *Recommendation 3: Focus Renewable Energy Development* – Encourage renewable energy development in communities that are open to renewable energy production and are located near available energy infrastructure.
    - *Recommendation 4: Consider Renewable Energy Center in Conklin* – Leverage existing commercial distribution center in Conklin to encourage renewable energy development.

- *Recommendation 5: Consider Renewable Energy Siting Evaluation Program* – Expand upon the County's Weatherization & Home Repairs Programs to provide access to renewable energy generation to disadvantaged communities.

2. Alternative Fuel Production
    - *Recommendation 6: Conduct In-Depth Alternative Fuel Siting Study for Greater Binghamton Airport* – Leverage airport as cornerstone consumer for alternative fuel production facility.
    - *Recommendation 7: Consider Hydrogen Production Center in Conklin* – Leverage existing commercial distribution center in Conklin and evaluate potential for hydrogen production hub in this area.
3. Transportation Systems
    - *Recommendation 8*: *Continue Investment in Zero-Emissions Bus Fleets* – Invest in electric buses, investigate hydrogen fuel buses for public transportation and school districts.
    - *Recommendation 9: Invest in Active Transportation-Focused Infrastructure* – Invest in infrastructure that encourages walking, cycling in more densely populated areas.
    - *Recommendation 10: Encourage Municipalities to Invest in Smart Growth/Compact Development* – Review and adjust zoning laws to allow for compact, mixed-use development in urban and suburban communities.
4. Building Electrification
    - *Recommendation 11: Push NYSEG to Invest in Climate-Resilient Transmission Upgrades* – Monitor and ask for progress updates from NYSEG on proposed transmission and distribution upgrades in the County.
    - *Recommendation 12: Provide Resources for Low-Income Households to Electrify Building Systems* – Build upon the existing Weatherization & Home Repair Programs to install heat pumps in disadvantaged communities.
    - *Recommendation 13: Provide Community with Resources for Rebates* – Educate public on available financial assistance, provide incentives for landlords to electrify buildings, and partner with local institutions to facilitate building electrification in disadvantaged communities.

The Broome County Energy Action Plan outlines a detailed pathway for sustainable energy transformation and resilience in response to climate challenges. The recommendations offer a robust framework to help the County reduce greenhouse gas emissions, adapt infrastructure for future climate conditions, and ensure long-term energy security for its residents.

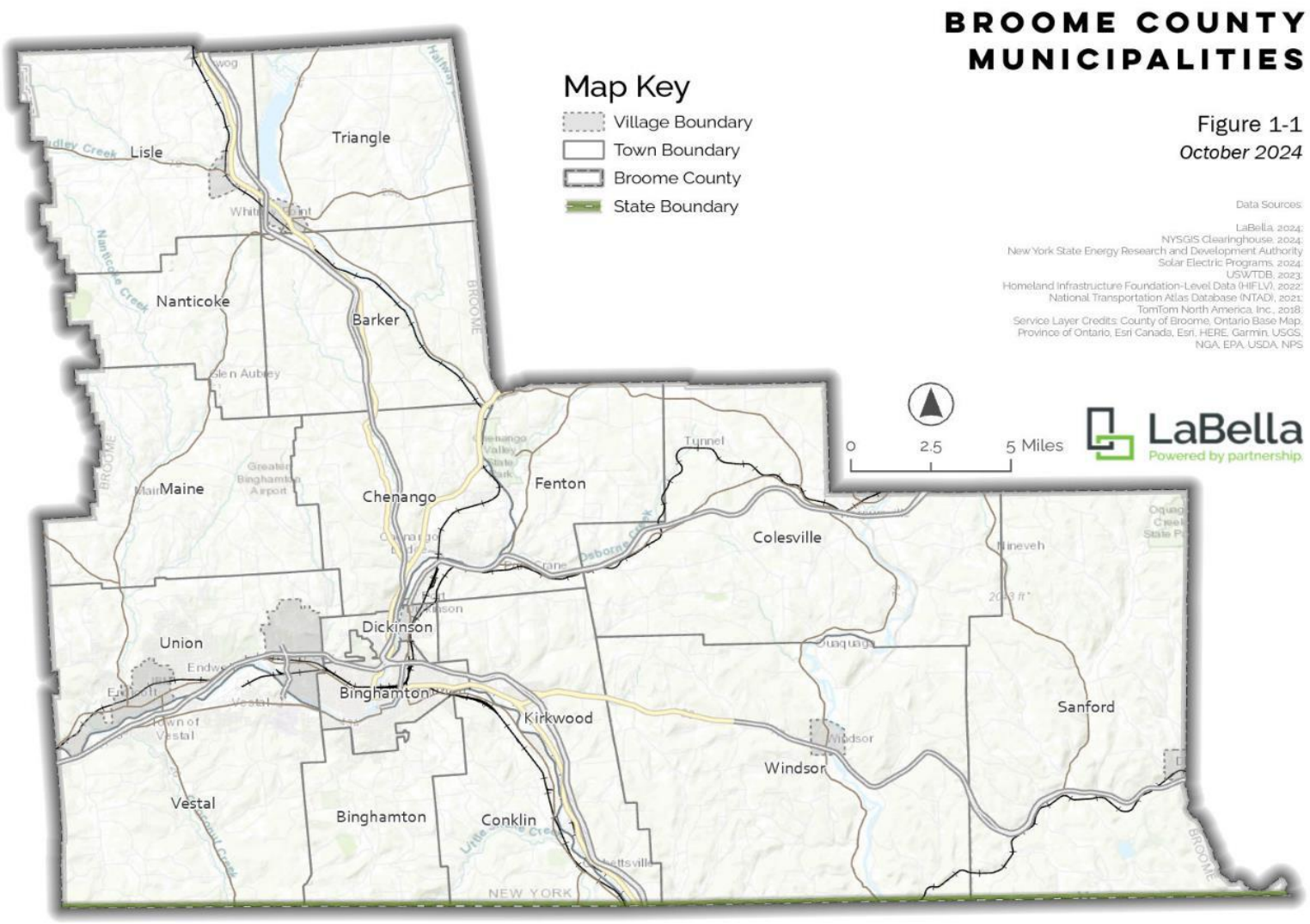
1.0 Introduction

Broome County is an important, centrally located community in New York State containing a diverse set of urban, suburban, and rural communities. These communities rely on different types of transportation, heating methods, and electrical sources daily, all of which contribute to greenhouse gas emissions to various degrees. Over the years, many institutional and physical controls have been constructed in the County to help protect residents, property, and infrastructure. As our world's climate begins to change at an accelerated rate, Broome County is working proactively to fully understand its contribution to greenhouse gas emissions, identify strategies to mitigate these emissions, and develop a long-term strategy to adapt its energy infrastructure to changing needs and challenges over the course of the 21st century.

To have the greatest impact, these efforts will need to be implemented not only at a county level, but also on an individual community level. This Broome County Community Energy Action Plan (EAP) has been developed to document existing energy usage, infrastructure, and land use conditions throughout Broome County's communities and provide recommendations to help these communities mitigate and adapt to a changing energy landscape.

1.1. Broome County Setting

Broome County is located in south-central New York State in the eastern Southern Tier region of the State. The County is home to 198,107 residents (2023 U.S. Census) across twenty-four (24) municipalities. Broome County accounts for approximately 1% of New York State's total population. The County is home to 81,339 households (1.07% of New York State) and 4,033 listed businesses (0.75% of New York State). The County is approximately 716 square miles (mi^2) in size, including 706 mi^2 land and 9.7 mi^2 water, accounting for approximately 1.5% of New York State's total area. The County is bordered by Chenango County to the north, Delaware County to the east, Tioga County to the west, Cortland County to the northwest, and the State of Pennsylvania to the south. The seat of Broome County is the City of Binghamton, which is located at the confluence of the Chenango and Susquehanna Rivers and is home to 47,115 residents (2023 U.S. Census). A majority of Broome County is located within the Susquehanna River watershed and contains portions of the Tioughnioga, Chenango, and Susquehanna Rivers. The County is susceptible to numerous environmental hazards that adversely affect the community, built environment, and natural environment, most notably flooding along the Susquehanna River.


BROOME COUNTY MUNICIPALITIES
Figure 1-1
October 2024
Map Key
Village Boundary
Town Boundary
Broome County
State Boundary
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
New York State Energy Research and Development Authority Solar Electric Programs, 2024;
USWTDB, 2023;
Homeland Infrastructure Foundation-Level Data (HIFLV), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: County of Broome, Ontario Base Map; Province of Ontario, Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
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1.2. Plan Purpose and Objectives

The EAP was developed with the intent of documenting the current state of energy generation and consumption in Broome County to determine the County's current greenhouse gas (GHG) emissions footprint; to provide a climate assessment to evaluate how environmental hazards will affect energy usage; and to provide a look ahead at projected energy usage through the mid-21st century. Using this information, this plan provides recommendations on how communities within Broome County can mitigate their contributions to overall GHG emissions by promoting responsible renewable energy development as well as vehicle and building electrification. This plan also provides high-level recommendations on how the community can adapt its energy infrastructure to a changing climate.

The objectives of this plan are as follows:

- Document current energy production, energy usage, greenhouse gas production, and transmission and distribution infrastructure in Broome County;
- Document projected energy usage, transmission and distribution system upgrade requirements, and potential energy production opportunities resulting from CLCPA;
- Review how the State's CLCPA goals are expected to impact disadvantaged communities;
- Identify opportunities to increase renewable energy production within Broome County;
- Identify strategies and opportunities to reduce community energy consumption;
- Identify strategies and additional opportunities to reduce community greenhouse gas emissions;
- Provide recommendations on how Broome County's energy infrastructure can adapt to a changing climate over the 21st century; and
- Provide high-level recommendations related to Community electrification.

1.3. Federal, State, and County Goals

Over the past decade, the Federal government and New York State have been developing goals to reduce energy consumption and greenhouse gas emissions generated because of Federal and State actions. New York State's newly established goals set aggressive targets for both State and private sector energy consumption and greenhouse gas emissions. These goals represent "minimum requirements" that Broome County will need to address over the coming decades. This section summarizes these Federal and State goals and provides recommended quantifiable goals for Broome County.

1.2.1. Federal Goals and Mandates

Improving energy efficiency and reliability and reducing GHG emissions are two major goals of the Federal government over the coming decades. These two broad goals require many actions to be taken across multiple sectors (energy generation, transportation, buildings, waste management, etc.), many of which are or will be mandated via executive order, legislation, or through enforcement actions. These goals and mandates only apply to targeted Federal operations but provide a useful comparison for mitigation and adaptation goals. Presented below is a summary of Federal goals, mandates, and timelines (when available) that were evaluated as part of this plan:

GHG Emissions Reduction:

Executive Order (EO) #14057 directed the Federal government to develop the "Federal Sustainability Plan", which establishes GHG emissions reduction from Federal sources. The goal of this EO is to achieve "net-zero" emissions across all Federal operations. This reduction in GHG emissions and achievement of net-zero emissions will be achieved through the individual goals listed below. This

EO and subsequent "Federal Sustainability Plan" specifies the following GHG emissions reduction goals:

- ***Goal(s):*** 100% "net-zero" operations, with an expedited timeline for 65% reduction in GHGs.
- ***Timeline:*** 2030 for 65% reduction in GHG emissions from Federal operations, 2050 for 100% "net-zero" Federal operations.
- ***Lead Agency:*** Office of the Federal Chief Sustainability Officer.

Renewable/Carbon-Free Energy Usage:
EO #14057 directed the Federal government to develop the "Federal Sustainability Plan", which establishes goals for GHG emissions reduction from federal sources. This EO and subsequent plan specifies the following GHG emissions reduction goals:

- ***Goal(s):*** Power federal facilities with 100% carbon pollution-free electricity. This includes a minimum of 50% carbon pollution-free electricity usage on a 24-hour-a-day, 7-days-a-week basis.
- ***Timeline:*** By 2030.
- ***Lead Agency:*** Office of the Federal Chief Sustainability Officer.

Fleet Electrification:
EO #14057 specifies fleet electrification goals for the Federal fleet to have zero-emission vehicles (ZEVs) replace traditional gasoline- or diesel-powered vehicles. This EO and the "Federal Sustainability Plan" establish the following fleet electrification goals for Federal vehicle fleets:

- ***Goal(s):*** 100% ZEV acquisitions for all vehicle fleets, including an expedited timeline for light-duty ZEVs.
- ***Timeline:*** 2027 for light-duty ZEVs, 2035 for all vehicles.
- ***Lead Agency:*** Office of the Federal Chief Sustainability Officer.

Buildings Emissions:
EO #14057 specifies goals to reduce GHG emissions to eventually reach net-zero emissions from federal buildings. These goals are meant to push Federal facilities to electrify heating and cooling system, reduce water consumption, and reduce the waste generated from buildings. This EO and the "Federal Sustainability Plan" establish the following building emissions goals for Federal buildings:

- ***Goal(s):*** 100% net-zero emissions buildings, including an expedited timeline to achieve 50% GHG reduction from Federal buildings.
- ***Timeline:*** 2032 to achieve 50% GHG reduction; 2045 to achieve net-zero emissions buildings.
- ***Lead Agency:*** Office of the Federal Chief Sustainability Officer.

Waste Management/Organics Reduction:
Methane is a potent GHG that is generated from multiple sources, including from the anerobic degradation of organic material in landfills. According to the White House Office of Domestic Climate Policy's "U.S. Methane Emissions Reduction Action Plan" (November 2021), landfills account for approximately 17% of all methane emissions in the United States. One strategy to reduce landfill-generated methane is to reduce the amount of food waste and organic material that enters into landfills in the U.S. It is worth noting that at the time of this report, these goals have not yet been

officially mandated by the USEPA. The "U.S. Methane Emissions Reduction Action Plan" sets the following goals for food waste/organics reduction nationwide:

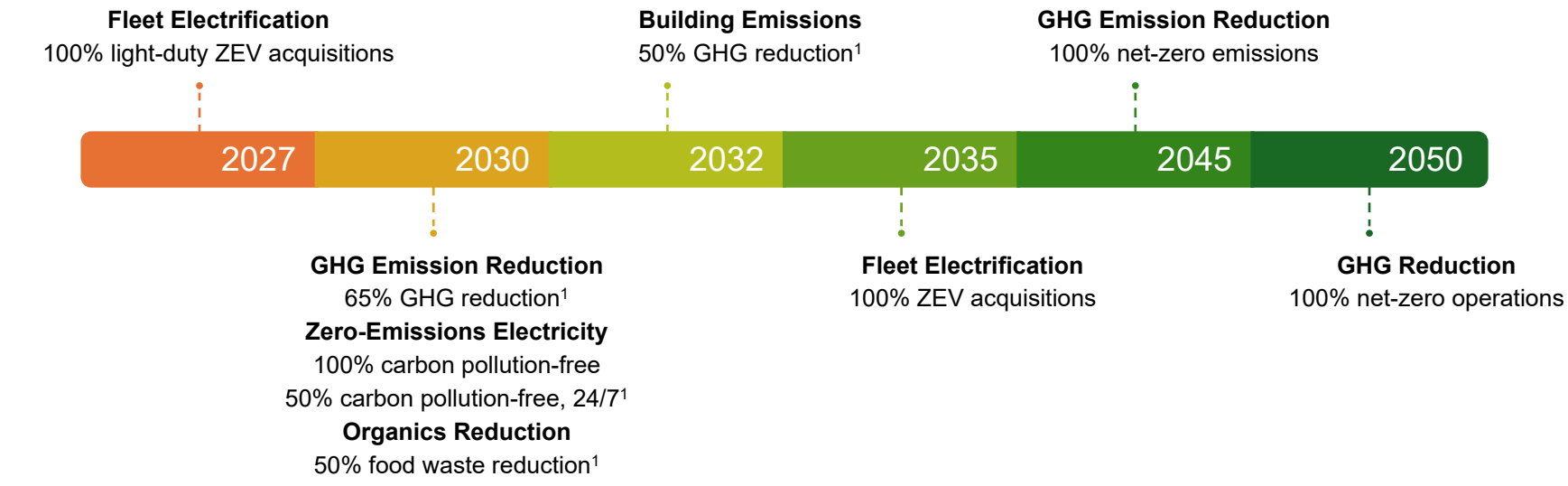
- ***Goal(s)***: 50% reduction in food loss and waste (reduction of food waste from 24% to 12% of total waste entering into landfills).
- ***Timeline***: By 2030.
- ***Lead Agency***: United States Environmental Protection Agency (USEPA), with assistance from the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA).

Climate Resilient Infrastructure and Operations:
EO #14057 directs Federal agencies to develop agency-specific climate adaptation and resilience plans that evaluate the most significant climate-related risks and vulnerabilities for each agency, and to identify actions to manage and reduce those risks and vulnerabilities. The following goals and timelines have been established for Federal agencies to develop these Climate Resilient Infrastructure and Operations plans:

- ***Goal(s):*** Prepare and maintain agency-specific Climate Resilient Infrastructure and Operations plans as described above.
- ***Timeline:*** No timeline specified.
- ***Lead Agency:*** Office of the Federal Chief Sustainability Officer.

Below is a visual representation of these proposed Federal goals and mandates and their timelines.

Federal GHG Emission Goals



NOTES:

3. Indicates minimum goal.

1.2.2. New York State Goals and Mandates

The Climate Leadership and Community Protection Action (CLCPA), which establishes greenhouse gas reduction, renewable energy production, and climate resilience goals for New York State (NYS), was signed into New York State law in July 2019. The final Scoping Plan was developed, and portions of the plan took effect on January 1, 2024. The Scoping Plan provides detailed goals and timelines for reducing greenhouse gas emissions from energy production, transportation, building energy usage, and waste management. Additionally, this plan provides mandates for State and local governments throughout NYS.

This Energy Action Plan identifies the goals, mandates, and timelines that the CLCPA provides, evaluates where the County stands, and provides recommendations on how Broome County can meet or exceed these goals and mandates. Presented below is a summary of CLCPA goals, mandates, and timelines relevant to Broome County:

GHG Emissions Reduction:

Under the CLCPA, NYS has established aggressive goals and timelines to curb greenhouse gas emissions generated in the State from various sources. The goal is to eventually achieve economy-wide "carbon neutrality" in NYS. This means that unlike the Federal goals and mandates which apply only to the Federal government, the goals and mandates established by the CLCPA apply to the public and private sectors in NYS. The CLCPA specifies the following GHG emissions reduction goals:

- ***Goal(s):*** Reduce NYS GHG emissions to 60% of 1990 levels, followed by 15% of 1990 levels.
- ***Timeline:*** 2030 to achieve reduction to 60% of 1990 levels; 2050 to achieve reduction to 15% of 1990 levels.
- ***Lead Agency:*** New York State Department of State (NYSDOS) with assistance from other NYS entities (New York State Energy Research and Development Agency [NYSERDA] and New York State Department of Environmental Conservation [NYSDEC])

Renewable Energy Production:

Achieving the above GHG emissions reduction targets is only achievable if NYS fundamentally alters how it generates electricity. While demand for renewable energy such as solar and wind power has grown, power generation that generates GHG emissions is still prevalent in NYS. The CLCPA establishes specific goals to achieve a reduction in GHG emissions from the energy generation sector, which are summarized below:

- ***Goal(s):*** Deployment of 6,000 megawatts (MW) of distributed solar generation, generation of 70% of statewide energy from renewable resources, deployment of 3,000 MW of energy storage, deployment of 9,000 MW of offshore wind, establishment of a zero-emissions energy system (including retirement/decommissioning of all fossil fuel-fired facilities), and an increase in total electrical system capacity from 37 gigawatts (GW) to between 111 GW and 124 GW (including 15 GW to 45 GW of "on-demand" or dispatchable generation).
- ***Timeline:***
    - *2025*: Deployment of 6,000 MW of distributed solar statewide.
    - *2030*: Deployment of 3,000 MW of energy storage; 70% of statewide energy production is from renewable/zero-emissions sources.
    - *2035*: Deployment of 9,000 MW of offshore wind.
    - *2040*: Establishment of zero-emissions energy system, including retirement of all fossil fuel-fired facilities; increase in electrical system capacity to a minimum of 111 GW; and installation of a minimum 15 GW of "on-demand" or dispatchable generation sources.
- ***Lead Agency***: NYSDOS with assistance from other NYS entities (NYSERDA, NYSDEC).

ZEV Targets and Goals:
The transportation sector, especially single-passenger vehicles, are a major, inefficient contributor to GHG emissions across the globe. However, our nation's infrastructure and economy are highly dependent on light-duty passenger and heavy-duty freight vehicles. As such, the CLCPA establishes specific goals to reduce GHG emissions from the transportation sector, with a heavy focus on a transition to battery-powered ZEVs. While NYS will not "ban" traditional gasoline- and diesel-powered vehicles, these vehicles will be phased out by establishing goals for vehicles sold in NYS. These goals and timelines are summarized below:

- ***Goal(s):*** 100% of all light-duty vehicles (LDV) sold in NYS are ZEVs; 30% of all medium- and heavy duty (MHD) vehicles sold in NYS are ZEVs, followed by transition to 100% ZEV MHD vehicles sold in NYS.
- ***Timeline:***
    - *2030*: 100% LDVs solid in NYS are ZEV; 30% MHD vehicles sold are ZEV
    - *2050*: 100% MHD vehicles sold in NYS are ZEV
- ***Lead Agency***: NYSDOS/New York State Department of Motor Vehicles (NYSDMV), with assistance from other entities (NYSDEC).

Waste Reduction:
As noted above in Section 2.2.1, GHG emissions from landfills has been recognized as a major emissions source from human activities. In NYS, the waste sector produces approximately 12% of the State's total emissions. Landfills are responsible for approximately 78% of these emissions due to the generation of methane. The CLCPA acknowledges that waste diversion, organics composting, and recycling all must be dramatically increased over the next quarter century to reduce the amount of GHG emissions generated from the waste sector. However, the CLCPA stops short of establishing concrete measurable goals to reduce GHG emissions from the waste sector. The general goals provided in the CLCPA are provided below:

- ***Goal(s):*** Significantly increase the amount of waste diverted away from landfills using a circular approach to materials management; improve the technology around emissions monitoring and leak reduction; and utilize landfills and combustors sparingly for specific waste streams.
- ***Timeline:*** 2030 for significant waste reduction, change in materials management strategies, and improvement in emissions monitoring and leak reduction; 2050 for utilizing landfills and combustors "sparingly."
- ***Broome County Status:*** A detailed waste audit, recommended as part of the Broome County Sustainable Operations Plan, is required to determine where the County currently stands in terms of organic and recyclable waste reduction.
- ***Lead Agency:*** USEPA, NYSDOS with assistance from other entities (NYSDEC).

Agricultural Methane Emissions:
As noted above, methane is a potent GHG that is also generated from agricultural processes. Specifically, manure management from livestock is a large source of methane in the United States, with manure management accounting for approximately 10% of all methane emissions. While specific methane-reduction goals for agricultural sources have not been specified, the "U.S. Methane Emissions Reduction Action Plan" established funding for farms to construct and manage anaerobic manure digesters and renewable energy biogas generation facilities on farms. This funding is administered through the USDA and is discussed further below in "Waste Generation and Organics Diversion."

Building Emissions:
NYS is home to an extensive residential and commercial buildings sector, with over 6 million buildings across the State. The vast majority of these buildings utilize natural gas as the main source of heat in the winter, while air conditioning is used to cool buildings in the summer. Peak energy consumption is currently in the summer when air conditioning is heavily utilized, while peak GHG emissions directly from buildings occur in the winter when natural gas and other fossil fuels are utilized for heating. In order to reduce GHG emissions generated from NYS buildings, the CLCPA sets goals for installation of electrified heating systems (i.e. heat pumps) for buildings across the State. These systems will be either ground-source heat humps (GSHPs), which typically perform better in extreme cold weather, or air-source heat pumps (ASHPs) which typically are cheaper to install but require secondary backup heat in extreme cold.

The CLCPA establishes goals for building heating, ventilation, and air conditioning (HVAC) electrification, which are summarized below:

- ***Goal(s):*** HVAC electrification of 1- to 2-million NYS homes and 10% - 20% of NYS commercial space, followed by HVAC electrification of 85% of homes and commercial building space statewide.
- ***Timeline:*** 2030 for HVAC electrification of 1- to 2-million NYS homes and 10% - 20% of NYS commercial space; 2050 for 85% HVAC electrification of all homes and commercial building space.
- ***Broome County Status:*** Building electrification data is unavailable for the entire county.
- ***Lead Agency:*** NYSDOS, with assistance from other entities (NYSERDA, NYSDEC).

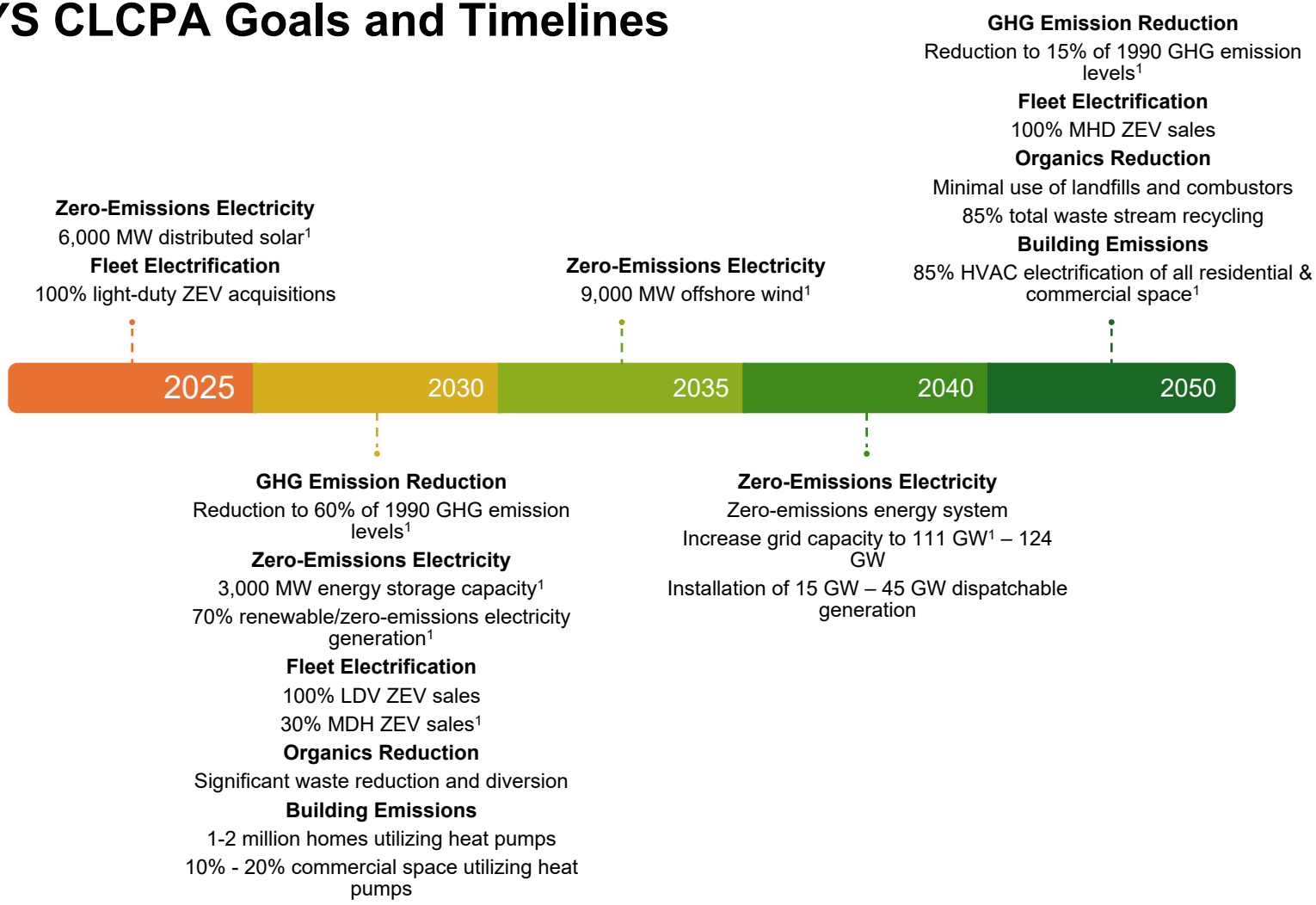
Climate Resilient Infrastructure and Operations:
Similar to the Federal government goals and mandates described above in Section 2.2.1, the CLCPA does not have specific measurable goals or timelines to increase the State's capacity for overall climate resilience. Instead, the CLCPA focuses on mitigating the effects of climate change by working to reduce GHG emissions generated in NYS. However, it is important that communities begin to develop and implement strategies to adapt to climate change while also working to mitigate its effects through GHG emissions reduction. The CLCPA provides general goals and strategies that communities can utilize to help improve or enhance their resilience to more extreme weather events in the future:

- ***Goal(s):***
    - Build resilience capacity:
        - Create, implement, and update comprehensive and equitable adaptation and resilience plans;
        - Incorporate these equitable adaptation and resilience strategies into State funding opportunities;
        - Improve public education and community outreach about climate resilience; and
        - Develop equitable strategies and projects to improve and enhance insurance protection.
    - Enhance community and infrastructure resilience:
        - Provide State agency planning and technical support for resilience projects;
        - Include future climate conditions in land use planning and environmental reviews;
        - Develop and improve tools to evaluate inland and coastal flooding;
        - Develop policies and strategies to reduce human risks associated with extreme temperatures; and

        - Ensure the reliability, resilience, and safety of the energy system.
    - Enhance resilience of living systems;
        - Develop policies and programs to reduce risks threatening ecosystems and biodiversity;
        - Enhance climate resilience/adaptability of the agricultural sector; and
        - Preserve/protect the ability of forests to sequester carbon.
- ***Timeline:*** No timeline specified
- ***Lead Agency:*** No specific enforcement agency. Individual agencies will begin incorporating these goals into their requirements as a prerequisite for future funding.

Presented below is a visual representation of these CLPCA goals and their timelines.

NYS CLCPA Goals and Timelines



NOTES:
1. Indicates minimum goal.

1.2.3. Broome County Goals, Targets, and Objectives

In addition to meeting the goals and mandates set by the Federal government and the NYS CLCPA, Broome County is striving to become a leader in GHG emissions reduction, climate resiliency, and overall sustainability. The table below summarizes the minimum target values that Broome County must reach to meet the mandates set forth in the CLCPA. Note that "goals" refer to State-wide CLCPA mandates, while "targets" refer to scaled values for Broome County for tracking. This table includes:

- CLCPA Sectors;
- Individual goals (i.e. reduction of GHG emissions, solar energy production, zero-emission vehicles, etc.);
- CLCPA timelines to achieve each goal;
- NYS-mandated goals; and
- CLCPA goals scaled down for Broome County.

Table 1-1: Broome County Minimum Target CLCPA Metrics

NYS Goals	*Timeline*	*New York State Goals*	*Broome County Targets*	*Units*
Greenhouse Gas Emissions				
60% of 1990 Levels[1,2]:	2030	245.87	2.45	mmt
15% of 1990 Levels[1,2]:	2050	61.47	0.61	mmt
Renewable Energy Production				
Solar Generation Capacity[3,4]:	2025	6,000	89.88	MW
Energy Storage Capacity[3,4]:	2030	3,000	29.90	MW
Dispatchable Energy Sources[3,4]:	2040	15,000	224.69	MW
ZEVs				
100% LDVs; 30% MHDs Sold[5,6]:	2030	3,000,000	3,625	LDVs
100% MHD Vehicles Sold[5,6]:	2050	10,000,000	12,083	LDVs
Building Emissions				
Home Electrification[7,8]:	2030	2,000,000	21,392	homes
20% Business Electrification[8,9]:	2030	107,152	801	businesses
85% Home Electrification[7,8]:	2050	6,463,845	69,138	homes
85% Business Electrification[8,9]:	2050	455,394	3,403	businesses

NOTES:
1. Value obtained from 6 NYCRR Part 496, "Statewide Greenhouse Gas Emission Limits."
2. Broome County target value calculated based on proportion of County population to total State population.
3. NYS Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Section 1.4, "Sector Summaries."
4. Broome County target value calculated based on proportion of County land area to total State land area.
5. NYS LDV Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Chapter 11, "Transportation."
6. Broome County target values calculated based on proposed State targets for LDVs.
7. NYS Home Electrification Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Section 1.4, "Sector Summaries."
8. Broome County target values calculated based on proposed State targets for home and business electrification.
9. NYS Business Electrification Goals are based on square footage, not individual businesses.

The targets above were established using the following methodology:

Greenhouse Gas Emissions:
New York State's GHG goals were established using baseline GHG emissions in 1990 (404.26 mmt). Broome County's population accounts for 1.00% of the total State population. While each individual has their own unique "carbon footprint", it is assumed that total population is the most important factor in GHG production. Therefore, the above GHG emissions targets assume a baseline emission level of 4.05 mmt for Broome County. The CLCPA goals of reducing GHG emissions to 60% of 1990 levels by 2030 and to 15% of 1990 levels by 2050 were used to calculate the target GHG emissions targets for Broome County above.

Broome County Status: Broome County has achieved approximately 98.8% of its GHG emissions target for 2030, meaning it will need to reduce its overall GHG emissions 1.1% by 2030. The County has achieved approximately 24.7% of its 2050 goal and will need to reduce emissions 75.3% by 2050 to meet the CLCPA's goals.

Renewable Energy Production:
New York State has established State-wide renewable energy production goals based on current energy production capacity and projected energy consumption needs. Renewable energy production is highly dependent on available area for solar, wind, or geothermal facility construction, while battery energy storage systems (BESS) are best suited to store energy near where it will be utilized. Therefore, renewable energy production is treated as a function of total land area (Broome County is 1.5% of total NYS area), while BESS is treated as a function of population (Broome County is 1.0% of total NYS population).

Broome County Status: Broome County currently has 25.17 MW of solar generation capacity, which is 28% of its CLCPA target. However, a total of 141 MW of renewable energy is currently produced in the County which is 156.9% of the CLCPA target for solar generation alone. The County currently has 0.19 MW of energy storage (0.63% of County CLCPA target by 2030) and 4.19 MW of dispatchable energy sources (1.86% of County CLCPA target by 2040).

Zero-Emissions Vehicles (ZEVs):
New York State is utilizing a phased approach to replace gasoline- and diesel-fueled vehicles with ZEVs by establishing goals for number of ZEVs sold in the State, with a target of 3,000,000 ZEVs in service by 2030. For this plan, a Broome County's target for light-duty ZEVs is set at 30% of the total number of vehicles registered in the County. Using this assumption, the CLCPA goals for ZEVs, and publicly available NYS Department of Motor Vehicles (DMV) data, the goals for total number of light-duty ZEVs registered in Broome County are calculated. The target number of ZEVs is based on the current number of LDVs registered in Broome County.

Medium- and heavy-duty ZEV technology is still significantly behind that of light-duty ZEVs, and therefore MHDV ZEV goals have been adjusted accordingly. For this plan, a goal of 3% MHDV ZEVs by 2030 is recommended, along with a goal of 95% MHDV ZEVs by 2050. The target number of MHDV ZEVs is based on the current number of MHDVs registered in Broome County.

Broome County Status: 602 total registered ZEVs (4.98% of all LDVs in County; 2023 data). This is 16.6% of the County's CLCPA target for 2030 and 5% of the County's CLCPA target by 2050.

Building Emissions:
New York State aims to reduce GHG emissions from buildings by moving towards electrified heating, ventilation, and air conditioning (HVAC) systems to replace traditional systems. Minimum targets for

Broome County were developed using goals defined in the CLCPA. By 2030 New York State aims to electrify up to 2,000,000 households, accounting for approximately 26% of the total households in the State. By 2050, the goal is to electrify 85% of all households in the State.

Business electrification goals are based on the total square footage of business space electrified. New York State has established goals of 20% of total business square footage electrified by 2030 and 85% of total business square footage electrified by 2050. In Broome County, the total square footage of buildings occupied by businesses is unknown. Therefore, the total number of businesses with an address in Broome County is used to establish business building electrification goals. It is assumed that businesses will be electrified at a consistent rate regardless of the footprint that they occupy. However, it is important to note this assumption and efforts should be made to monitor the progress of larger businesses in Broome County.

The targets presented above are intended to serve as concrete metrics to advancing the County's overall objectives, listed below.

2.2.1.1 Energy Efficiency

Improving how we currently use energy, whether for transportation, heating, or everyday operations, is an important first step to both mitigating GHG emissions and creating a more sustainable community. Improving energy efficiency in the short term helps reduce the impact that Broome County has on GHG emissions and reduces the costs associated with energy consumption. In the long term, improving energy efficiency helps reduce the strain on the electrical grid as New York State moves towards overall electrification and increases in grid capacity. This EAP provides high-level recommendations to improve energy efficiency in buildings and transportation.

2.2.1.2 Cost Reduction

Improved energy efficiency not only equates to a reduction in GHG emissions, but also equates to a reduction in costs for individual households. Broome County's median household income is $58,317, with nearly 20% of the County's population living below the Federal poverty line (2022 U.S. Census). This EAP provides high-level recommendations on how to ease the cost burden of energy usage on individual households and on the Broome County community in general.

2.2.1.3 Green Job Creation

As the Federal government and NYS move towards construction and utilization of renewable energy sources, the demand for design, construction, and long-term maintenance of renewable energy systems has grown. Improvements in energy efficiency also require labor for installation of upgraded heating and cooling systems, high-efficiency insulation, electrical vehicle charging stations, and upgrades to the electrical grid. Additionally, labor will be required for the design, construction, and long-term maintenance of existing infrastructure and new physical resiliency controls to protect the Broome County community from evolving environmental hazards. All these needs will equate to the creation of "green" jobs, which this EAP identifies as potential future opportunities.

2.2.1.4 Enhanced Community Resiliency

As noted above in the sections above, environmental hazards are expected to change in frequency and intensity, at an accelerated rate, over the 21st century. Feasible environmental hazards in Broome County will change, and the community can begin taking steps to adapt to these changing hazards. This EAP provides insight into how these hazards are expected to change and identifies strategies (i.e. policies, initiatives, and capital improvements projects) to help the community adapt to a changing climate. The objective is to provide Broome County with the right tools to be able to withstand more frequent and powerful environmental hazards, sustain minimal damage and prevent

injuries and fatalities, and serve as an example for the rest of New York State as a climate resilient community.

2.2.1.5 Greenhouse Gas Reduction

The most cost-effective way to mitigate or adapt to the effects of a changing climate is to mitigate GHG emissions from a community. By investing in improved energy efficiency, renewable energy, overall systems electrification, and strategies to reduce organic waste into landfills, Broome County can reduce its overall GHG emissions. Electrification is not without its challenges, and this EAP identifies these challenges and provides recommendations on how the County can navigate these to reduce its overall GHG emissions footprint.

2.2.1.6 Increased Energy Security and Equity

Our current energy systems are highly dependent on fossil fuels that are generated outside of New York State, the United States, and even North America. While this system has fueled growth in the past, it leaves the residents of Broome County susceptible to fluctuations in supply and pricing that are well outside of their control. New York State has made the decision to move towards the electrification of buildings and transportation because it allows electricity to be generated, transmitted, stored, and utilized entirely within the State. This creates a local, self-sufficient system that is significantly less dependent upon the global economy and improves energy security. Additionally, New York State has identified Disadvantaged and Climate Justice communities across the State. These are communities that have traditionally been at a disadvantage due to socioeconomic disparities, and they are now receiving preference for electrification, climate resilience, and GHG emissions reduction projects. There are several communities in Broome County that are classified as Disadvantaged Communities by NYSERDA, which prioritizes them for future funding opportunities as they become available.

1.4. Climate Smart Communities

The New York State Climate Smart Communities (CSC) program was established to help local governments act to both reduce greenhouse gas emissions and adapt to a changing climate. This points-based program offers grants to communities to implement programs and capital improvements projects, offers rebates for electric vehicles, and provides free technical assistance. Communities can either be registered by or certified with the CSC program. Registered communities are required to pass the CSC pledge as a municipal resolution to join the program. Certified communities have adopted the CSC pledge and are required to complete and document a suite of actions that mitigate and adapt to climate change at the local level. Once registered, communities can become either Bronze- or Silver-certified CSCs by completing minimum Pledge Elements (PEs) and associated Priority Actions (PAs). Bronze-certified CSCs have completed and documented PAs that total a minimum of 120 points, while Silver-certified CSCs have completed and documented PAs that total a minimum of 300 points.

Broome County became a certified CSC on September 26, 2019, and is currently a Bronze-certified community. The County was recertified as Bronze in August 2024. The recertification process was led by the Broome County Planning Department. The recommended procedures, policy changes, and strategies summarized in this Energy Action Plan were crafted to advance CSC Program recertification and align with the pledge elements and actions of the CSC Program. The Community Greenhouse Gas Inventory and Renewable Energy Siting Analysis all were conducted consistent with the guidelines provided by the CSC program.

1.5. Analyses Conducted

The following analyses were conducted as part of this Plan:

- Hazards, Vulnerabilities, and Climate Considerations (Section 2.0)
    - Review of existing environmental hazards, existing electrical infrastructure vulnerabilities to these hazards, and a summary of projected changes to environmental hazards in the County that would impact energy usage or electrical infrastructure.
    - Conducted to assist with CSC Pledge Element 7 Action: Climate Vulnerability Assessment.
- Current County Energy Profile (Section 3.0)
    - Review of existing energy consumption across residential, commercial, industrial, and transportation sectors, summary of community GHG emissions across these sectors, summary of existing electrical infrastructure, review of existing renewable energy laws and development patterns, and summary of local and regional energy plans.
    - Includes local and regional examples of building and transportation system electrification efforts.
- Projected County Energy Profile (Section 4.0)
    - Analysis of projected energy usage across residential, commercial, industrial, and transportation sectors through 2050, analysis of required electrical generation, transmission, and distribution upgrades required to account for additional demand, review projected CLCPA impacts to disadvantaged communities, and summary of challenges and opportunities for Broome County.
    - Includes a summary of renewable energy siting analysis recommendations.
- Community GHG Inventory (Appendix B)
    - Review of Broome County community sectors that are most responsible for GHG emissions.
    - Conducted in accordance with CSC Pledge Element 2 Action: Community GHG Inventory.
- Renewable Energy Siting Analysis (Appendix C)
    - Review of Broome County parcels to identify those that are best suited for renewable energy generation based on location, current use of property, and available space for renewable energy generations.
    - Conducted to advance CSC Pledge Element 4 Action: Renewable Energy Feasibility Studies.

2.0 Hazards, Vulnerabilities, and Climate Considerations

Natural hazards affect Broome County on an annual basis, sometimes with devastating effects. These hazards can adversely affect energy transmission and distribution infrastructure and affect the demand for energy in the Broome County community.

The risks from these hazards are expected to evolve over the course of the 21st century at an accelerated rate due to the emission of greenhouse gases from human activity. As these hazards change in magnitude and frequency it is important to understand what effects these changes will have on both energy transmission and distribution infrastructure as well as on overall energy demand. The purpose of this section is to provide context on how energy infrastructure and demand will be impacted as a result of climate change in Broome County.

2.1. Broome County Hazards of Concern

Historically, Broome County has suffered significant economic, environmental, and human loss from certain natural hazards. As such this section will focus on the County's main hazards of concern, derived from the County's 2019 Hazard Mitigation Plan[2.1] (HMP), which are ranked as follows: 1) flooding, 2) severe winter weather, 3) severe weather, 4) extreme temperature, 5) drought, 6) wildfires, and 7) dam/levee failure.

The pending HMP also includes three other hazards of concern: invasive species, disease outbreak, and earthquakes. However, as these hazards of concern would only be affected qualitatively rather than quantitatively by climate change, they have been omitted from this section.

Presented below is a discussion of the climate modeling utilized to evaluate the current and future conditions of the hazards of concern, followed by an analysis of how each of these hazards affects existing energy infrastructure and demand. This analysis includes how each hazard is expected to change over the 21st century and how these changes will affect energy infrastructure and demand in the future in Broome County.

2.2. Hazard Modeling – Climate Considerations

As the climate changes and continues to get warmer, it is important to analyze how natural hazards will evolve and affect Broome County over the next century. The following subsections describe various models used to project emissions, warming and hazard scenarios. The projections are then utilized to examine how the hazards of concern for Broome County are expected to change over the 21st century.

2.3.4. Emissions Model Projections

For this analysis, two different climate models – the National Oceanic and Atmospheric Administration (NOAA) Climate Explorer[2.2] and the Cornell University Northeast Regional Climate Center (NRCC) Intensity-Duration Frequency (IDF) Curves[2.3] – were utilized to understand how greenhouse gas (GHG) emissions will affect future hazard conditions. For both NOAA and NRCC climate models, two scenarios were analyzed: one with lower GHG emissions estimates (RCP 4.5 Model) and one with higher GHG emissions estimates (RCP 8.5 Model).

2.2.1.1 Lower Emissions Scenario (RCP 4.5 Model)

The first climate scenario utilized is the Temperature Change (RCP 4.5) climate model, modeled from 2006 – 2100. When considering various scenarios of changing GHG concentrations in the atmosphere over time, the RCP 4.5 model is considered an intermediate scenario, with lower long-

term GHG concentration projections than the RCP 8.5 model described below. In lower emissions scenario (RCP 4.5), emissions peak in the middle of the 21st century, then decline. According to NOAA, some notable assumptions of this climate scenario are:

- The earth gets warmer as CO_2 increases in the atmosphere;
- The earth doesn't warm uniformly – the oceans warm slower than the continents and the Arctic;
- Projections are based on a low-emissions scenario;
- CO_2 levels rise to just over 550 parts per million by 2100;
- Employment of a range of technologies and strategies for reducing greenhouse gas emissions are assumed in this stabilization scenario.

The RCP 4.5 model is referred to as the "lower emissions scenario" for the remainder of this report.[2.4]

2.2.1.2 Higher Emissions Scenario (RCP 8.5 Model)

The second climate scenario utilized is the Temperature Change (RCP 8.5) climate model, modeled from 2006 – 2100. This scenario is a high emissions scenario, in which GHG emissions continue to increase throughout the 21st century and reach concentrations almost twice that of the lower emissions scenario by 2100. According to NOAA, some notable assumptions of this climate scenario are:

- The earth gets warmer as CO_2 increases in the atmosphere;
- The earth doesn't warm uniformly – the oceans warm slower than the continents and the Arctic;
- Projections are based on a high-emissions scenario;
- Projections for temperature according to RCP 8.5 W/m^2 show extreme change; and
- CO_2 levels rise to 936 parts per million (ppm) by 2100, making the global temperature rise by about 5-6°C by 2100.

The RCP 8.5 Model is referred to as the "higher emissions scenario" for the remainder of this report.[2.5] The Intergovernmental Panel on Climate Change (IPCC) has noted that the higher emissions scenario is a more accurate depiction of observed atmospheric warming to date. Unless otherwise specified, climate metrics described below refer to the higher emissions scenario.

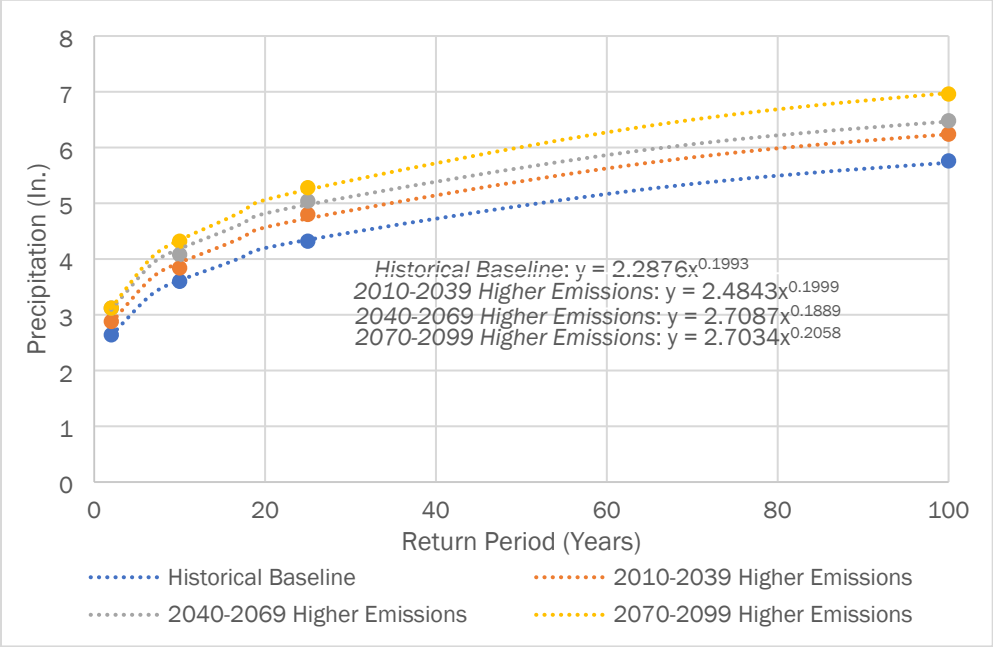
2.3.5. Cornell University NRCC Intensity-Duration Frequency (IDF) Curves

As the climate changes, increasingly severe storms are expected, and precipitation will generally increase in Broome County throughout the century. Multiple studies conducted in the northeastern region of the country since the mid to late 20th century have shown increases in both the frequency and magnitude of extreme precipitation. The Northeast Regional Climate Center (NRCC), operated by Cornell University, provides IDF curves for storm events for the following return periods[2.3]:

- 2-year storm (50% annual chance of occurring);
- 10-year storm (10% annual chance of occurring);
- 25-year storm (4% annual chance of occurring);
- 50-year storm (2% annual chance of occurring); and
- 100-year storm (1% annual chance of occurring).

Precipitation intensity and frequency are two direct climate parameters that both the Cornell University NRCC and the NOAA Climate Explorer tools provide clear projections on. The current and projected NRCC IDF curves provide a look at how storm intensity and frequency of large storms is expected to increase in Broome County through 2100. Figure 2-1 shows the historical baseline (1970 – 1999) IDF curve for 2-year, 10-year, 25-year, and 100-year, 24-hour storms and compares these intensities to projections for 2010 – 2039, 2040 – 2069, and 2070 – 2099 using the higher emissions scenario.[2.3]

Figure 2-1: Current and Projected 24-Hour Storm Frequencies and Intensities – Higher Emissions



As Figure 2-1 shows, the intensity of 2-year, 10-year, 25-year, and 100-year storms for Broome County are expected to increase over the coming century. The intensities (i.e. amount of precipitation expected to fall over a 24-hour period) of 2-year, 10-year, 25-year, and 100-year storms are expected to increase between 18% and 22% by 2100. This means that current design standards for return period will quickly become outdated, and that existing stormwater infrastructure is likely to be inadequate by the end of the 21st century. These increases also indicate that peak river flows during storm events are likely to increase, which poses a threat to electrical substations and transmission towers located in or near flood zones. Electrical substations are most vulnerable to floodwaters that may damage equipment, while transmission towers are most vulnerable to debris flows (i.e. large trees) in the floodwaters.

2.3.6. NOAA Climate Explorer

The NOAA Climate Explorer uses the Lower and Higher Emissions GHG scenarios and compares the metrics described below to historically observed data from 1961-1990. These climate metrics include:

<u>Energy Usage</u>

- Projected Heating Degree Days
- Projected Cooling Degree Days

<u>Temperature and Extreme Temperature</u>

- Projected Average Daily Maximum Temperature

- Projected Number of Days with Daily Maximum Temperature of <32°F
- Projected Number of Days with Daily Minimum Temperature of <32°F
- Projected Number of Days with High Temperature of >90°F

Intensity and Frequency of Precipitation

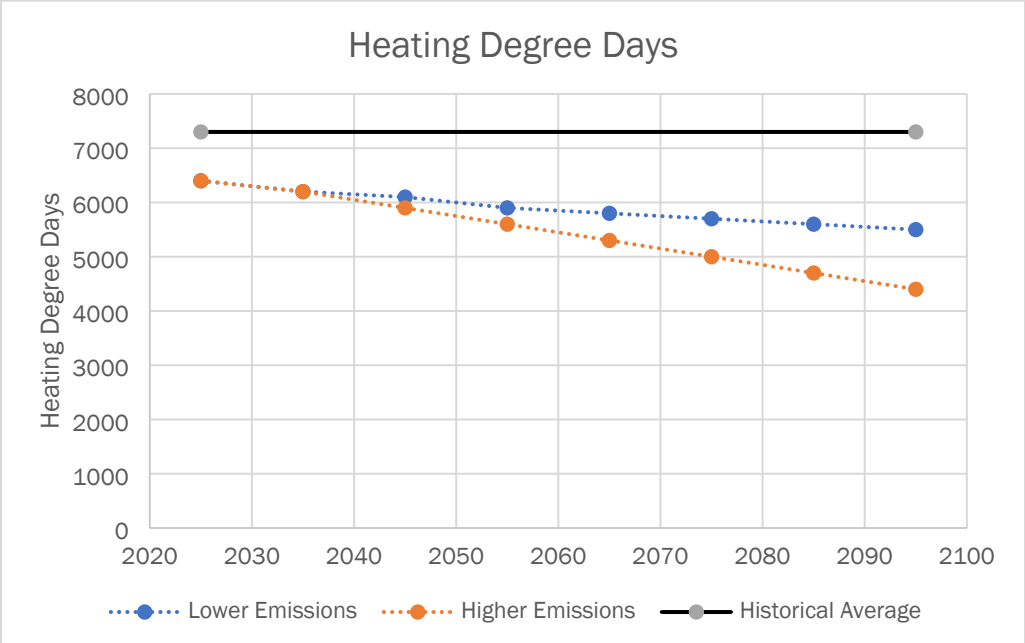
- Projected Number of Days With >2" Precipitation
- Projected Number of Days With >3" Precipitation
- Projected Annual Precipitation
- Projected Annual Number of Dry Days

2.2.3.1 Energy Usage

The NOAA Climate Explorer provides projections for heating degree days and cooling degree days. Heating and cooling degree days are used as a general measure to determine heating or cooling needs for buildings. Heating degree days are days in which average ambient outdoor temperature is below 65°F. Heating degree days are calculated by taking the average daily temperature and subtracting it from the baseline temperature of 65°F. If the average outdoor ambient temperature is 40°F, that day is assigned 25 heating degree days and zero cooling degree days. Conversely, cooling degree days are days in which the average ambient outdoor temperature is above 65°F. Cooling degree days are calculated by taking the average daily temperature and subtracting the baseline temperature of 65°F. If the average outdoor ambient temperature is 80°F, that day is assigned 15 cooling degree days and zero heating degree days.

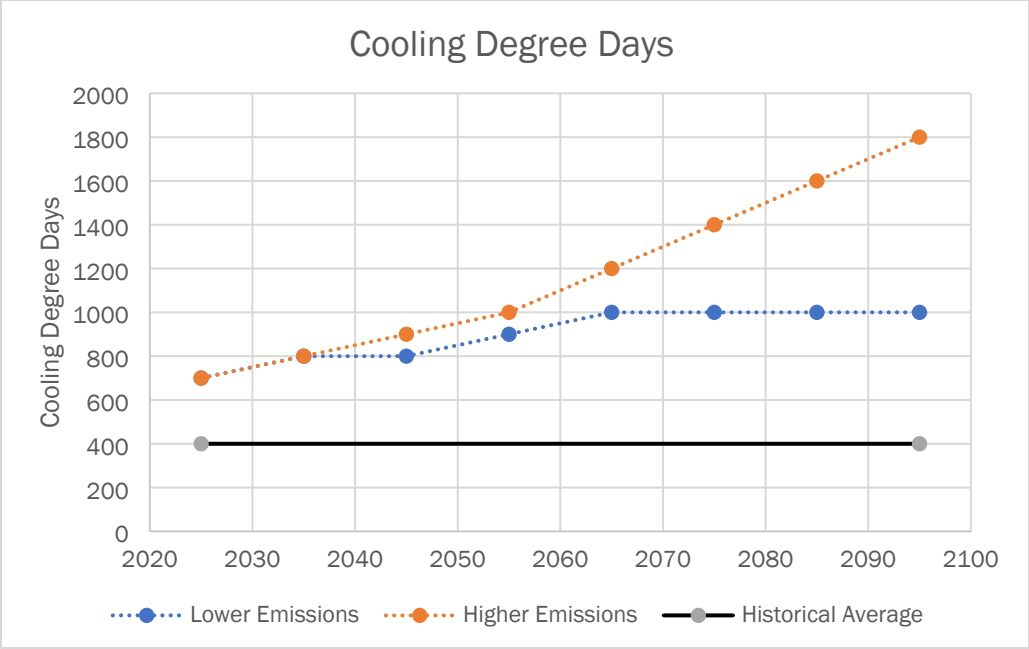
First, projected heating degree days is presented below in Figure 2-2. As the average daily maximum temperature is projected to rise in Broome County, heating degree days are projected to decrease. This indicates that residents will generally need to use less energy for heating indoor spaces as we progress through the 21st century. Broome County historically averages 7,300 heating degree days annually. The higher emissions scenario projects this to decrease by just over 23% by the 2050s to 5,600 heating degree days, with a nearly 40% decrease to 4,400 heating degree days by the 2090s.

Figure 2-2: Projected Heating Degree Days



Next, projected cooling degree days is presented below in Figure 2-3. As the average daily maximum temperature is projected to increase, cooling degree days are projected to increase. This indicates that residents will generally need to use more energy for cooling indoor spaces. Broome County historically averages 400 cooling degree days annually. The higher emissions scenario projects this to increase by 150% by the 2050s to 1,000 cooling degree days, with a 350% increase to 1,800 cooling degree days by the 2090s.

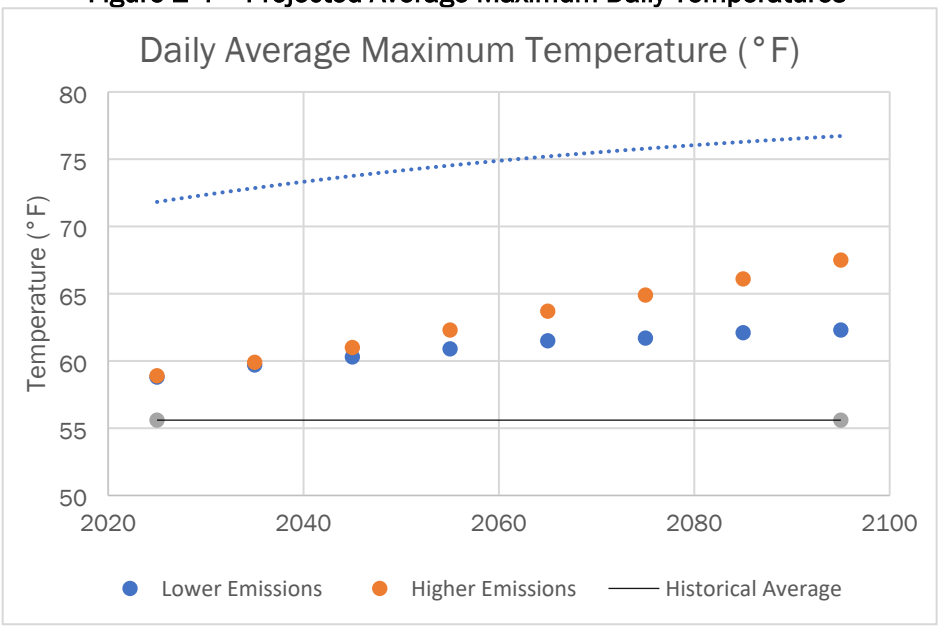
Figure 2-3: Projected Cooling Degree Days



2.2.3.2 Temperature and Extreme Temperature

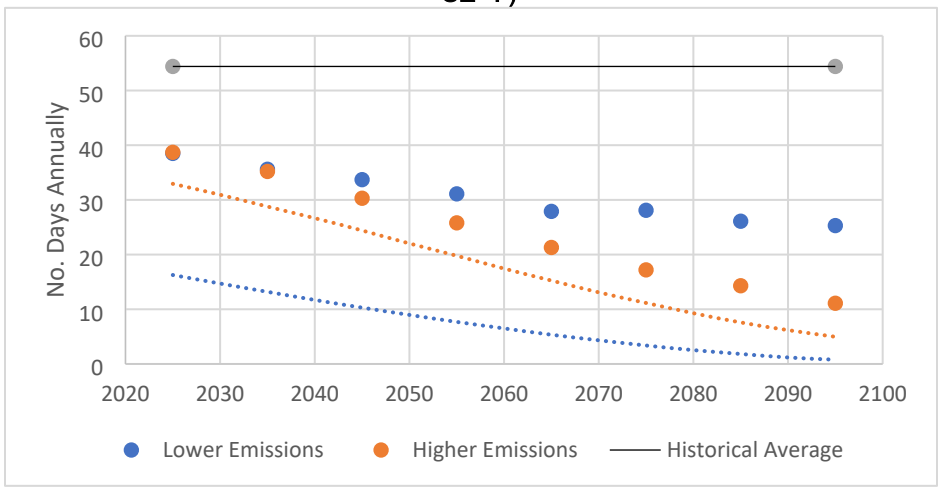
Changes to both the average daily temperature and temperature extremes (i.e. extreme cold and heat) are important when determining evaluating how hazards of concern are expected to change over the remainder of the century. The first climate metric evaluated is the projected average maximum daily temperature. The NOAA Climate Explorer model examines changes in average annual temperature through the end of the 21st century. The historical daily average temperature for Broome County is 55.6°F. Modeling indicates that the daily average temperature will consistently increase in the next decades, by as much as 21.4% in the 2090s (67.5°F). Changes to average daily maximum temperature are shown below.

Figure 2-4 – Projected Average Maximum Daily Temperatures



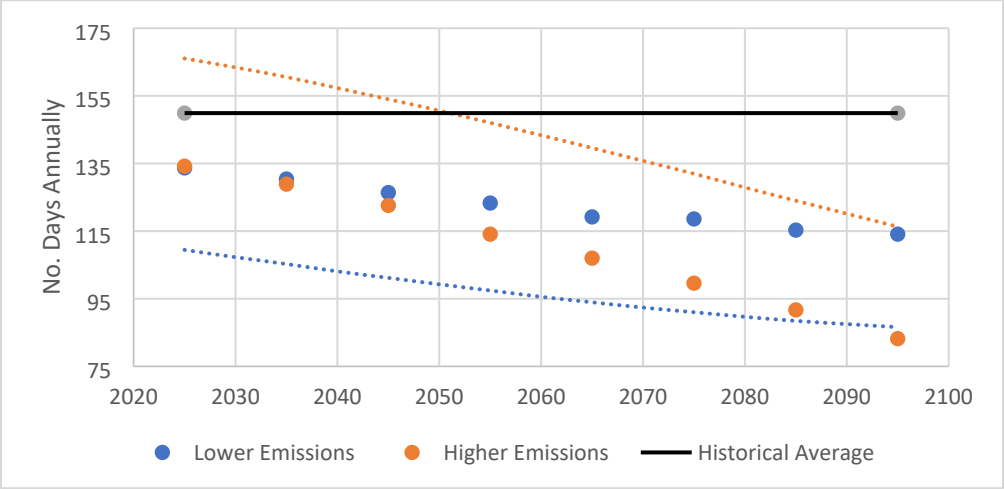
Next, NOAA's Climate Explorer model indicates that Broome County had a historical average of 54.4 days in which the daily temperatures were entirely below freezing, or in other words, the maximum temperature did not exceed 32°F. The number of days where the daily temperature is entirely below freezing is expected to significantly decrease by the end of this century, with Broome County experiencing a decrease of approximately 79.6% by the 2090s, or an average of only 11.1 days with temperatures entirely below freezing. Changes to the projected number of days spent below freezing are presented below:

Figure 2-5: Projected Number of Days with Daily Temperatures Entirely Below Freezing (Max Temp <32°F)



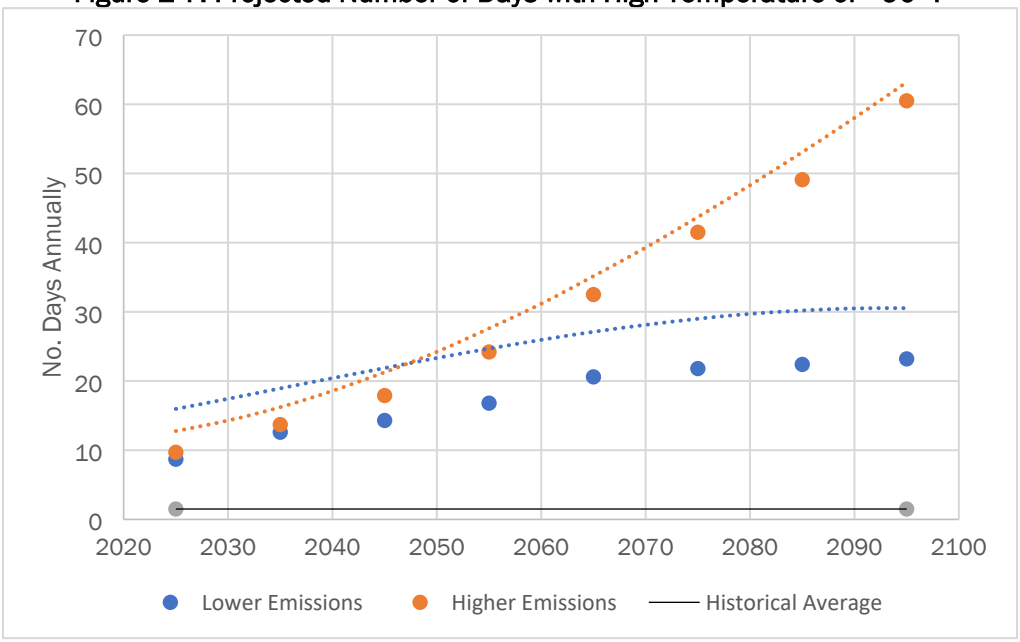
The next climate metric, projected number of days with a freeze-thaw cycle, or in other words when the daily minimum temperature remains below 32°F, is a potential indicator of days in which ice storms or damage from the freeze-thaw cycle can occur. Broome County historically averages 149.9 days in which freeze-thaw cycles occur per year. By the 2090s, the projected number of days with a freeze-thaw cycles are expected to decrease by about 44.5% (83.2 days annually). Full NOAA Climate Explorer data for days with freeze-thaw cycles is presented below.

Figure 2-6: Projected Number of Days with a Freeze-Thaw Cycle (Min Temp <32°F)



Average daily temperature is a good indicator of general warming trends but is not indicative of extreme events such as heat waves. Per the National Weather Service (NWS) definition of a heat wave, it is more useful to look at the potential increase of days in which the maximum temperature reaches 90°F or higher. Broome County historically averages 1.5 days per year in which the temperature reaches 90°F or greater. Modeling indicates that the number of days with temperatures exceeding 90°F is expected to significantly increase in both the short-term and long-term, with a possible increase of 3933% (60.5 days annually), by the 2090s. Full NOAA Climate Explorer data for days in which the maximum temperature reaches 90°F or higher is presented below.

Figure 2-7: Projected Number of Days with High Temperature of >90°F

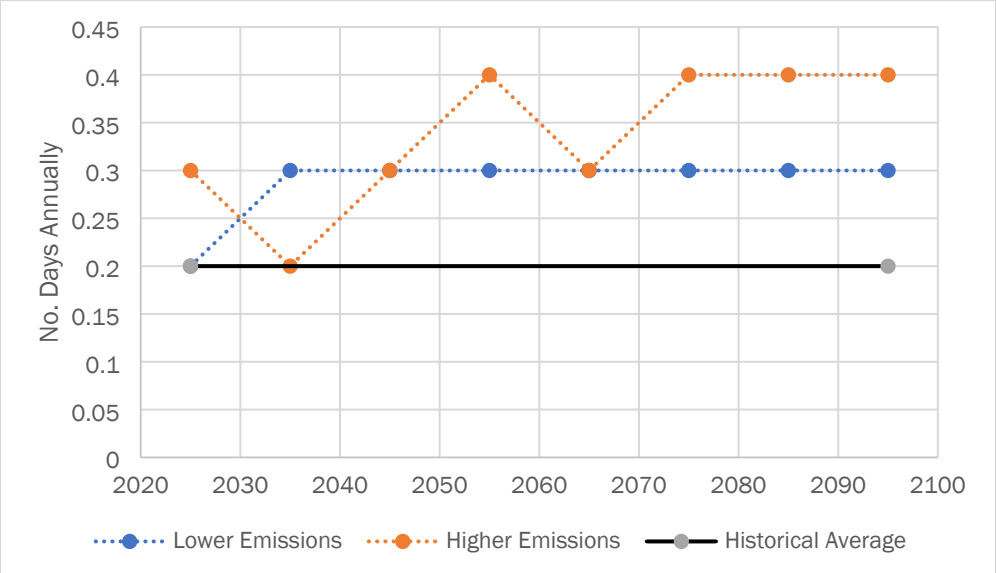


2.2.3.3 Precipitation Intensity and Frequency

In addition to the NRCC IDF curves above, the NOAA Climate Explorer provides projections for days in which greater than 2" and 3" of precipitation are expected to fall over the next century. The projection for days where greater than 3" of precipitation falls did not provide clear enough results to

draw confident conclusions regarding the anticipated changes to the hazards of concern. As such, this model was omitted from the following subsection and any hazard discussion that utilizes projected changes to precipitation intensity and frequency. Instead, the projection for days in which greater than 2" of precipitation are expected to fall (Figure 2-8) and the NRCC IDF curves for current and projected 24-hour storm frequencies and intensities (Figure 2-1) were utilized in these respective discussions. It should be noted that Figure 2-8 shows the probability that greater than 2" of precipitation could fall at any given location within Broome County, while Figure 2-1 represents projections for the National Weather Service station located in Binghamton. Figure 2-8 is more useful as a projection of how extreme precipitation events are expected to increase instead of projecting storm return periods. The projected number of days with greater than 2" precipitation is presented below:

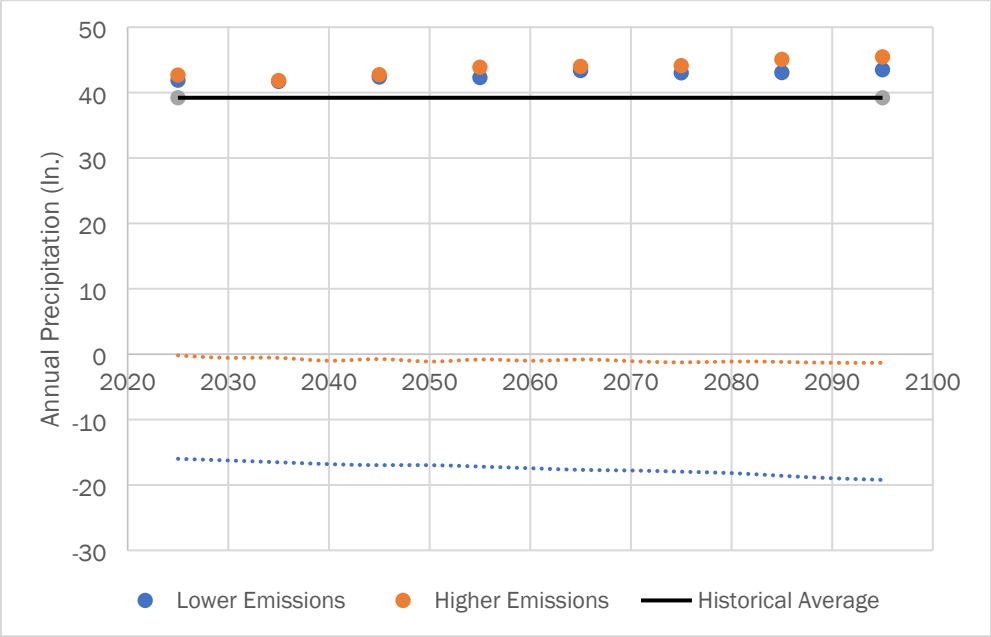
Figure 2-8: Projected Number of Days with >2" Precipitation



Historically (i.e. from 1961-1990), any given location within Broome County can expect to see greater than 2" precipitation 0.2 days each year. As Figure 2-8 shows, the frequency of 2" or greater storm events is expected to increase under both the higher emissions scenarios by as much as 100% by the end of the century.

Total changes in annual precipitation area a reasonable indicator of whether overall wetter conditions will exist, which plays a role in evaluating hazards of concern over time. Although total precipitation does not consider extreme precipitation events that can skew on-the-ground conditions, this climate metric gives a general overview of what future precipitation conditions will look like. Projected annual precipitation is presented below in Figure 2-9.

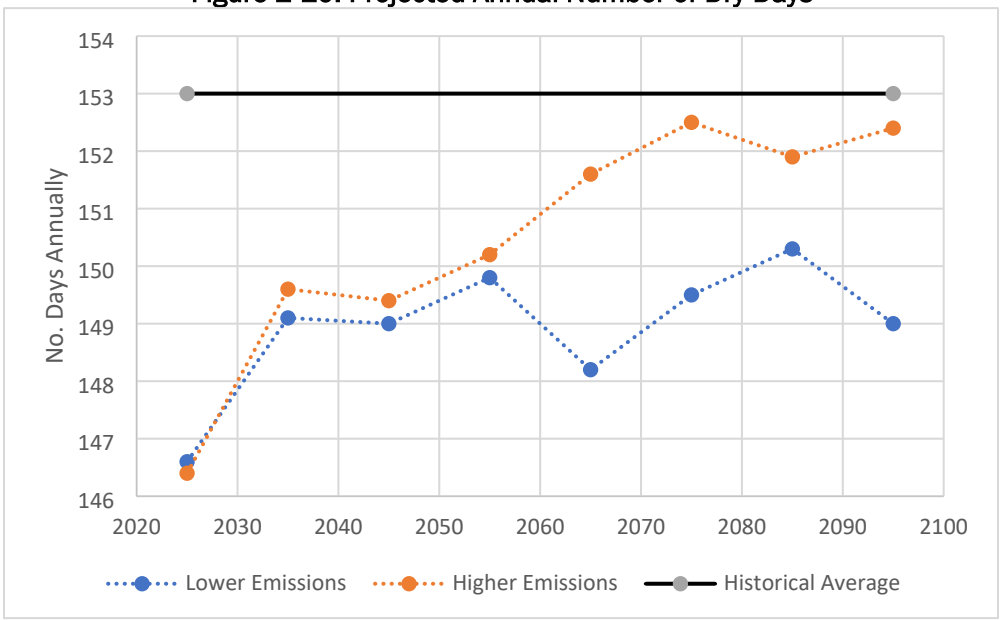
Figure 2-9: Projected Annual Precipitation



The historical average for annual precipitation in Broome County is 39.21 inches. The higher emissions scenario projects that average precipitation is expected to increase approximately 12% by the 2050s (43.88 inches) and approximately 16% by the 2090s (45.46 inches).

Finally, looking at the total number of expected dry days (i.e. days in which there is no precipitation) is a good indicator of the potential for drought and wildfire to occur. Full NOAA Climate Explorer data for predicted number of dry days is presented below.

Figure 2-10: Projected Annual Number of Dry Days



Broome County historically averages 153 dry days per year. The projected number of dry days in Broome County is expected to remain lower than the historical average in the next decades for both

the lower and higher emissions models. However, the margin of difference between the higher emissions projection and the historical average is expected to decrease significantly from 2020 to 2090. In the short term (2020s), the projected number of dry days (146.6) is expected to be lower than the historical average by approximately 6.4 days, or a percent decrease of approximately 4.3%. In the long term (2090s), the projected number of dry days (152.4) is expected to be lower than the historical average by only 0.6 days, or a percent decrease of approximately 0.4%. It is possible that in the next few decades after the 2090s, the number of dry days per year could match and then surpass the historical average. However, climate projections generally do not extend beyond 2100.

2.3. Flooding

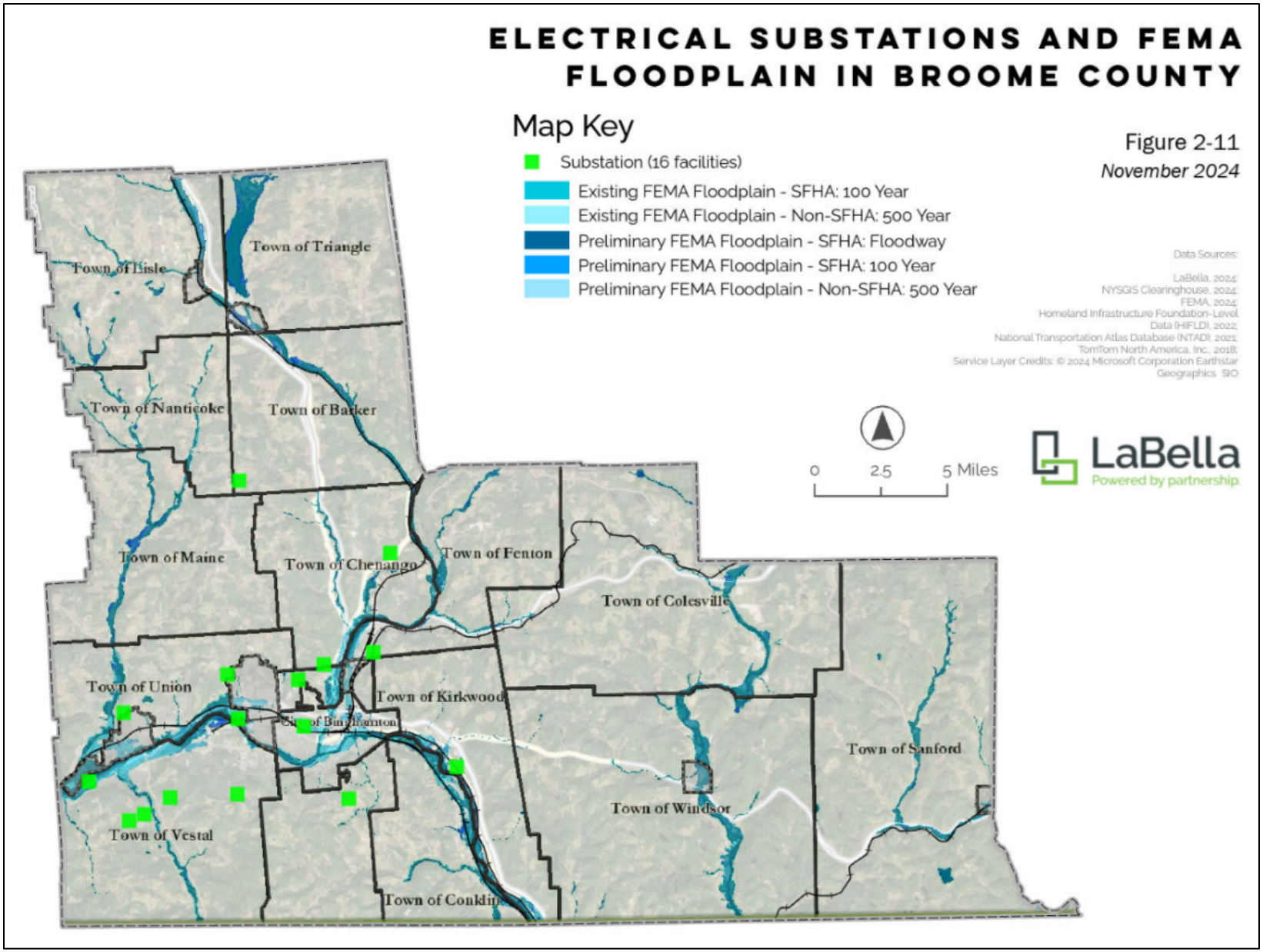
Flooding has historically been the most destructive and widespread natural hazard to affect Broome County. Broome County has extensive flood control measures in place to prevent the loss of life and property, including levee systems and flood control dams throughout the County. Several areas and critical infrastructure are still vulnerable to flooding, and the flooding threat is expected to increase over the remainder of the 21st century.

2.3.1. Flooding Impacts on Energy Infrastructure

Flooding in Broome County typically occurs in three (3) different forms: flash flooding, ice jam flooding, and riverine flooding. Flooding poses a threat to substations, electrical transmission and distribution networks. In particular, flash flooding has the potential to flood substations in the County. Additionally, flooding and ice jam flooding could affect substations near waterways and can cause damage to transmission systems near waterways if debris carried by floodwaters hits the electrical power line structures.

Flooding has caused the most damage to the County in terms of economic loss, injuries, and deaths. In particular, in 2011, Tropical Storm Lee reached Broome County and caused a flash flooding event which resulted in $102 million in property damage across the towns of Binghamton, Chenango, Vestal, Maine, Fenton, Nanticoke, and the villages of Endicott, and Whitney Point. This same storm also caused a flooding event in the towns of Conklin, Union, Binghamton, Chenango, and Windsor, which resulted in a total of $400.8 million dollars in property damages. The Westover substation, which is a major substation located in the Town of Union, sustained substantial damage due to flooding during Tropical Storm Lee.[2.6]

In order to help quantify the risk a particular area has to flooding, FEMA has developed mapping across the country showing areas that are expected to have a 1% annual chance of flooding (100-year flood zones) and a 0.2% annual chance of flooding (500-year flood zones). Figure 2-11 below shows the FEMA-mapped floodplains in relation to the sixteen (16) substations located throughout Broome County.[2.7]


ELECTRICAL SUBSTATIONS AND FEMA FLOODPLAIN IN BROOME COUNTY
Map Key
Substation (16 facilities)
Existing FEMA Floodplain - SFHA: 100 Year
Existing FEMA Floodplain - Non-SFHA: 500 Year
Preliminary FEMA Floodplain - SFHA: Floodway
Preliminary FEMA Floodplain - SFHA: 100 Year
Preliminary FEMA Floodplain - Non-SFHA: 500 Year
Figure 2-11
November 2024
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
FEMA, 2024;
Homeland Infrastructure Foundation-Level Data (HIFLD), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: © 2024 Microsoft Corporation Earthstar Geographics SIO
0
2.5
5 Miles
LaBella
Powered by partnership
Town of Triangle
Town of Lisle
Town of Nanticoke
Town of Barker
Town of Maine
Town of Chenango
Town of Fenton
Town of Colesville
Town of Union
Town of Kirkwood
City of Binghamton
Town of Sanford
Town of Windsor
Town of Vestal
Town of Conklin

As shown above, there are several substations (located in Vestal, Union, and Kirkwood) located in or near FEMA-mapped flood zones. The County utilizes a network of flood control measures to protect the community, infrastructure, and built environment from flooding events. The County is home to thirteen (13) levee systems which are a total of eighteen (18) miles long.[2.8]

2.3.2. Flooding Impacts on Energy Usage

Flooding events do not typically impact energy usage on a significant scale. In some cases, during emergency situations, there may be an increased energy demand for pumping water. However, in general, flooding events pose a greater risk to energy infrastructure. As noted, the Westover substation in Union sustained damage during Tropical Storm Lee and still requires some repairs to return this substation to its full capacity. Other substations in Vestal and Kirkwood are located in areas that are currently vulnerable to flood events or could potentially be affected by flooding in the future.

2.3.3. Projected Changes to Flooding

As demonstrated in the climate metrics described above, Broome County's climate is projected to experience significant changes over the remainder of the 21st century. These changes will directly impact the hazards of concern for the County. Evaluating how flooding is expected to change in Broome County requires a look at the following climate metrics:

- Projected IDF Curves (Figure 2-1)
- Projected Days with > 2" Precipitation (Figure 2-8)
- Projected Annual Precipitation (Figure 2-9)
- Projected Annual Number of Dry Days (Figure 2-10)
- Projected Average Daily Maximum Temperature (Figure 2-4)

Flooding can occur as a result of numerous conditions, including intense storm events, snowmelt and rain events, or large storms precluded by smaller storms that saturate soil. The intensity of storms and frequency at which these storms occur is expected to increase by approximately 20% by 2100 (Figure 2-1), and the frequency at which storms deliver more than 2" (Figure 2-8) of precipitation is expected to increase. An increase in large storm events indicates that flooding is likely to become both more frequent and more destructive.

Additionally, average annual precipitation (Figure 2-9) and projected number of dry days (Figure 2-10) are important climate metrics to evaluate. The average annual precipitation in Broome County is projected to increase by approximately 16% (higher emissions scenario) by 2100. This climate metric generally indicates that Broome County will be "wetter" than it is today, but this metric could be skewed by large storm events followed by extended dry periods. Therefore, it is important to look at changes to the projected number of annual dry days. The total number of dry days each year are projected to decrease significantly in the short term and rebound to near the observed historical average by 2100. An increase in total precipitation paired with a slight decrease in the total number of dry days indicates that precipitation is likely to occur in a similar fashion to the way it has historically, punctuated by more intense storm events. These more intense storm events will likely drive up the total annual precipitation that falls in the County. This indicates that soil conditions are more likely to be saturated rather than dry, which can lead to increased flooding.

Finally, looking at the average annual maximum temperature (Figure 2-4) allows us to make a broad determination on whether precipitation will fall in the form of rain or snow. The average maximum daily temperature is expected to increase by over 21% (higher emissions) by 2100, indicating that precipitation will increasingly fall more as rain than snow. This also reduces the risk of ice jam

flooding in the long term, as warmer temperatures will make it less likely that significant ice will form on local creeks and rivers.

2.3.4. Projected Flooding Impacts on Energy Infrastructure

The risk of flooding in Broome County is expected to increase due to an overall increase in precipitation and increases in large storm intensity. The increased risk of flooding poses a threat to the energy infrastructure of Broome County already located within or near FEMA-mapped flood zones. Energy infrastructure, such as substations and transmission systems, located outside of the FEMA-mapped flood zones can still be inundated and sustain significant damage, particularly in the coming years, as the scope of flood impacts is expected to affect a greater area and may include an increase in the frequency of the hazard. Additionally, substations throughout the County are vulnerable to flash flooding during extreme precipitation events. The risk of flooding from both flash flooding and riverine flooding are projected to increase, meaning that the County will need to dedicate more time and resources into protecting its energy infrastructure or consider relocating these facilities to other locations.

Transmission systems are also likely to be impacted by the increased risk of flooding. The risk of transmission systems damage is projected to increase, as debris can be carried by floodwaters which can impact transmission systems located near waterways. This can lead to localized power outages or in extreme scenarios, widespread, countywide outages. Mass, prolonged power outages have the potential to impact economic activity and disrupt critical infrastructure and essential services, such as hospitals and water treatment plants[2.9].

2.3.5. Projected Flooding Impacts on Energy Usage

Currently, flooding events cause minimal impacts to energy usage in the form of pumping during emergency events. While flooding is likely to become both more frequent and more destructive in the coming decades, flooding impacts on energy usage is not expected to increase significantly. It is anticipated that flooding will continue to affect energy infrastructure to a greater extent than energy usage in Broome County.

2.4. Severe Winter Weather

Winter weather, including snow storms, ice storms, and blizzards, is a common annual occurrence in Broome County. Severe winter weather can pose a significant threat to utilities, with the potential to have major impacts on energy infrastructure, especially aboveground energy infrastructure. Severe winter weather also has an impact on community energy usage in the form of increased heating demand. The County is well-equipped to handle winter weather events, and the threat of winter weather is expected to decrease over the remainder of the 21st century.

2.4.1 Severe Winter Weather Impacts on Energy Infrastructure

There are five (5) different severe winter weather events reported by the NOAA NCEI SED: winter storms, blizzards, heavy snow, lake-effect snow, and ice storms. All five (5) severe winter weather events were reported in Broome County between 1950 and 2023, with varying frequency and severity. The biggest threat to energy infrastructure during severe winter weather events is from wind and ice storms, which can damage above-ground electrical transmission lines and result in widespread power outages.[2.6]

During severe winter weather events, travel corridors are often disrupted which can result in significant difficulty in the maintenance and repair of transmission lines. As such, power outages can last for prolonged periods of time during these events, potentially disrupting critical infrastructure and essential services, such as hospitals and water treatment plants. Additionally, outages can lead

to the employment of alternative and unsafe heating measures, such as using a gas oven for space heating which can lead to fire and/or carbon monoxide poisoning. Prolonged outages affect homes that use natural gas and electric heat pumps, as both require electricity to start and maintain these heating systems.

2.4.2 Severe Winter Weather Impacts on Energy Usage

Severe winter weather events lead to an increased energy demand in the form of heating. Prolonged periods of severe cold temperatures that occur during winter weather events increase the demand for natural gas and electricity for heating. Additionally, with transmission systems at risk of damage and delayed repairs and maintenance during severe winter weather events, there has been a rise in the use of natural gas for heating due to reliability. Air-source heat pumps can be reliable during severe winter weather events, but typically require significant insulation upgrades to maintain their efficiency.

2.4.3 Projected Changes to Severe Winter Weather

Evaluating how severe winter weather is expected to change in Broome County requires a look at the following climate metrics:

- Projected Annual Precipitation (Figure 2-9)
- Projected Average Daily Maximum Temperature (Figure 2-4)
- Projected Days with Maximum Temperature < 32°F (Figure 2-5)
- Projected Days with Minimum Temperature < 32°F (Figure 2-6)

The main hazard associated with severe winter weather comes from precipitation and wind, particularly in the form of ice storms. Total precipitation in Broome County is expected to increase over the coming century, which has the potential to make severe winter weather more impactful. However, the threat of severe winter weather must be paired with temperature projections to understand whether severe weather or winter weather is expected to intensify.

The overall daily maximum temperature in Broome County is expected to increase over the 21st century, with a projected increase in average daily maximum temperature of up to 21% by the 2100. An overall increase in daily maximum temperature indicates that severe winter weather will overall become less common. A warming atmosphere also means that there will be more extreme swings in temperature as the atmosphere becomes unstable, so it is also important to evaluate the number of days in which the minimum and maximum temperature is below freezing.

The number of days in which the temperature does not reach above freezing (32°F) is expected to decrease significantly. The number of days in which the temperature remains below freezing could drop by as much as 80% from the historical average by the 2090s. Additionally, the number of days in which the temperature dips below freezing is expected to decrease by as much as 45% by the 2090s. These decreases indicate that events like heavy snow and blizzards are expected to decrease significantly by the end of the century. Conditions that are conducive to ice storms (i.e. days in which the temperature hovers around 32°F) are expected to decrease as well when compared to historical conditions.[2.2]

Based on these climate metrics, it is likely that severe winter weather will significantly decrease in frequency by the end of the 21st century. Damage to energy infrastructure and utilities is expected to decrease as well, as the number of days in which the freeze-thaw cycle takes place will decrease. Precipitation will generally fall as rain rather than ice or snow, which will likely make severe weather a more significant hazard to Broome County than winter weather moving forward.

2.4.4 Projected Severe Winter Weather Impacts on Energy Infrastructure

The threat of severe winter weather events to Broome County is expected to decrease in the coming decades. As such, severe winter weather impacts such as disruption of travel, interruption of service from overhead utilities, and delayed maintenance and repair of transmission lines are also expected to decrease. This overall increase in average temperatures will also reduce the frequency of the annual freeze-thaw cycle and will likely reduce the frequency of ice storms which can damage above-ground electrical transmission lines and result in widespread power outages. While there will still be a need to perform winter weather maintenance on energy infrastructure, the frequency and magnitude of such activities will decrease significantly by the end of the 21st century.

2.4.5 Projected Severe Winter Weather Impacts on Energy Usage

As severe winter weather events decrease in Broome County, the demand for energy in the form of heating will also decrease. The projected trend of warmer average temperatures will shift the energy demand in the County away from natural gas for heating to an increased demand for electricity for cooling. Overall, impacts to energy usage from severe winter weather events are expected to decrease in the coming decades.

2.5. Severe Weather

Severe weather including heavy rain, tropical storms and hurricanes, and lightning, is another major threat to Broome County and typically goes hand-in-hand with flooding. However, severe weather poses a threat to energy infrastructure and affects energy demand during these events. Much of Broome County's critical infrastructure is vulnerable to severe weather, and the threat of severe weather is expected to increase over the remainder of the 21st century.

2.5.1 Severe Weather Impacts on Energy Infrastructure

There are five (5) different types of severe weather events that affect energy infrastructure: lightning, heavy rain, hurricanes, thunderstorm wind, and tornado. These events could potentially occur or have been reported within Broome County and are defined in further detail below:

Aside from flooding concerns (addressed in Section 2.3), tornadoes, wind, and lightning are the three biggest hazards associated with severe weather. Tornadoes are relatively rare but are responsible for approximately $4.12 million in damage in Broome County since 1950. Wind associated with thunderstorms is responsible for approximately $2.59 million in damage across Broome County over that time period. While lightning has also accounted for an additional $128,000 in damages. It should be noted that there have been three (3) FEMA disaster declarations for hurricanes in Broome County since 1970. One of these declarations was for the evacuation during Hurricane Katrina, while the other two were for Hurricane Sandy (2012) and Hurricane Henri (2021). Hurricane-force winds did not impact Broome County, but wind, lightning, and heavy precipitation did affect the County during these events. Tropical storms are another hazard that do not typically directly affect Broome County but may induce causative events such as wind and flooding (i.e. Tropical Storm Lee in 2011).[2.6]

Strong wind is also a major concern throughout the County, as wind that accompanies thunderstorms or larger regional storms can cause localized damage and utility interruptions. Strong wind is one of the most commonly occurring hazards in the County, posing a threat to energy infrastructure as summertime thunderstorm wind events can cause damage to residences and utility corridors. There are risks to residents as well from falling tree branches or debris during these events. These risks are elevated during extreme events, such as tornadoes, in which wind speeds can exceed 100 miles per hour. Although tornado events are relatively rare in Broome County (ten

[10] recorded tornadoes since 1950), these events can be extremely destructive and pose a risk to property, infrastructure, and utilities.[2.6]

Severe weather events can pose a major threat to the energy infrastructure of Broome County. In particular, lightning events can cause power outages and significant damage if substations or transmission lines are struck. Any damages experienced from lighting are typically localized to the immediate areas and/or structures that are hit. Additionally, wind events pose a significant threat to energy transmission infrastructure when transmission lines and poles are damaged and they can cause local outages and widespread damage. Furthermore, while tornadoes are less likely to occur, the hazard has the potential to cause significant damage to substations and transmission systems and will cause major service interruptions. Similarly, hurricanes are less likely to directly impact the County but would have indirect effects such as flooding, and wind which have the potential to cause significant damage to the electrical systems in Broome County.

2.5.2 Severe Weather Impacts on Energy Usage

Severe weather events do not typically have major impacts on energy usage in Broome County, although damages to substations and electrical power lines can cause power outages leading to a temporary reduction in energy demand. In the event of an outage during a severe weather event, there is a need for dispatchable power systems to help bring power back online. Additionally, for any severe weather events that occur during the summer months, there may be a slight increase in energy demand for cooling. However, in general, severe weather events cause greater impacts to energy infrastructure than energy usage in Broome County.

2.5.3 Projected Changes to Severe Weather

Evaluating how severe weather is expected to change in Broome County requires a look at the following climate metrics:

- Projected IDF Curves (Figure 2-1)
- Projected Days with > 2” Precipitation (Figure 2-8)
- Projected Annual Precipitation (Figure 2-9)
- Projected Annual Number of Dry Days (Figure 2-10)
- Projected Average Daily Maximum Temperature (Figure 2-4)

Severe weather is a combination of precipitation, wind, and lightning hazards that can affect Broome County. The intensity of storms and frequency at which these storms occur is expected to increase by approximately 20% by 2100 (Figure 3-2), and the frequency at which storms deliver more than 2” (Figure 3-9) of precipitation is expected to increase. An increase in large storm events indicates that severe weather is likely to become both more frequent and more destructive. Although wind and lightning frequency and intensity cannot be projected, it is reasonable to assume that larger storm events bring a greater potential for wind and lightning damage. An increase in the frequency and intensity of storm events also presents a challenge to current stormwater management techniques throughout the County.[2.2]

Similar to flooding, changes to average annual precipitation (Figure 2-9) and projected number of dry days (Figure 2-10) are helpful when evaluating whether storms will occur as smaller, more frequent and potentially less damaging events or as less frequent, more intense, and more destructive events. The average annual precipitation in Broome County is projected to increase by approximately 16% (higher emissions scenario) by 2100, while the number of dry days is expected to generally remain just below the historical average through the end of the century. An increase in total precipitation paired with a slight decrease in the total number of dry days indicates that precipitation is likely to occur in a similar fashion to the way it has historically, punctuated by more

intense storm events. These intense storm events will place additional stress on stormwater conveyance features throughout the County.

Evaluating the average annual maximum temperature (Figure 2-4) allows us to make a broad determination on how much energy is available in the atmosphere to create damaging wind and lightning conditions, as well as to determine if precipitation will fall as rain or snow. The average maximum daily temperature is expected to increase by over 21% (higher emissions) by 2100, indicating that precipitation will increasingly fall more as rain than snow. This also increases the risk of more damaging storms, as increased daily maximum temperatures means that there will be more available energy in the atmosphere for localized and regional thunderstorms. Warmer temperatures also increase the potential for a large hurricane to be able to track inland and potentially affect Broome County with hurricane-force winds. It is important to note that the risk of wind, lightning, and severe precipitation from hurricanes is elevated by rising annual maximum temperatures.

2.5.4 Projected Severe Weather Impacts on Energy Infrastructure

The threat of severe weather in Broome County is expected to increase due to an overall increase in average daily maximum temperatures, an increase in precipitation, and increases in large storm intensity. The increased risk of severe weather poses a major threat to the energy infrastructure of Broome County. Damages to overhead utility systems, such as transmission lines, are anticipated to increase in the coming decades due to greater number of lightning events, wind events, tornadoes, and hurricanes. Heavy rain events are also anticipated to increase in frequency as the climate changes but the impacts to energy infrastructure due to this event are minimal. As damages to overhead utilities increase in both frequency and magnitude, the costs to repair and upgrade systems will also increase and likely be passed on to users in the form of higher utility rates. Furthermore, the cost of utility repairs and upgrades due to severe weather events will have a disproportionate effect on lower-income families and disadvantaged communities. Overall, the impacts of severe weather events on the energy infrastructure of Broome County are expected to increase through the 21st century.

2.5.5 Projected Severe Weather Impacts on Energy Demand

Severe weather events do not typically have major impacts on energy usage in Broome County. However, the threat of the hazard is expected to increase in the coming decades as the climate changes and as discussed in the above section, this will lead to increased damages to the energy infrastructure of the County. Although, minimal impacts to energy usage are anticipated, a cascading effect could occur where electricity user fees increase during the year to pay for any substation or transmission system damages and/or resiliency upgrades.

2.6. Extreme Temperature

Broome County has historically experienced extreme cold temperatures during winters, which is typical for New York State's climate. Extreme heat events are increasing in frequency and still present challenges for the community. The County's residents, infrastructure, and building stock are all vulnerable to extreme temperatures and these events have major implications on energy usage. Extreme temperature events are expected to change over the 21st century, with extreme cold becoming less frequent while extreme heat becomes a regular occurrence.

2.6.1 Extreme Temperature Impacts on Energy Infrastructure

Extreme temperatures (i.e. extreme heat and extreme cold) can have negative impacts on existing energy infrastructure. Extreme cold tends to affect the physical properties of exposed, overhead infrastructure. Extreme cold contracts wiring and cabling, which can place additional physical stress on these systems. The effects of cold weather on overhead utilities are mitigated by utility

companies, and extreme cold weather tends not to affect energy infrastructure. However, extreme heat can have significant effects on electrical infrastructure. Transmission lines are not able to move electricity as efficiently during hot weather, which places stress on the overall electrical grid during periods of high demand.

Nineteen cold or extreme cold/wind chill events have been reported in Broome County from 1950 to 2023, resulting in $23,000 in property damages. Only five (5) heat or excessive heat events were reported over the same time period and did not result in any damages.[2.6]

2.6.2 Extreme Temperature Impacts on Energy Usage

Extreme temperatures (i.e. heatwaves and coldwaves) can have major impacts on the Broome County community. Heatwaves and coldwaves tend to have the greatest impact on vulnerable populations, including low-income, elderly, and homeless populations. Extreme temperatures create a spike in energy usage, whether for heating (natural gas, propane, electricity, biomass, etc.) or cooling (electricity) which lead to higher costs. Additionally, these extreme temperature events place stress on the heating and cooling systems of residents. Vulnerable populations may lack or have inadequate heating or cooling systems to deal with these extreme temperature events.

Coldwaves place social, financial, and physical stress on vulnerable populations, infrastructure, and County operations. As noted above, extreme cold requires residents to increase their energy usage, leading to higher heating costs and increased stress placed on heating systems. Coldwaves also place stress on the infrastructure in Broome County, typically in the form of water main repairs. Much of the infrastructure in urban and suburban areas of the County is older, and when prolonged cold increases the frostline depth, it can affect older water lines. Water line ruptures as a result of frost have led to interruptions in water service, boil water advisories for residents, and costly emergency repairs for municipalities. Additionally, Broome County typically provides warming centers for vulnerable residents during coldwave events. Operating these centers requires staff and resources to ensure that vulnerable residents are safe. Broome County operates up to thirteen (13) warming shelters at libraries and senior centers in Binghamton, Endwell, Deposit, Harpursville, Endicott, Johnson City, Whitney Point, and Vestal. In addition to the libraries and senior centers, Broome County also utilizes the transit busses for warming and cooling “shelters”.[2.10]

Heatwaves also place social, financial, and physical stress on vulnerable populations, infrastructure, and County operations in different ways than coldwaves. As noted above, extreme heat requires residents to increase energy usage for cooling, leading to higher electricity costs, increased stress on cooling systems, and increased stress on the local electrical grid. Heatwaves place stress on infrastructure via thermal expansion, as roadways, bridge joints, and even building envelopes can expand and become damaged during prolonged extreme heat events. Heatwaves place additional stress on urban environments through the urban heat island effect. As sunshine hits pavement and darker building materials in urban areas, these areas can experience amplified heat well above the ambient air temperature in non-developed areas. This heat island effect requires additional energy usage in urban areas to cool living spaces and places additional stress on cooling systems and urban electrical infrastructure. Finally, Broome County operates cooling centers during heatwave events, which also require staff and resources. Broome County operates up to twenty-six (26) cooling centers at libraries, senior centers, and recreational centers in Binghamton, Endwell, Deposit, Whitney Point, Harpursville, Endicott, Lisle, Johnson City, and Vestal.[2.11]

2.6.3 Projected Changes to Extreme Temperatures

Evaluating how extreme temperatures are expected to change in Broome County requires a look at the following climate metrics:

- Projected Average Daily Maximum Temperature (Figure 2-4)
- Projected Days Entirely Below Freezing (Figure 2-5)
- Projected Days with Freeze-Thaw Cycle (Figure 2-6)
- Projected Days with Maximum Temperature > 90°F (Figure 2-7)

In general, a changing climate due to greenhouse gas emissions is associated with a general warming trend, which means that the frequency and intensity of cold waves is likely to decrease in Broome County. The average daily maximum temperature is expected to increase up to 21% by the 2090's, which is indicative of an overall warmer climate. The number of days in which the temperature dips below freezing and does not reach above freezing are also both expected to decrease, indicating that cold waves/wind chill hazards are likely to significantly decrease by the end of the century. By the 2090s, Broome County is projected to experience as few as 11.1 days in which the temperature stays below freezing. This would be a significant decrease from the historical average (54.4 days) and a strong indicator that cold waves will be rare.[2.2]

While cold waves are expected to become a rare occurrence, heatwaves are likely to become more prevalent. Along with a projected increase in daily average maximum temperature, the number of days in which the high temperature exceeds 90°F is expected to significantly increase. By the 2090s, Broome County is projected to experience as many as 60.5 days where the temperature exceeds 90°F. This would be a significant increase from the historical average of 1.5 days per year. Heatwaves will likely become more frequent and more intense over time, which will place additional stress on vulnerable populations as well as building cooling systems.

2.6.4 Projected Extreme Temperature Impacts on Energy Infrastructure

In the coming decades, extreme cold events are expected to decrease significantly, while extreme heat events are expected to increase in Broome County. A decrease in the frequency of extreme cold events will result in less physical impacts to the electrical grid. However, an increase in the frequency of extreme heat events will lead to a reduced ability for the electrical grid to deliver electricity to residences and cooling centers during extreme heat events. An increase in the number of extreme heat events that the County experiences will result in increased energy demand for cooling, A significant increase in energy demand for cooling during these events can lead to transmission and distribution system damage, system failure, and the potential to start wildfires during extreme heat and drought events if the County's existing systems are not properly upgraded and protected. More frequent heatwaves will result in less efficient electricity transfer, as power lines cannot move electricity as efficiently during hot weather. This will reduce available electricity supply during high-demand times for cooling buildings. Overall, impacts to the energy infrastructure in Broome County in the future due to extreme temperature events will be the result of extreme heat events.

2.6.5 Projected Extreme Temperature Impacts on Energy Usage

The way in which Broome County residents, businesses, and industries consume energy is expected to significantly change in the future. As noted above in Section 2.6.3, heating and cooling degree days are expected to change significantly by 2100. Broome County as a whole can expect to consume significantly less energy heating building spaces, as heating degree days are expected to decrease by as much as 40% by the 2090s while days spent below freezing will decrease by as much as 80%. As such, overall energy demand for natural gas or electric heating will also significantly decrease. However, the residents can expect to consume significantly more energy to cool building spaces, as cooling degree days are expected to increase by as much as 350% and the number of days that exceed 90°F are expected to increase nearly 4,000%. An increase in extreme heat days will result in an increase in electric energy demand for cooling, particularly in the summer months. Further, an increase in extreme heat events will have a disproportionate effect on

disadvantaged communities and low-income families, as increased energy demand combined with a reduced system capacity will result in greater energy costs during extreme heat events.

2.6.5.1 Impacts on Energy Usage – Urban Heat Island Effects

Heatwaves and extreme heat events are expected to significantly increase in Broome County through the remainder of the 21st century. These events will have a magnified effect on urbanized areas, where conventional roofing, asphalt pavement, and other dry hard surfaces absorb sunlight and generate additional heat. According to the United States Environmental Protection Agency (USEPA), the urban heat island effect can increase ambient air temperatures between 1°F and 7°F higher than usual during the daytime and 2°F to 5°F higher at nighttime.[2.12] This results in increased energy use demands, places a strain on vulnerable populations in urban areas (young children, the elderly, people with pre-existing or cardiovascular conditions, etc.), and impacts stormwater quality by increasing the ambient temperature of stormwater entering natural water bodies during storms.

The urban heat Island effect is likely to become more intense in urbanized areas throughout Broome County, such as the City of Binghamton and areas of the Villages of Johnson City and Endicott. In the coming decades, densely populated municipalities will need to consider different adaptation techniques, such as using alternative building materials that do not absorb sunlight and radiate heat, improving cooling systems in urban areas, and investing in urban vegetation to help create a cooling effect.

2.7. Drought

Droughts are relatively rare in the northeastern United States and tend to be significantly less impactful on day-to-day life than in other parts of the country. The presence of the Great Lakes and larger river systems throughout New York State makes the state fairly resilient against drought conditions. However, changes in precipitation frequency and the expected number of dry days over the 21st century will affect the likelihood of droughts occurring in Broome County. Drought conditions have limited impacts on energy infrastructure and demand but can create dangerous conditions that increase the likelihood of wildfires to occur.

2.7.1 Drought Impacts on Energy Infrastructure

Droughts typically affect a large area rather than being local events, and thus are reported by NOAA as affecting the entirety of Broome County, with local effects likely to vary. NOAA's NCEI database utilizes the multi-agency "Drought Monitor" drought classification system to define drought events across the United States. For reference, droughts are rated as Abnormally Dry (D0), Moderate (D1), Severe (D2), Extreme (D3), or Exceptional (D4). For locations east of the Rocky Mountains, drought events are recorded when areas reach a classification of Severe (D2) or higher. From 1950 to 2023, six (6) drought events were reported in Broome County. No deaths, injuries, crop damages, or property damages were reported for any of the events. The most recent drought event occurred on September 1st, 2016.[2.6]

Droughts typically pose a low risk of damage to energy infrastructure. Prolonged droughts can cause ground surface elevations to change as the soil condenses due to lack of precipitation, but energy infrastructure is typically designed to withstand these negative effects.

2.7.2 Drought Impacts on Energy Usage

Drought events are relatively rare in Broome County; however, they can have significant short-term impacts on the community when they do occur. The main impact droughts have is on water resources; approximately 80% of water for public use comes from groundwater sources.[2.13] A decrease in available groundwater due to short-term drought conditions can lead to water use

restrictions, water quality issues, and increased energy usage to pump groundwater from deeper in the local aquifer systems. The City of Binghamton obtains its drinking water from the Susquehanna River, and supplies potable water to the Town of Binghamton, the Town of Dickinson, and the Village of Port Dickinson. The Susquehanna River has been designated as Class "A" by the New York State Department of Environmental Conservation (NYSDEC), indicating that its best use is as a source of water supply for human consumption. In the event of drought in Broome County, the depth to water in both private and public wells may increase, and groundwater recharge of the Susquehanna River could decrease. Groundwater levels are reliant on recharge from infiltration of precipitation, so when dry periods persist into droughts, groundwater levels may decline.

Droughts pose the biggest impact to energy infrastructure when paired with extreme heat. Higher electricity demand for cooling paired with dry conditions places significant stress on electrical infrastructure. This combination of environmental hazards and increased energy demand has led to man-made wildfires in the western United States, such as the Camp Fire in 2018 that was caused by poorly maintained Pacific Gas & Electric (PG&E) equipment[2.14].

2.7.3 Projected Changes to Drought

Evaluating how droughts are expected to change in Broome County requires a look at the following climate metrics, which are predictive of conditions conducive to droughts:

- Projected IDF Curves (Figure 2-1)
- Projected Days with > 2" Precipitation (Figure 2-8)
- Projected Annual Precipitation (Figure 2-9)
- Projected Annual Number of Dry Days (Figure 2-10)
- Projected Average Daily Maximum Temperature (Figure 2-4)
- Projected Days with Maximum Temperature > 90°F (Figure 2-7)

Precipitation in Broome County is expected to fall on approximately the same number of days in which it does now but will likely be punctuated by more intense storm events that drive up the total precipitation that falls annually. Figures 2-1, 2-8, and 2-9 show that storm intensity, frequency of intense storms, and annual precipitation are all projected to increase throughout the 21st century Additionally, the number of dry days is expected to generally remain just below the historical average through the end of the century. When looking at these climate metrics together, the overall threat of drought conditions is likely to decrease over the coming century.

Extreme temperatures are also a major contributor to drought conditions. Both the daily average maximum temperature and number of days where the temperature exceeds 90°F are expected to increase over the coming century, which can contribute to drought conditions. However, while there is the potential that that short-term droughts are likely to occur cyclically like they have in the past, it is unlikely that long-term, severe drought conditions will be a major issue for Broome County through 2100.

2.7.4 Projected Drought Impacts on Energy Infrastructure

Drought is not expected to be a significant threat to Broome County in the coming decades – with an anticipated decrease in the overall conditions conducive to drought events. As such, any impacts to the energy infrastructure of the County are expected to remain minimal compared to the other hazards of concern discussed in this section.

2.7.5 Projected Drought Impacts on Energy Usage

While the threat of droughts is not expected to increase significantly in Broome County in the coming decades, the hazard still has the potential to impact energy usage. As occurs currently in the County during drought events, a decrease in available groundwater due to short-term drought conditions can lead to water use restrictions, water quality issues, and increased energy usage to pump groundwater from deeper in the local aquifer systems. In general, the threat of drought has the potential to impact energy usage in Broome County in the future but drought impacts are not expected in increase in either frequency or magnitude.

2.8. Wildfire

Wildfires have become a major concern over the past decade, with several high-profile fires impacting air quality and energy infrastructure across North America. These events include the Canadian wildfires in Quebec and Alberta that negatively impacted air quality in Broome County in the late spring/early summer of 2023, as well as the Camp Fire in California in 2018.[2.14] Wildfires pose numerous risks to humans, infrastructure, and building stock, and the risk of wildfires occurring is expected to increase over the 21st century.

2.8.1 Wildfire Impacts on Energy Infrastructure

No wildfires were reported in Broome County from 1950 to 2023.[2.6] All municipalities in Broome County were listed as "Fire Towns" as of 2018 by the NYSDEC. This designation indicates that NYSDEC maintains an approved fire protection system which includes fire observation stations and other equipment necessary to prevent and extinguish forest fires.[2.15]

Wildfires can have major impacts on energy infrastructure when they occur. Transmission lines through remote, forested areas are most likely to be impacted if a wildfire were to occur. Additionally, these transmission lines can potentially be the cause of wildfires during drought events when demand for electricity is high (i.e. drought and extreme heat events). High-demand periods can place additional stress on electrical infrastructure and spark wildfires, like the Camp Fire in California in 2018.

2.8.2 Wildfire Impacts on Energy Usage

Wildfires can have far-reaching impacts on air quality, as evidenced by the Quebec and Alberta wildfires in 2023. It is extremely difficult to predict when these types of air quality events will take place, since they are highly dependent on climate conditions far from Broome County as well as prevailing wind and precipitation currents. These impacts on air quality can lead to a higher demand for energy to provide for heating, cooling, and air filtration as people move indoors to seek better air quality. Additionally, wildfires can lead to higher energy demand for cooling or associated with pumping water to control fires.

2.8.3 Projected Changes to Wildfires

Evaluating how wildfires are expected to change in Broome County requires a look at the following climate metrics, which are predictive of conditions conducive to wildfires:

- Projected IDF Curves (Figure 2-1)
- Projected Days with > 2" Precipitation (Figure 2-8)
- Projected Annual Precipitation (Figure 2-9)
- Projected Annual Number of Dry Days (Figure 2-10)
- Projected Average Daily Maximum Temperature (Figure 2-4)
- Projected Days with Maximum Temperature > 90°F (Figure 2-7)

Precipitation in Broome County is expected to fall on approximately the same number of days in which it does now but will likely be punctuated by more intense storm events that drive up the total precipitation that falls annually. Figures 2-1, 2-8, and 2-9 show that storm intensity, frequency of intense storms, and annual precipitation are all projected to increase throughout the 21st century. Additionally, the annual number of dry days is expected to generally remain just below the historical average through the end of the century. When looking at these climate metrics together, the overall threat of wildfire conditions is likely to decrease over the coming century.

Extreme temperatures are also a major contributor to wildfire conditions. Both the daily average maximum temperature and number of days where the temperature exceeds 90°F are expected to increase over the coming century, which can contribute to wildfire conditions. However, while it is likely that short-term wildfire threats are likely to occur cyclically like they have in the past, it is unlikely that severe or large-scale wildfire threats will occur, particularly given the anticipated increase in precipitation in Broome County.

The potential threat to air quality and human health from distant wildfires is likely to remain a threat to Broome County. Detailed climate conditions across North America were not evaluated as part of this report; however, projected warmer and drier conditions across much of North America and in areas to the west of Broome County present a major threat to the region's air quality. Wildfire smoke and its impacts to air quality are likely to become more frequent throughout the 21st century, which will impact residents typically in the summer months.

2.8.4 Projected Wildfire Impacts on Energy Infrastructure

While the threat of wildfires is not expected to increase significantly in Broome County in the coming decades, the hazard still has the potential to impact energy infrastructure. Wildfires have the potential to significantly damage transmission and distribution systems. Additionally, the threat of droughts in addition to an increased probability of extreme heat events means an increased probability of wildfires being sparked by overhead electrical lines, especially in remote forested areas that are not regularly/closely monitored. In order to reduce the risk of wildfires for Broome County in the future, upgrades to electrical systems and safety measures need to be enacted by utility companies.[2.16]

2.8.5 Projected Wildfire Impacts on Energy Usage

Wildfires are not expected to be a significant threat to Broome County in the coming decades – with an anticipated decrease in the overall conditions conducive to wildfire events. While there is potential for wildfires to be sparked by overhead electrical lines, especially in remote forested areas, the overall threat of wildfires is not expected to increase significantly in the County. As such, any impacts to the energy usage in the County are expected to remain minimal, with increases in energy demand for cooling driven by an increase in extreme heat events.

2.9. Conclusions

Energy infrastructure is likely to be adversely affected by the increased threat of flooding, severe weather, and extreme heat events in the 21st century. Flooding and severe weather pose physical threats to transmission and distribution systems, as this physical infrastructure could potentially face damage from flooding, debris flows in flooding, wind, lightning, and tornadoes. Extreme heat events are also projected to increase dramatically by the 2090s, which will increase transmission and distribution energy losses during these events.

Energy consumption will also be affected by changes to Broome County's climate. Extreme temperatures will have the greatest impact on energy consumption, as cooling degree days are expected to increase throughout the 21st century. Conversely, heating degree days are expected to

decrease significantly by the 2090s. This indicates that peak energy demand will likely shift more towards the summer months as the County's climate becomes more temperate during the winter months. This is a potential threat to electrical transmission and distribution infrastructure, as loss of system capacity during extreme heat events typically coincides with peak energy demand. Drought also has the potential to impact energy usage, as most of Broome County's drinking water is derived from groundwater aquifers.

2.10. Resources

2.1 Broome County 2019 Hazard Mitigation Plan
2.2 NOAA Climate Explorer: Climate Explorer (nemac.org)
2.3 NRCC IDF Curves: NY Projected IDF Curves (cornell.edu)
2.4 NOAA RCP4.5 Scenario: Climate Model: Temperature Change (RCP 4.5)-- 2006--2100-- Science On a Sphere (noaa.gov)
2.5 NOAA RCP8.5 Scenario: Climate Model: Temperature Change (RCP 8.5)-- 2006--2100-- Science On a Sphere (noaa.gov)
2.6 NOAA NCEI SED: Storm Events Database-- Search Results | National Centers for Environmental Information (noaa.gov)
2.7 BC Floodplain Maps: Broome County GIS Portal (broomecountyny.gov)
2.8 USACE National Levee Database: National Levee Database (army.mil)
2.9 Electric Transmission & Distribution and Protective Measures: https://www.energy.gov/sites/default/files/2023-11/FINAL_CESER%20Electricity%20Grid%20Backgrounder_508.pdf
2.10 Broome County Warming Centers: Broome County Emergency Services, Health Dept. Warn Residents of Extreme Cold, Wind Chill | Broome County
2.11 Broome County Cooling Centers: Cooling Stations Available to Residents | Broome County
2.12 USEPA Urban Heat Island: Learn About Heat Islands | US EPA
2.13 BC Comprehensive Plan: Broome County depends on water resources, including rivers and streams, lakes and ponds, and aquifers, for drinking water, recreation, industry and agriculture (gobroomecounty.com)
2.14 PG&E Pleads Guilty On 2018 California Camp Fire:"Our Equipment Started That Fir": PG&E Pleads Guilty On 2018 California Camp Fire:"Our Equipment Started That Fir" : NPR
2.15 ECL 9-1011 Fire Towns: NYS Open Legislation | NYSenate.gov
2.16 U.S. Department of Energy: Electric Transmission & Distribution and Protective Measures: How It Works: Electric Transmission & Distribution and Protective Measures

3.0 Broome County Energy Profile

New York State's focus under the CLCPA is to reduce GHG emissions by dramatically increasing renewable and zero-emissions electricity production and replacing existing heating and transportation fuels with electrified systems. The transition from fossil fuels to electrification and generation of renewable energy is already having drastic effects on energy infrastructure in New York State and Broome County. As Broome County works to position itself as a leader in sustainable energy generation and consumption, it is important to understand how energy is currently generated, transported, and consumed in the County. This section provides a snapshot of how energy is currently consumed in the County, the amount and types of electricity generated, how this electricity is distributed, and a discussion of current community electrification efforts in terms of building electrification and renewable energy development.

3.1 Current Energy Consumption

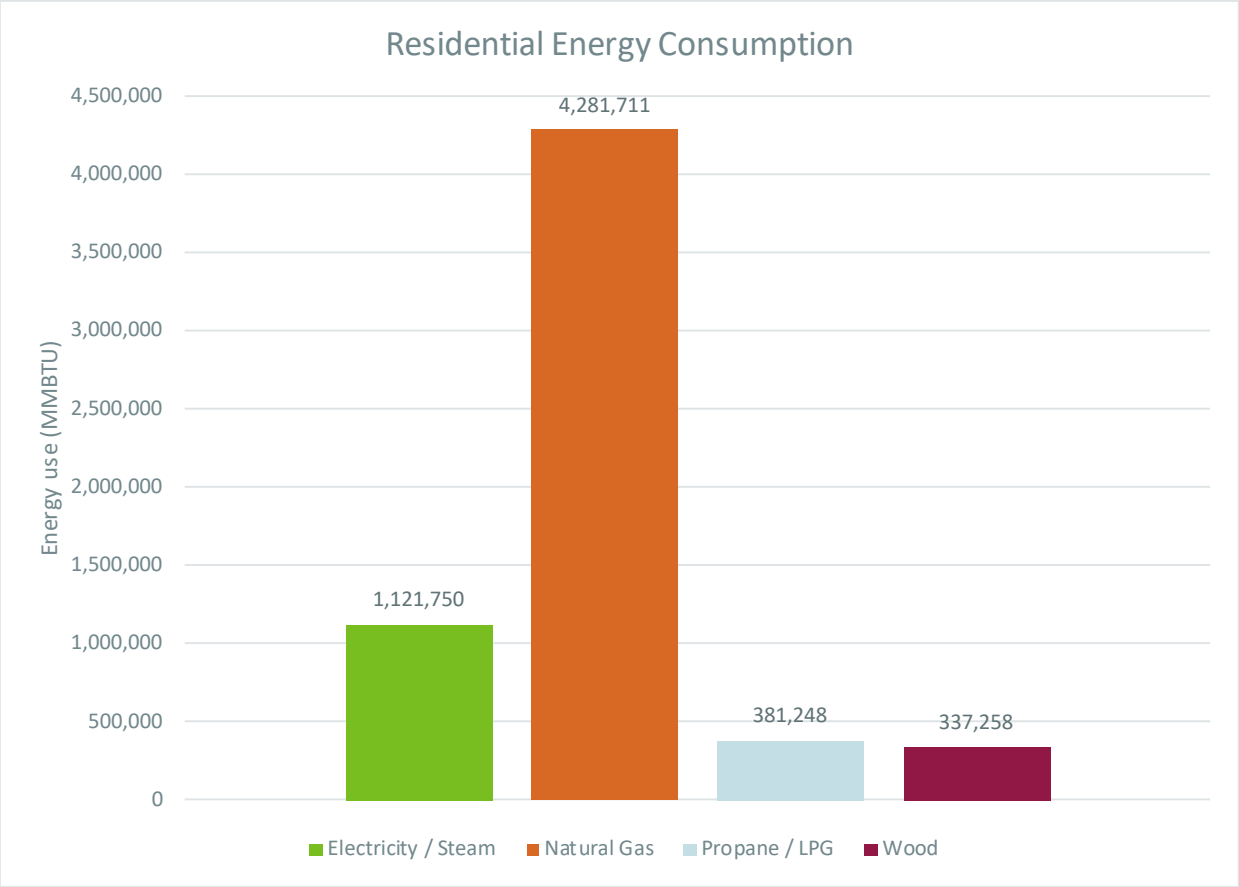
Understanding how energy is currently consumed in Broome County is the first step to understanding how energy demands are likely to change over the next 25 years. Broome County's energy consumption was curated through data provided by the county itself, and through information from the Energy Information Administration (EIA)[3.1]. Data from the EIA was extrapolated based on NYS population data to appropriately reflect Broome Counties energy consumption.

3.1.3 Residential Energy Consumption

Residential energy consumption accounts for 20.6% of all energy consumption in Broome County, totaling 6,121,967 Metric Million British Thermal Units (MMBTU) annually[3.1]. Energy consumed by residences is in the form of electricity, natural gas, and lesser "delivered" fuel sources such as propane and wood. Residential electrical consumption totals 1,121,750 MMBTU (~18% of total sector energy consumption)[3.1]. This energy is provided to the residents through substations throughout the county, with most substations located on the western side of the County. This number will grow in the future with pushes towards the use of more electric appliances in homes through state regulations. This is discussed further in Section 4.0.

Natural Gas accounts for the most energy consumption in the residential sector with a total of 4,281,711 MMBTU being used[3.1]. This is attributed to the overwhelming majority of households in the County utilizing natural gas for heating purposes, as well as for limited appliance uses (i.e. natural gas-powered stoves). Natural gas consumption is expected to decrease in the near future as building heating systems begin to become electrified.

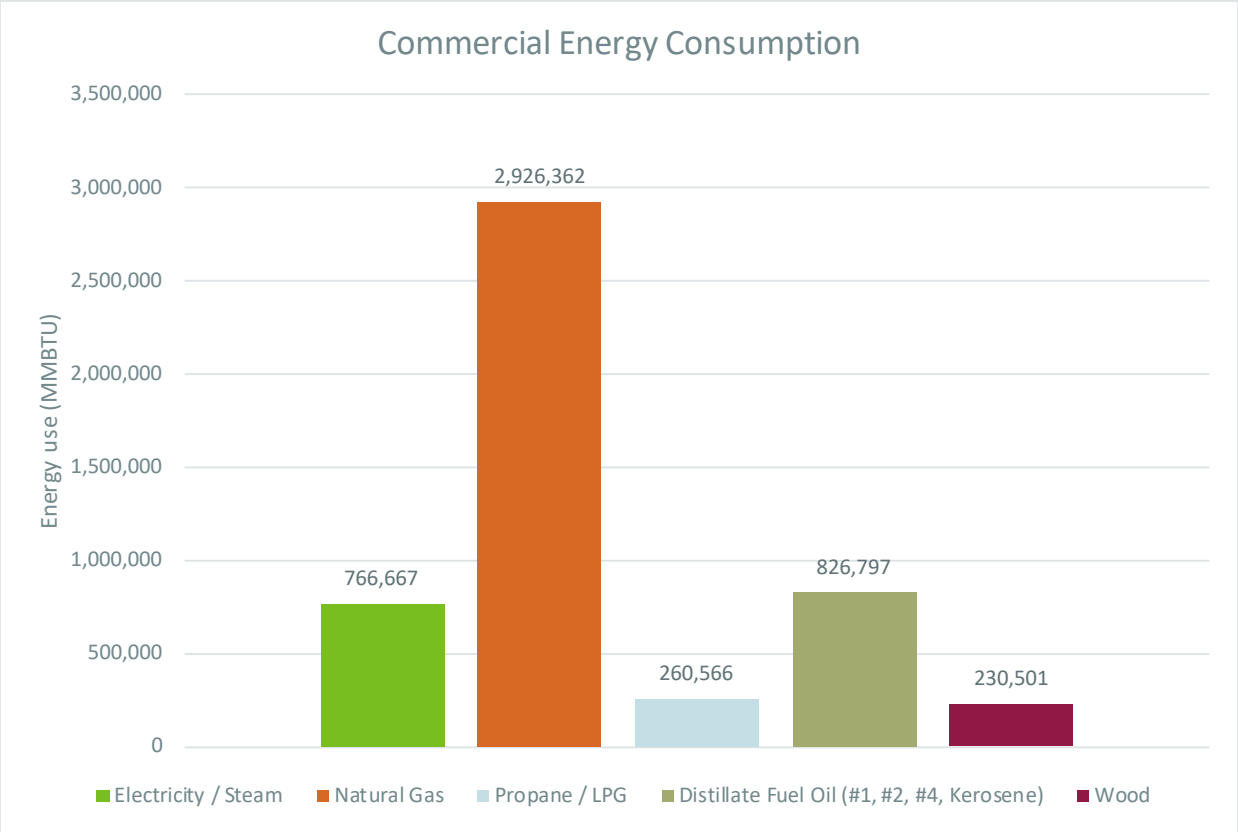
While lesser than electric and natural gas, the use of propane and wood in residential energy consumption is noteworthy. This would mainly be used for heating and small appliances within a residence. Total residential energy consumption is shown below in Graph 3-1.



Graph 3-1: Residential Energy Consumption in Broome County

3.1.2 Commercial Energy Consumption

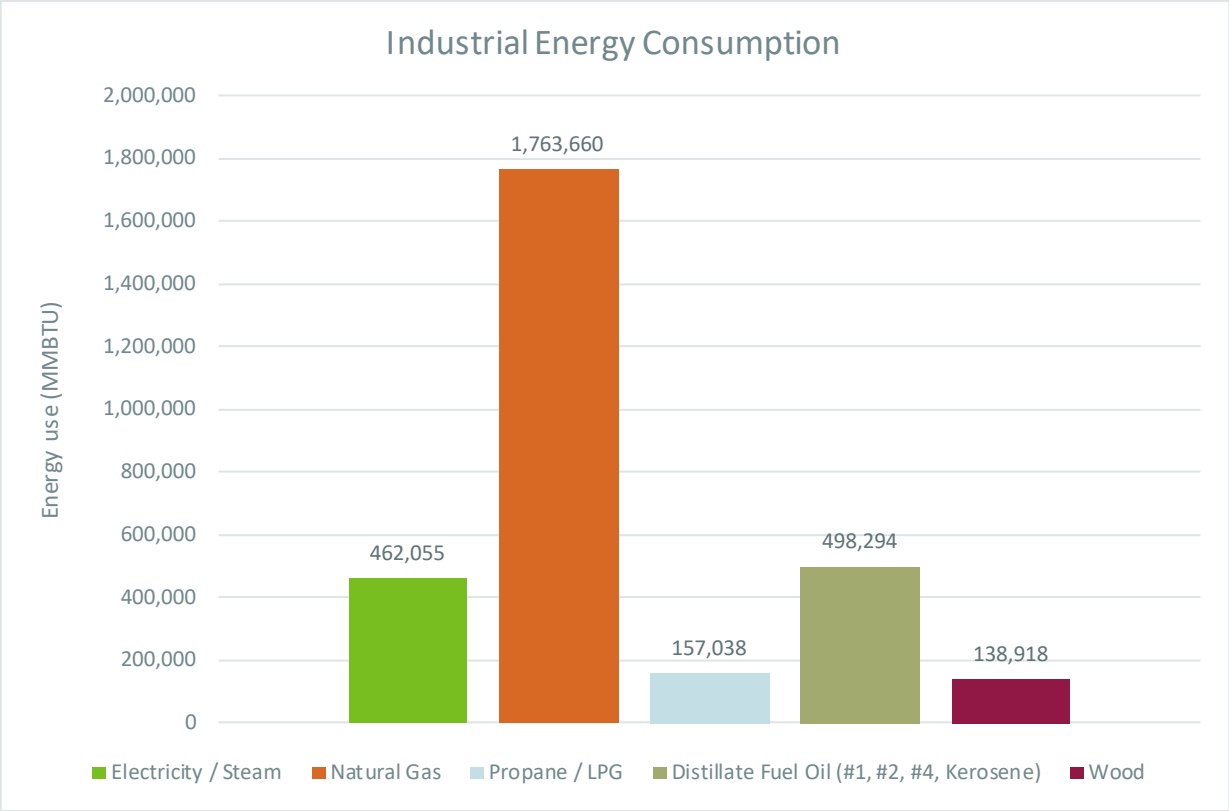
Commercial energy consumption accounts for just under 16.9% of all energy consumption in Broome County, totaling 5,010,893 MMBTU annually[3.1]. The commercial sector in the County consumes energy through electricity, natural gas, distillate fuel oil, propane, and wood. Commercial electric consumption totals at 766,667 MMBTU (~15% of total sector energy consumption), coming from powering all commercial buildings within Broome County[31]. Natural gas has the highest energy use in the commercial sector, sitting at 2,926,362 MMBTU (~58% of total sector energy consumption)[3.1]. This high natural gas consumption can be attributed to building heating systems as well as for use in businesses (i.e. cooking fuel for restaurants). The other fuels calculated in commercial energy consumption consist of distillate fuel oil, propane, and wood. These fuels are mainly used for heating in commercial buildings. It is noteworthy that total energy consumption from distillate fuel is slightly higher than total electricity usage, indicating that delivered petroleum fuel is used at a higher rate than electricity in many businesses across Broome County. Total energy consumption by fuel type for the Broome County commercial sector is shown below in Graph 3-2.



Graph 3-2: Commercial Energy Consumption in Broome County

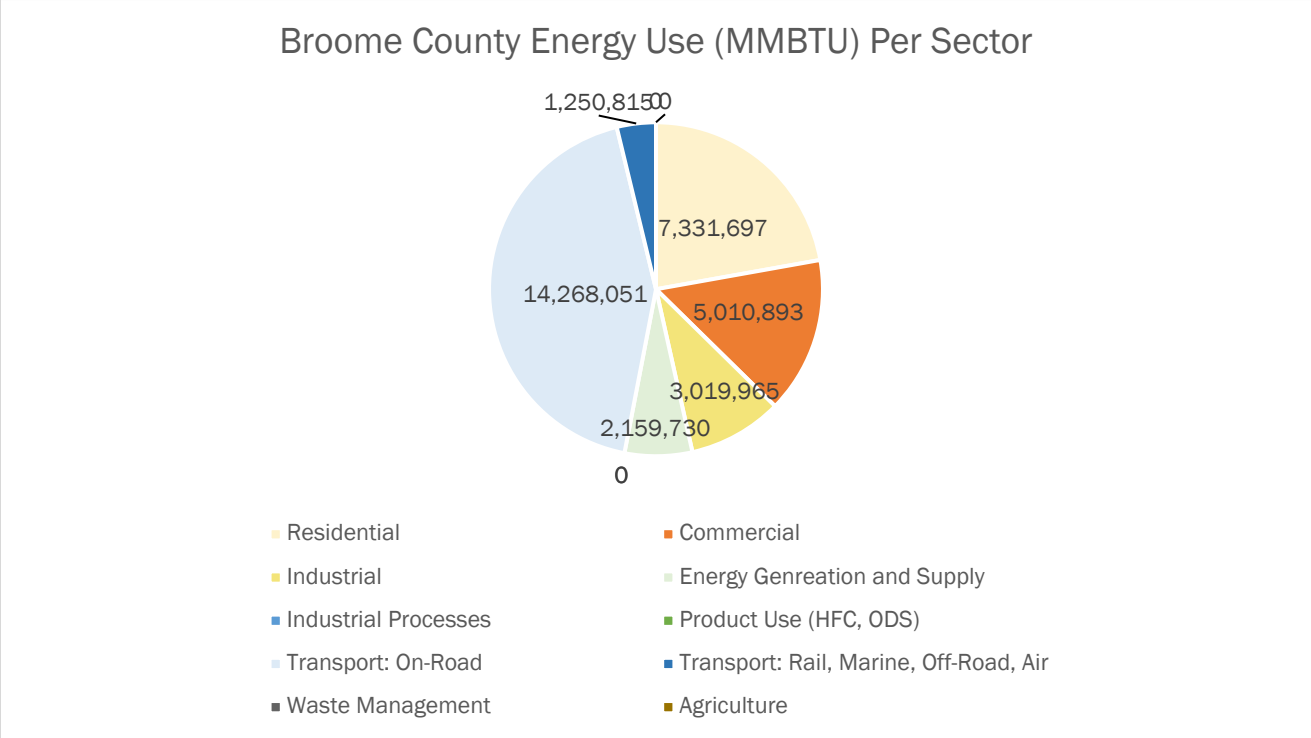
3.1.3. Industrial Energy Consumption Profile

Industrial energy consumption accounts for 10.2% of total energy consumption in Broome County at 3,019,966 MMBTU annually[3.1]. This smaller volume of energy consumption is a result of a decreasing industrial presence in Broome County over the past few decades. Industrial sector businesses in Broome County consume energy in the form of electricity, natural gas, distillate fuel oil, propane, and wood. A total of 462,055 MMBTU electricity (~15% of total sector energy consumption) is consumed by industry in Broome County, while a total of 1,763,660 MMBTU of natural gas (~58% of total sector energy consumption) is consumed annually[3.1]. Similar to the commercial sector, it is noteworthy that total energy consumption from distillate fuel is slightly higher than total electricity usage. Total energy consumption by fuel type for the Broome County industrial sector is shown below in Graph 3-3.



Graph 3-3: Industrial Energy Consumption in Broome County

A visual representation of energy consumption per sector is presented below.

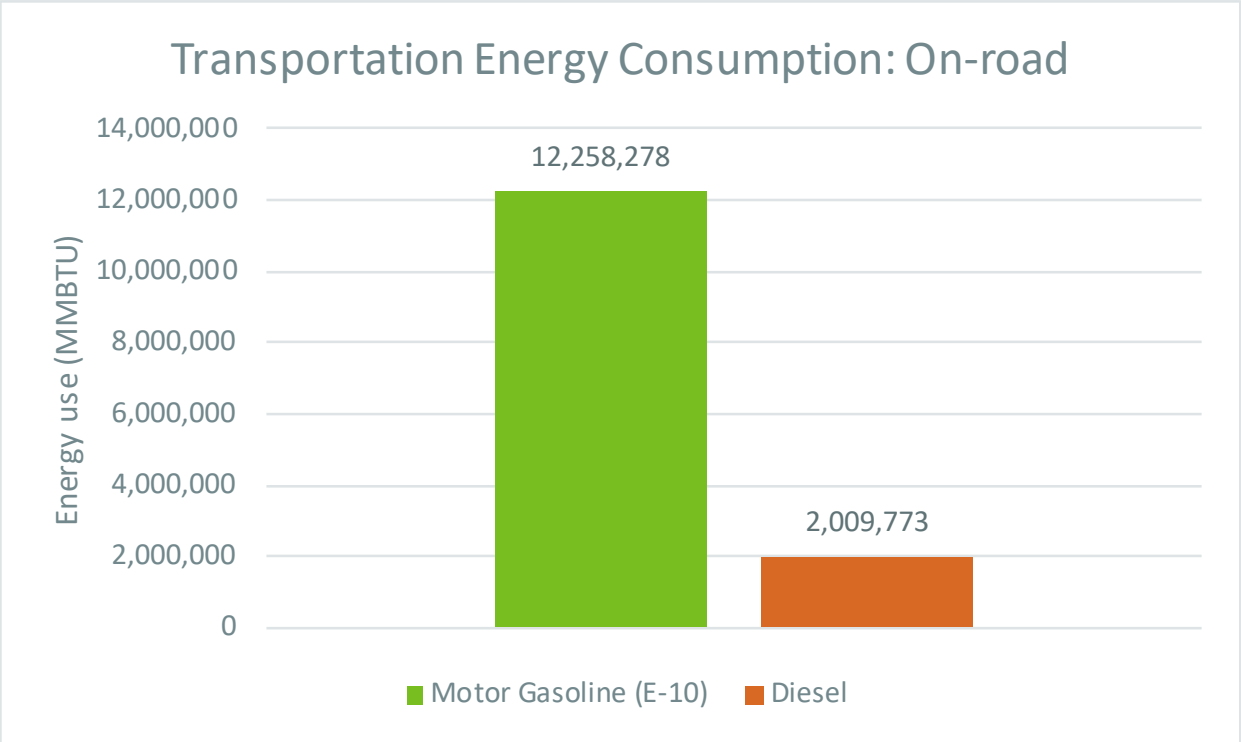


Graph 3-4: Broome County Energy Use (MMBTU) Per Sector

3.1.4 Transportation Energy Consumption Profile

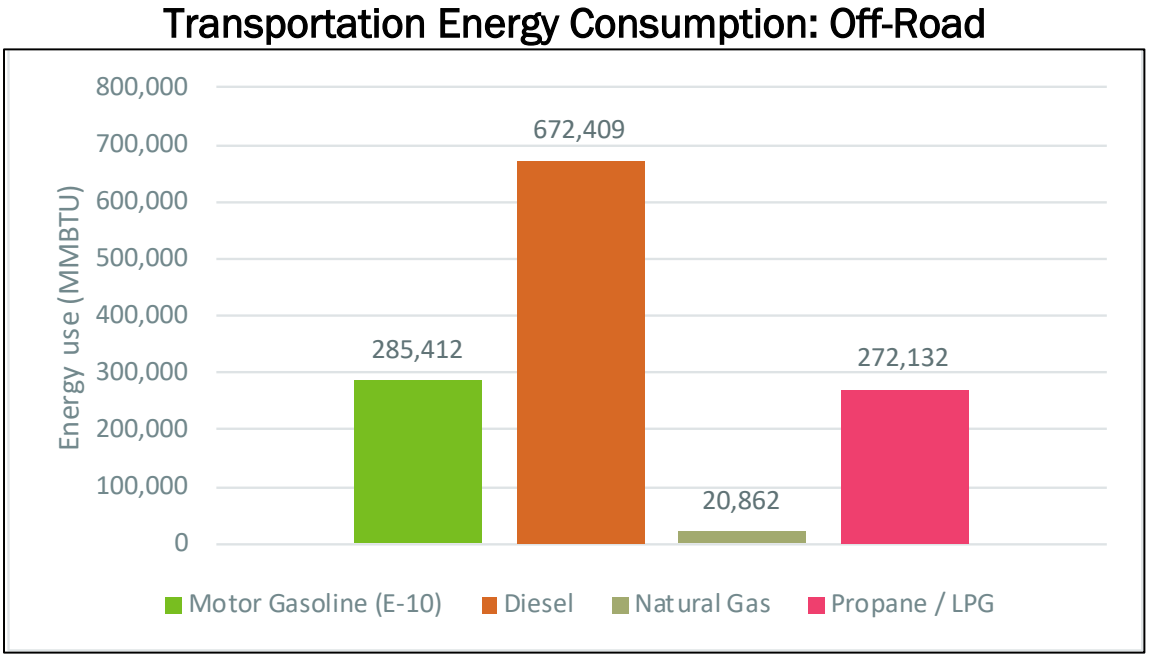
Energy consumption in the transportation sector is split into two categories: on-road and off-road. On-road transportation consists of energy consumed by typical transportation activities, such as commuting, trucking, and shipping of goods. Off-road transportation consists of activities such as agricultural production, where heavy-duty vehicles are used in an "off-road" setting to produce goods.

On-road transportation in Broome County consumes 14,268,051 MMBTU of energy annually[3.1]. Most on-road transportation uses either gasoline or diesel fuel as the main forms of energy. Gasoline accounts for 12,258,278 MMBTU annually, which is approximately 86% of total on-road energy consumption[3.1]. Diesel fuel accounts for 2,009,773 MMBTU of on-road energy usage[3.1]. Other fuel use types, such as natural gas and propane/LPG were negligible and not included in Graph 3-4. Total energy consumption by fuel type (gasoline and diesel fuel) for the Broome County on-road transportation sector is shown below in Graph 3-4.



Graph 3-5: Transportation Energy Consumption: On-Road

Off-road transportation energy usage accounts for just over 8% of total transportation energy usage in Broome County. Diesel fuel is overwhelmingly the most utilized fuel, with 672,409 MMBTU consumed annually[3.1]. A total of 285,412 MMBTU of gasoline is consumed annually, followed by propane (272,132 MMBTU annually)[3.1]. Natural gas accounts for 20,862 MMBTU of energy consumed[3.1]. Total energy consumption by fuel type for the Broome County off-road transportation sector is shown below in Graph 3-5.



Graph 3-6: Transportation Energy Consumption: Off-Road

3.1 Community Greenhouse Gas Inventory

A community GHG inventory was conducted as part of this plan to determine sectors of the County that currently are most responsible for GHG emissions. Residential, commercial, and industrial energy consumption data was gathered using available utility statistics, NYSERDA-published data in the Utility Energy Registry (UER), and the U.S. Energy Information Administration (EIA) database. Transportation sector data was derived from the EIA database. This analysis was conducted for the period from January 2023 – December 2023 and was conducted in accordance with CSC PE 2 Action: Community GHG Inventory.

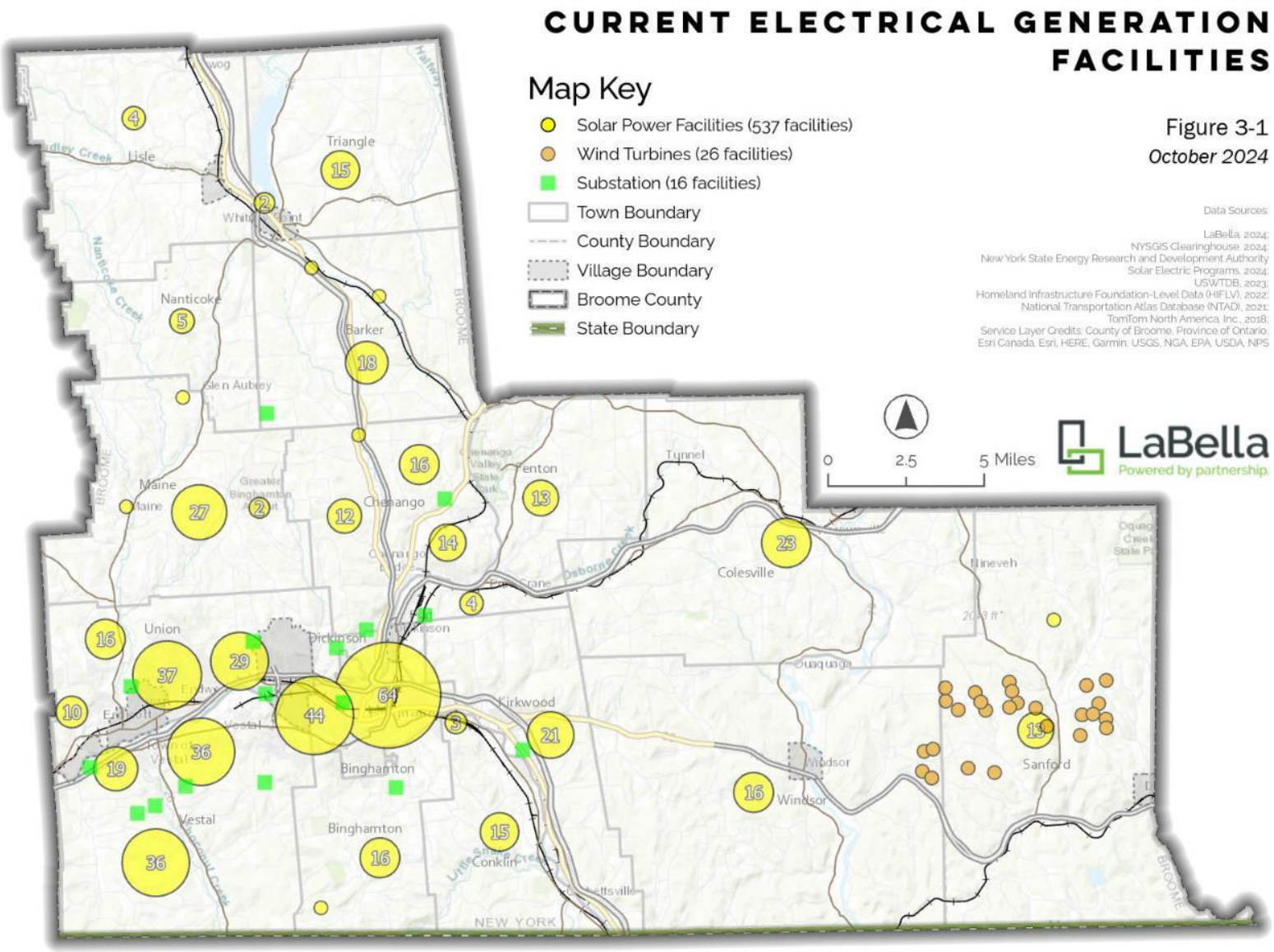
Broome County was responsible for generating 2,477,173 metric tons (MT) carbon dioxide equivalent (CO_2e) in 2023. This includes GHG emissions from the residential, commercial, industrial, and transportation sectors as well as emissions from industrial processes, product uses (i.e. refrigerants), waste management, and agriculture. Based on this inventory, Broome County has nearly reached its target GHG emissions for 2030 (2,450,000 $MTCO_2e$) to align with the CLCPA's goals. As discussed in Section 1.3.2, The County will need to reduce its GHG emissions approximately 75% by 2050 from 1990 levels to meet the ultimate CLCPA goal of 85% total emissions reduction (610,000 $MTCO_2e$ for Broome County by 2050). Broome County's status versus its CLCPA targets is summarized with more detail in Appendix A, Table A-3.

On-road transportation sector emissions were by far the largest source of GHG emissions, responsible for approximately 41% (1,012,362 $MTCO_2e$) of the County's total emissions in 2023. All transportation emissions (on-road and off-road) were responsible for just over 44% of the County's total GHG emissions. Residential GHG emissions from electricity usage and heating from natural gas, distillate fuel oil, wood, and propane accounted for nearly 16% of the County's emissions (386,436 $MTCO_2e$), while the commercial sector accounted for nearly 11% of the County's total GHG emissions (264,112 $MTCO_2e$). A full breakdown of GHG emissions by sector can be found in Appendix B.

3.3 Electricity Generation

The CLCPA has set a goal of a zero-emissions energy generation system by 2040 across New York State. To achieve this goal, renewable energy generating facilities will need to be developed in every County throughout the State, including in Broome County. Additionally, it is expected that building heating and cooling systems and transportation systems will move towards electrification or alternative zero-emissions fuels. This will further increase the demand for zero-emissions, renewable energy generation. Presented below is an inventory of current electrical generation facilities and associated generation capacities throughout Broome County. A summary of all Broome County electrical generation and storage facilities, including a comparison of current generation capacities versus Broome County CLCPA targets, is included in Appendix A, Table A-3.

All mapped energy infrastructure within Broome County (solar and wind generation facilities, transmission and distribution infrastructure, and substations) is shown below in Figure 3-1. derived from the NYSERDA OpenNY database[3.2].


CURRENT ELECTRICAL GENERATION FACILITIES
Map Key
Solar Power Facilities (537 facilities)
Wind Turbines (26 facilities)
Substation (16 facilities)
Town Boundary
County Boundary
Village Boundary
Broome County
State Boundary
Figure 3-1
October 2024
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
New York State Energy Research and Development Authority
Solar Electric Programs, 2024;
USWTDB, 2023;
Homeland Infrastructure Foundation-Level Data (HIFLV), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: County of Broome, Province of Ontario,
Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
0
2.5
5 Miles
LaBella
Powered by partnership.
Triangle
Lisle
Nanticoke
Barker
Glen Aubrey
Maine
Chenango
Union
Dickinson
Binghamton
Vestal
Kirkwood
Colesville
Windsor
Sanford
Conklin
NEW YORK

3.1.3 Biomass Facilities

Existing Biomass Facility Production: 4.0 MW

The Broome County Landfill currently operates a landfill gas-to-energy recovery system (Nanticoke LFG). The facility began operating in 2006 and is currently capable of generating up to 4.0 megawatts (MW) of electricity[3.2]. Although this system relies on the combustion of methane and other gases, it is considered to be a source of renewable energy since it captures and utilizes gases generated as a byproduct of anaerobic digestion of landfill waste. This system can also be considered as a ""dispatchable"" energy source, as it can be turned on and off based on electrical grid demand.

Landfill gas-to-energy recovery systems require a consistent stream of landfill waste to continue to produce electricity, and there is a drop in the amount of landfill gas produced by old landfills once they are closed. The Broome County Landfill is currently evaluating consolidation of old waste cells and expansion of the facility to include new landfill cells. This consolidation/expansion should continue to provide a consistent source of landfill gas to the Nanticoke LFG for the foreseeable future.

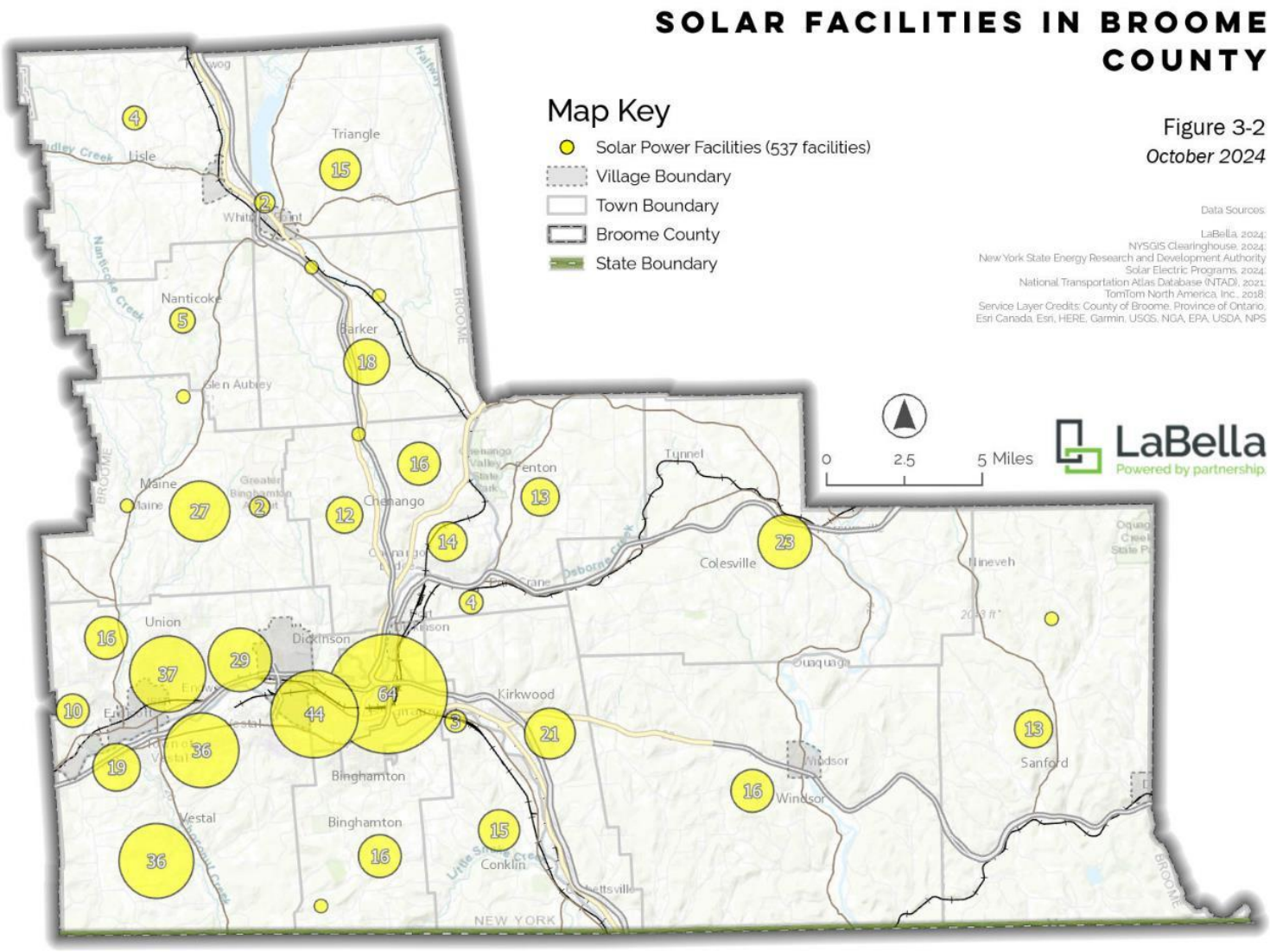
3.3.2 Solar Facilities

Existing Solar Facility Production: 25.17 MW

Solar development has risen dramatically across New York State with the development of the CLCPA and incentives for solar development driven by NYSERDA. Broome County has seen a dramatic increase in both rooftop and ground-mounted solar arrays, with a total of 537 solar arrays installed throughout the County. In total, these facilities can generate 25.17 MW of electricity, which is 28% of the recommended County goal for solar power generation by 2025[3.2]. Of these 537 facilities, 254 have been installed since 2019 when the CLCPA was originally developed[3.2]. Additionally, most of these solar arrays are smaller in size (>1 MW). There are six (6) solar array installations in the County that are currently capable of generating more than 1 MW of electricity.

Solar development in the County is centered around existing transmission and distribution infrastructure. The highest concentration of solar facilities is in the City and Town of Binghamton, Johnson City, Vestal, Endicott, and Union, where substations with additional capacity to accept renewable energy inputs are located. The influx of solar development in these areas have triggered a large number of Land Use (239) reviews for County Planning as individual municipalities struggle with how to govern and manage renewable energy development.

Presented below (Figure 3-2) are the locations of solar facilities throughout the County. Locations of these facilities relative to existing substations can be found in Figure 3-1[3.3].


SOLAR FACILITIES IN BROOME COUNTY
Figure 3-2
October 2024
Map Key
Solar Power Facilities (537 facilities)
Village Boundary
Town Boundary
Broome County
State Boundary
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
New York State Energy Research and Development Authority Solar Electric Programs, 2024;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: County of Broome, Province of Ontario, Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
0
2.5
5 Miles
LaBella
Powered by partnership.
Triangle
Lisle
Nanticoke
Barker
Glen Aubrey
Maine
Chenango
Tunnel
Fenton
Colesville
Nineveh
Union
Dickinson
Kirkwood
Binghamton
Vestal
Conklin
Windsor
Sanford
NEW YORK

3.3.3 Wind Facilities

Existing Wind Facility Production: ***111.8 MW***

Wind energy development has not seen the boom that solar development has in New York State for numerous reasons. Wind energy projects typically require large, rural areas and are subject to a robust permitting process. Additionally, NYSERDA's incentives have focused on solar and battery energy storage system (BESS) incentives rather than wind. This is reflected in the CLCPA, where wind energy generation goals have been set only for offshore wind. Currently, there are no goals set for terrestrial wind energy generation.

One (1) large wind energy generation facility, the Bluestone Wind Farm, was completed in 2023 in the Towns of Windsor and Sanford. The facility consists of twenty-six (26) individual turbine facilities and can generate 111.8 MW of electricity. Although there are no specific New York State or recommended Broome County goals for wind electricity generation, this facility generates 124% of the County's solar energy generation goal.

Presented below (Figure 3-3) are the locations of wind energy facilities throughout the County. Locations of these facilities relative to existing substations can be found in Figure 3-1.


WIND FACILITIES IN BROOME COUNTY
Map Key
Wind Energy Project*
Village Boundary
Town Boundary
Broome County
State Boundary
Figure 3-3
December 2024
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
USWTDB, 2023;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: Ontario Base Map, Province of Ontario,
Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
0
2.5
5 Miles
LaBella
Powered by partnership.
Triangle
Lisle
Nanticoke
Barker
Maine
Chenango
Fenton
Tunnel
Colesville
Nineveh
Union
Dickinson
Kirkwood
Windsor
Vestal
Binghamton
Conklin
NEW YORK
*Individual turbine locations shown.
Project consists of 26 total turbines.

3.3.4 Other Facilities

Broome County currently does not have any hydroelectric, nuclear, or fossil fuel-powered energy generation facilities. The County previously had two (2) fossil fuel-powered energy generation facilities: the Binghamton Cogeneration Power Plant (natural gas-powered, 48 MW plant decommissioned in 2017)[3.4] and the AES Westover Plant (coal-fired, 128 MW plant decommissioned in 2012)[3.5].

The County currently has 0.14 MW of energy storage capacity. Binghamton University recently teamed with the National Science Foundation (NSF) to create the Upstate New York Energy Storage Engine[3.6]. The focus of this program is to establish a "tech-based, industry-driven hub for new battery componentry, safety testing and certification, pilot manufacturing, applications integration, workforce development, and energy storage."[3.7] This program will establish Battery NY, which will be the central research and development laboratory for the program and located in Johnson City.

3.4 Electricity Transmission and Distribution

The delivery of electricity from generating facilities to end users is often overlooked as part of the process to reduce GHG emissions. As New York State and Broome County begin the process of building and vehicle electrification, it is critical to understand the congestion and capacity constraints of existing electrical infrastructure in both the State and County. This section discusses existing congestion and capacity constraints of electrical transmission infrastructure in the State and County.

3.1.3 New York State Constraints

New York State is currently divided into eleven (11) "Load Zones."[3.8] These Load Zones and associated Regions are as follows:

<u>"Rest of State" Region:</u>

- Zone A: Western New York
- Zone B:Genesee Region
- Zone C: Central New York (including western Broome County)
- Zone D: North Country
- Zone E: Mohawk Valley (including eastern Broome County)
- Zone F: Capital Region

<u>"Lower Hudson Valley" Region:</u>

- Zone G: Hudson Valley
- Zone H: Millwood
- Zone I: Dunwoodie

<u>"New York City/Long Island" Region:</u>

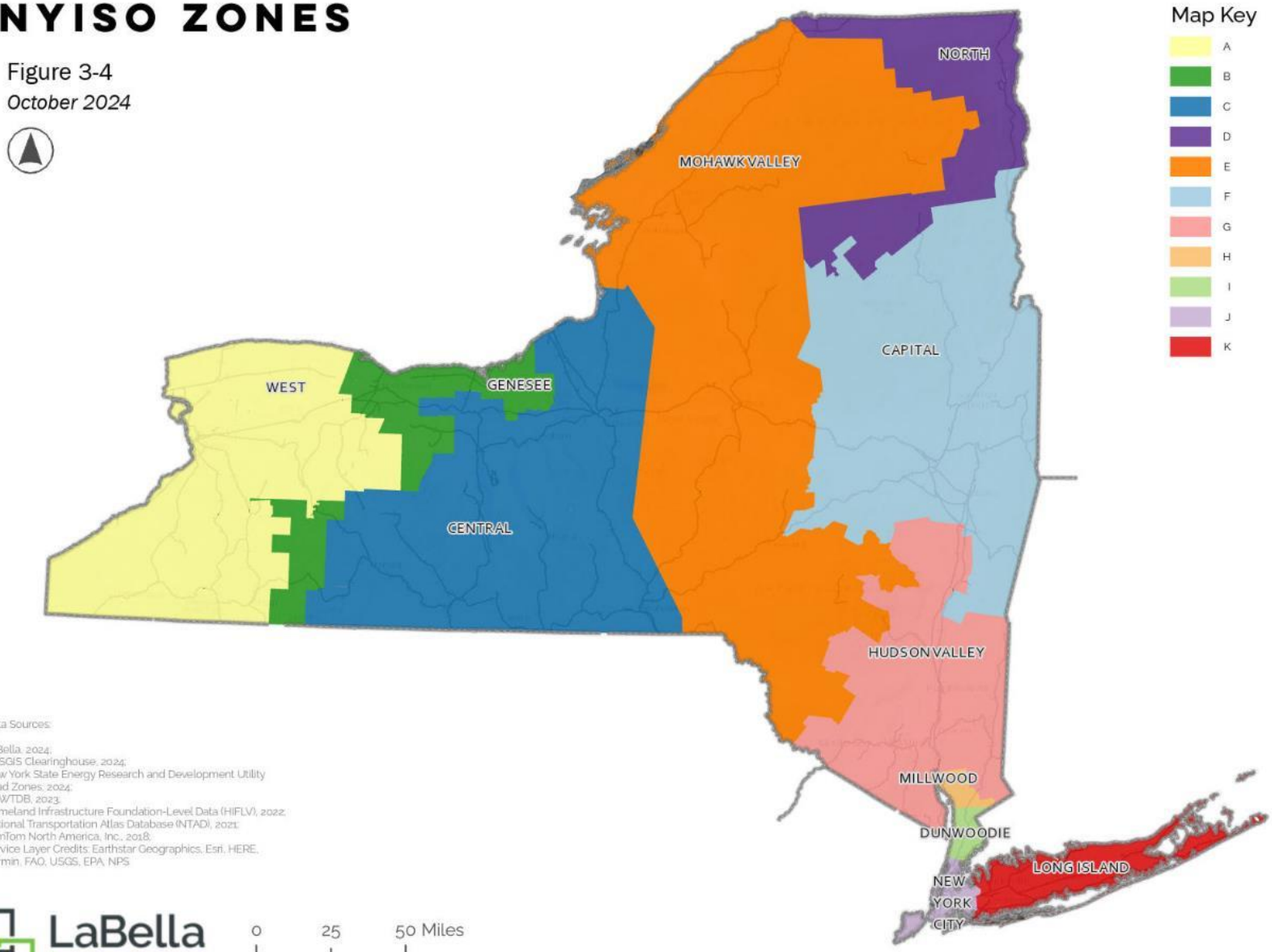
- Zone J: New York City
- Zone K: Long Island

Zones A – F comprise the "Rest of State" (ROS) region, which is primarily responsible for transferring power from upstate generation facilities to downstate demand centers. Zones G – I comprise the "Lower Hudson Valley" (LHV) region, which serves as a critical interface between the ROS region and the high-demand, densely populated areas of New York City and Long Island. Zones J – K are the New York City and Long Island region and are heavily dependent on power imports from other regions. This region does include some power generation facilities, including natural gas generation facilities and some renewable energy facilities.

NYISO ZONES

Figure 3-4

October 2024



Data Sources:

LaBella, 2024;
NYSGIS Clearinghouse, 2024;
New York State Energy Research and Development Utility Load Zones, 2024;
USWTDB, 2023;
Homeland Infrastructure Foundation-Level Data (HIFLV), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: Earthstar Geographics, Esri, HERE, Garmin, FAO, USGS, EPA, NPS

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As New York State continues to push for building and transportation electrification, statewide transmission congestion has started to become a major obstacle. The State current is facing high transmission congestion levels that are expected to increase by 23% by 2030 due to the integration of distributed renewable energy generation. Current electrical transmission infrastructure is structured around large, "traditional" energy generation facilities such as hydropower, nuclear, or fossil-fuel power stations that can generate large quantities of electricity from a single location. Renewable energy, on the other hand, is typically generated from a "distributed" model, with facilities connecting to the electrical grid at local substations that have excess capacity to accept these smaller inputs. This distributed model of energy generation, paired with an increase in overall electricity consumption in the New York City region, has contributed to significant congestion issues across New York State's grid.[3.8]

Adding to these current congestion issues are significant transfer limitations between the ROS region and the "downstate" regions (LHV and New York City/Long Island). In particular, the transfer of electricity between the ROS-LHV interface is one of the most congested areas. Transmission system upgrades are required to alleviate these issues.

3.4.2 Broome County Constraints

Broome County is in NYISO (Independent System Operator) Control Area Load Zones C (Central) and E (Mohawk Valley). The western side of the County, including the County's population centers, are located in Zone C. The eastern portion of the County (Colesville, Windsor, Sanford, and Deposit) are located in Zone E. The County is entirely serviced by New York State Electric and Gas (NYSEG) for electricity, while most of the County is serviced by NYSEG for natural gas. As noted above, Zone C is part of the ROS Region which mainly transfers power produced from generation facilities to the LHV and New York City/Long Island regions.[3.8]

Broome County sits in in a critical location along the Central-East NYISO interface, where electricity is sent downstate to the New York City area. As noted above, the Smart Path Reliability Project is currently underway and is aimed at improving the transfer of renewable energy from upstate regions (including Broome County) to high-demand areas like New York City. However, the Smart Path Reliability Project does not currently include any transmission system upgrades in Broome County. The nearest scheduled system upgrades are the Clean Path NY project in Delaware County (345 kV HVDC project led by the New York Power Authority) and the Empire State Line (345 kV project led by NextEra Energy Transmission). Although the Smart Path program is designed to alleviate transmission bottlenecks to the New York City area, construction of these upgrades can temporarily exacerbate transmission congestion in Broome County. In the short term, these projects affect the region's ability to handle additional power loads, including inputs from renewable energy generation sources.[3.8]

NYSEG currently owns and operates all electrical transmission lines in the County, including three (3) 345 kV lines, one (1) 230 kV line, and numerous 115 kV lines that serve the County. There are sixteen (16) total substations in the County, with three major substations that serve the County[3.9]:

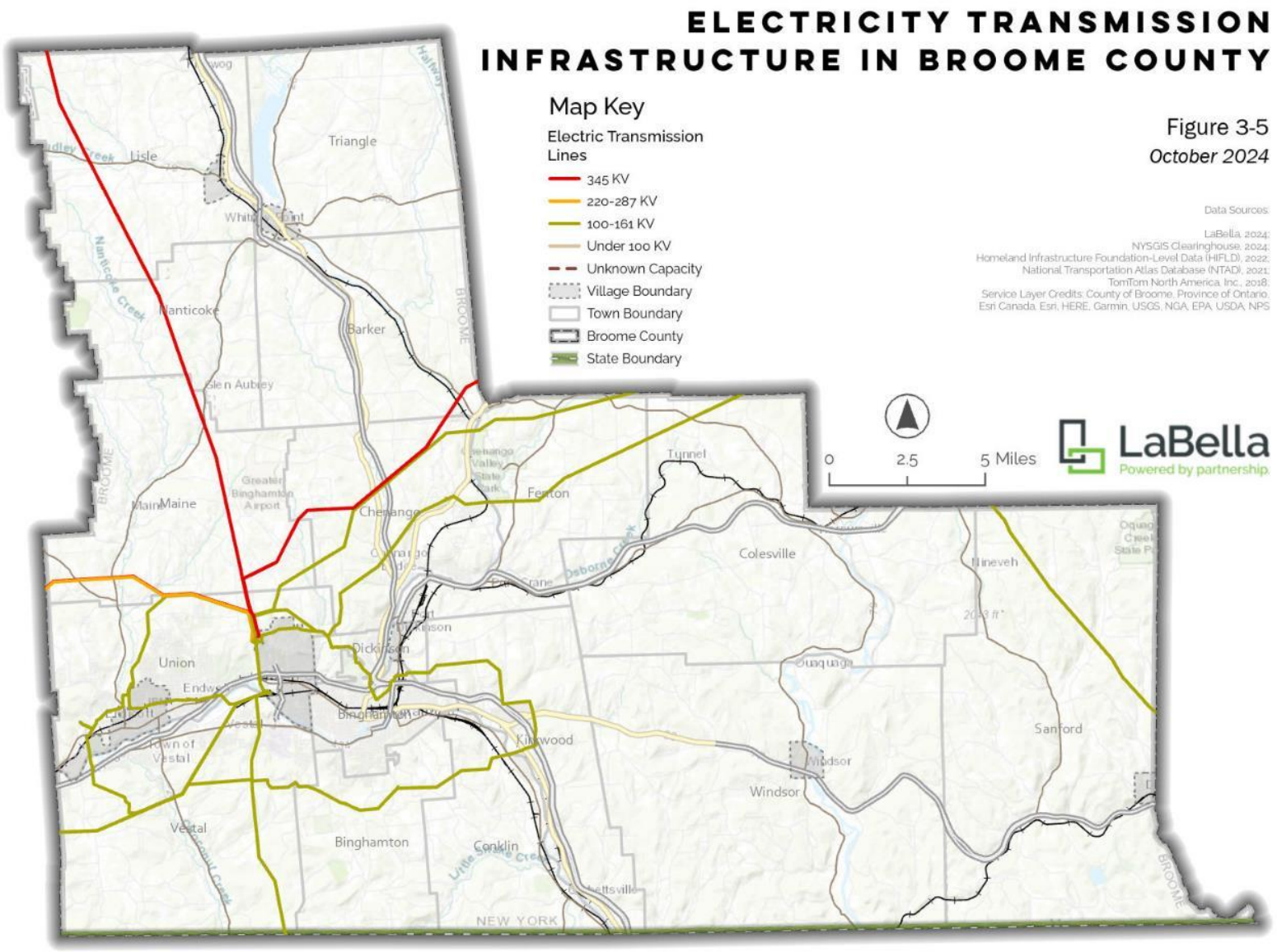
- North Endicott substation (Endicott);
    - Three (3) 115 kV lines, four (4) lines under 100 kV
- Oakdale substation (Johnson City); and
    - Three (3) 345 kV lines, one (1) 230 kV line, six (6) 115 kV lines, one (1) line under 100 kV
- Westover substation (Union)
    - Eight (8) 115 kV lines, five (5) lines under 100 kV

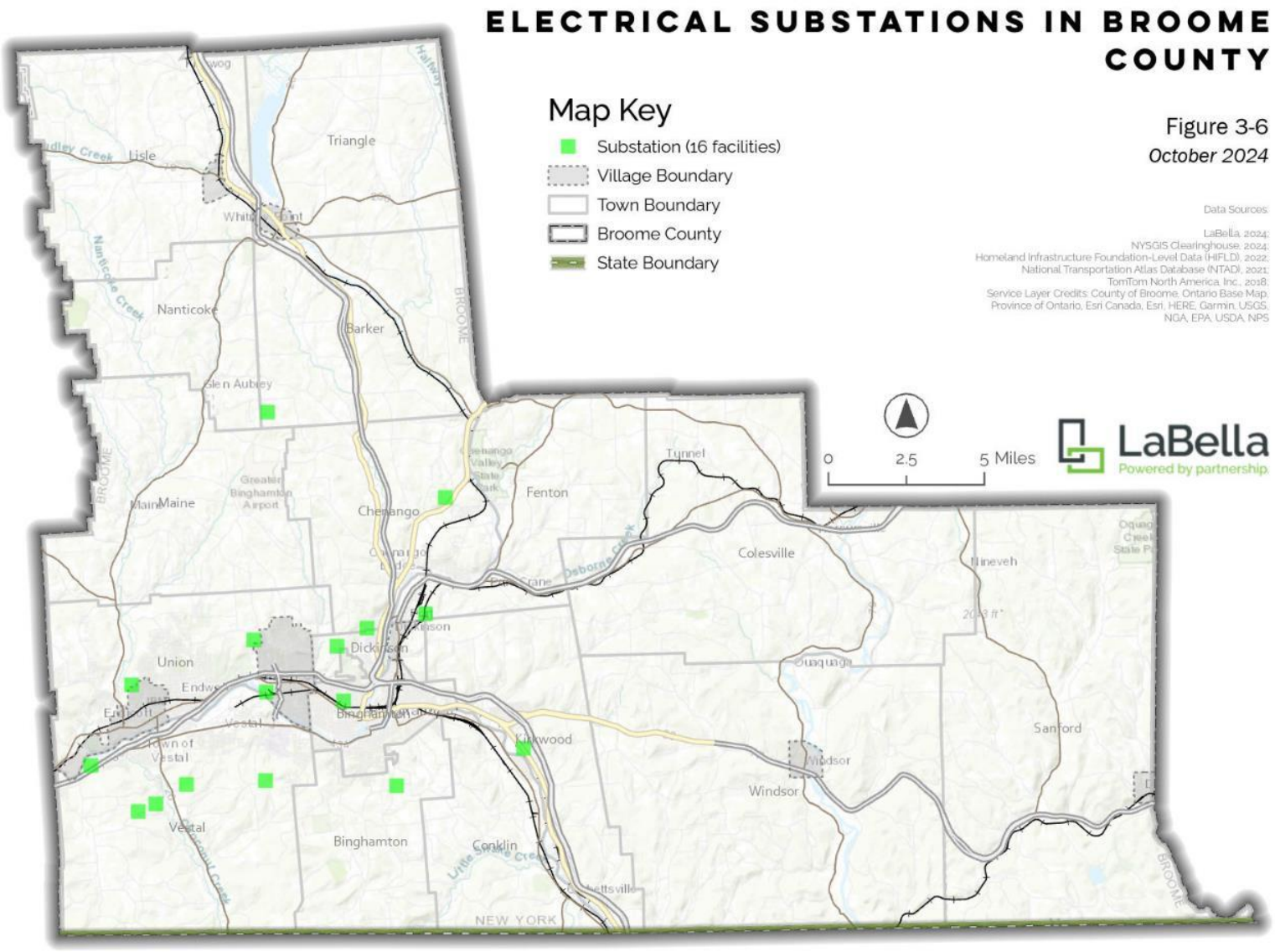
The Westover substation is located along the Susquehanna River to the south of Little Choconut Creek. This substation is in an area that is extremely vulnerable to flooding and sustained damage as part of the flood that occurred in 2011 as a result of Tropical Storm Lee.

The County is served by numerous other smaller substations, such as the Castle Gardens substation (Vestal) and the Robbie Ave. substation (Endicott). NYSEG is currently planning to conduct upgrades to several electrical substations across the County, including the following:

- Upgrading the Oakdale substation (Johnson City)[3.10];
- Relocating the Westover substation (Johnson City)[3.10];
- Replacing the Willet substation (Cortland County, but serves northern Broome County)[3.11];
- Resiliency upgrades to the Vestal 623 circuit[3.12];
- Re-routing of two (2) miles of new 34.5 kV and 115 kV lines[3.10];
- Rebuilding of three (3) existing 115 kV lines, eleven (11) 34.5 kV lines, and four (4) 4.8 kV lines[3.10]; and
- Upgrades to 230 electrical poles in Broome County[3.12,3.13].

No major upgrades to existing transmission lines through the County are currently planned. Presented below in Figure 3-5 are the locations of electrical transmission infrastructure throughout the County, while Figure 3-6 shows the locations of substations throughout the County[3.9].


ELECTRICITY TRANSMISSION INFRASTRUCTURE IN BROOME COUNTY
Figure 3-5
October 2024
Map Key
Electric Transmission Lines
345 KV
220-287 KV
100-161 KV
Under 100 KV
Unknown Capacity
Village Boundary
Town Boundary
Broome County
State Boundary
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
Homeland Infrastructure Foundation-Level Data (HIFLD), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: County of Broome, Province of Ontario, Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS
0
2.5
5 Miles
LaBella
Powered by partnership.
Triangle
Lisle
Nanticoke
Barker
Glen Aubrey
Maine
Greater Binghamton Airport
Chenango
Tunnel
Fenton
Colesville
Union
Endwell
Binghamton
Kirkwood
Windsor
Sanford
Vestal
Conklin
NEW YORK
BROOME


ELECTRICAL SUBSTATIONS IN BROOME COUNTY
Figure 3-6
October 2024
Map Key
Substation (16 facilities)
Village Boundary
Town Boundary
Broome County
State Boundary
Data Sources:
LaBella, 2024;
NYSGIS Clearinghouse, 2024;
Homeland Infrastructure Foundation-Level Data (HIFLD), 2022;
National Transportation Atlas Database (NTAD), 2021;
TomTom North America, Inc., 2018;
Service Layer Credits: County of Broome, Ontario Base Map,
Province of Ontario, Esri Canada, Esri, HERE, Garmin, USGS,
NGA, EPA, USDA, NPS
0
2.5
5 Miles
LaBella
Powered by partnership.
Triangle
Lisle
Nanticoke
Barker
Maine
Chenango
Fenton
Colesville
Union
Vestal
Binghamton
Kirkwood
Windsor
Sanford
Conklin
NEW YORK

3.5 Community Electrification

Building systems and transportation are the two sectors most responsible for GHG emissions in New York State. The CLCPA has established aggressive goals to reduce and eliminate GHG emissions from these two sectors by mandating electrification of buildings systems and phasing out of fossil fuel-powered vehicles. Community electrification comes with a unique set of challenges that must be navigated. Broome County has already begun to make progress on vehicle and building system electrification. These efforts are described below.

3.1.3 Vehicle Electrification and CLCPA

One of the major goals of the CLCPA is to significantly reduce and eventually eliminate GHG emissions from the transportation sector by making zero-emissions vehicles widely available and phasing out fossil fuel-powered vehicles. Currently, the most developed light-duty vehicle technology are electric vehicles (eVs). These are available on the automotive market, are competitively priced, and are beginning to replace traditional fossil fuel vehicles.

As of February 2024, there were 602 eVs registered with the New York State Department of Motor Vehicles (DMV) in Broome County[3.14]. This represents 4.98% of the total number of light- and medium-duty vehicles in the County. Broome County has the 26th most registered eVs of all counties in the State, despite being the 19th most populous county. This indicates that EV sales will need to increase in the County in coming years to match the pace of other counties throughout the State.

Vehicle electrification comes with some significant challenges that need to be considered. First, light-duty vehicles require AC Level 1 (120V 1-Phase AC) or AC Level 2 (208V or 240V 1-Phase AC) chargers, depending on vehicle usage. Most residential commuters can use AC Level 1 chargers, as their commutes tend to be shorter and vehicle batteries can be recharged overnight. However, commuters that have longer commutes may need to install AC Level 2 chargers to replenish their vehicle's battery overnight. Additionally, most workplaces and light-duty vehicle fleets require AC Level 2 chargers. These generally require electrical upgrades, which can become expensive for both residences and commercial buildings. Finally, EV charging will increase electrical demand as more and more eVs are purchased and driven. This will place an increased demand on residential systems and could potentially lead to increased electricity costs[3.15].

Medium- and heavy-duty vehicles and large -scale vehicle fleets typically require installation of DC Fast Chargers (208V or 480V 3-Phase AC). These chargers require significant electrical upgrades, including installation of new service to areas where vehicles are stored. This poses a significant challenge especially for rural school districts and operations that require significant travel daily. Rural districts typically cannot afford the electrical upgrades required to charge EV buses, and there are concerns about being able to re-charge the buses daily after they travel on lengthy routes. There are also concerns about the efficiency of eVs in cold weather, as batteries tend to lose their charge as the temperature drops. These costs and limitations will drive how quickly large scale, private fleets and medium- and heavy-duty vehicles move to eVs.

<u>Local Examples</u>

Broome County Transit recently received $9 million in funding to purchase seven (7) new electric buses to replace existing diesel-powered buses in the fleet. As part of this electric bus upgrade, the Broome County Transit Garage in Vestal will install rooftop solar panels and a BESS to help charge these buses when they are out of service.

The Rochester Regional Transit Service (RTS) recently placed two (2) hydrogen-fueled buses into service, joining its twenty plug-in electric bus zero-emissions fleet. The RTS has recently elected to begin investing in hydrogen-fueled buses to dramatically reduce the refueling time that electric

buses require and increase fleet range[3.16]. Additionally, the New York City Metropolitan Transit Authority (MTA) is preparing to place two (2) hydrogen-fueled buses into service in the Bronx[3.17].

3.5.2 Building Electrification and CLCPA

Broome County's transition to building electrification aligns with the CLCPA, which mandates a 40% reduction in greenhouse gas emissions by 2030 and a carbon-free electricity system by 2040. These ambitious targets drive the need for accelerated electrification across the state, but they present specific challenges for Broome County in terms of utility and building infrastructure. As more buildings shift from oil or natural gas to electric heating and cooling systems to meet CLCPA goals, Broome Counties electric grid will experience higher demand, especially during winter and summer peaks. Local utility infrastructure, including substations, transformers, and distribution lines, will require costly upgrades to handle this new load reliably. To meet the CLCPA's goals, integrating renewable sources like solar and geothermal energy generation will be essential, though this introduces challenges due to their variability, and the need for grid upgrades and energy storage solutions.

In Broome County, many buildings are older and were designed with fossil fuel heating systems, posing challenges for electrification. Retrofitting these structures to accommodate electric alternatives, such as heat pumps, can be complex and expensive, requiring modifications to walls, insulation, and electrical systems. Heat pumps also face efficiency issues in extremely cold conditions, which are common in Broome County's winters, possibly requiring backup heating systems. Such adjustments contribute to the costs and logistical challenges of meeting CLCPA requirements in a way that ensures reliable heating in these colder months. NYSEG currently offers residential, commercial, and industrial property rebates and incentives to help offset the costs associated with LED lighting upgrades, building envelope improvements, and HVAC and plumbing upgrades.[3.18]

Electrifying appliances is also key to aligning with the CLCPA, but this transition requires replacing natural gas-powered appliances with electric versions. These replacements often require upgrades to electrical infrastructure within the building and beyond to handle the increased load, a cost that can be prohibitive for many households in Broome County as well as the local utility. Programs under the CLCPA may provide incentives and financial assistance to offset these expenses, helping to make the transition more accessible. For Broome County to effectively contribute to New York's CLCPA targets, policies that support both utility and building infrastructure upgrades, along with assistance for residents, will be crucial in achieving state goals for building electrification.

Local and Regional Examples

The Broome County Office for the Aging currently provides a Weatherization & Home Repair Program to low-income residents who need financial assistance with weatherization of their homes, major and minor home repairs, and furnace repair or replacement. This program currently has six individual sub-programs for low-income homeowners[3.19]:

- **Weatherization**: Financial assistance for insulation, air-sealing, doors, and windows
- **Major Repair**s: Financial assistance for repairs to roofs, foundations, wells, and accessibility-focused remodeling
- **Minor Repair**s: Financial assistance with steps, faucets, grab bars, railing, lights, masonry, and ramps
- **Furnace Repair and Replacemen**t: Emergency assistance for damaged or failing heating systems
- **Overdue Heating Bill**s: Financial assistance for overdue utility bills
- **Electric Conservation Upgrade**s: Financial assistance for efficient refrigerators and freezers

This program currently helps advance goals of the CLCPA, including investment in upgraded insulation to improve building system efficiency. Other regional municipalities, such as the City of Rochester, offer similar programs to low-income residents. The City of Rochester is currently investigating expanding these programs to offer rooftop solar assessments at low-income residences as well as to install new air-source heat pumps at residences that require new heating systems.

3.6 Renewable Energy Development

Renewable energy development and generation is a cornerstone of the CLCPA as New York State works to meet its GHG reduction goals. To meet these goals, renewable energy (i.e. solar, wind, hydroelectric, hydrogen, methane recovery and combustion, etc.) will need to be deployed in nearly every municipality across the State. The CLCPA has driven renewable energy development in recent years in Broome County, and many municipalities have been impacted in some way by this development.

3.1.3 Renewables and CLCPA Goals

New York State's CLCPA has set aggressive GHG emission reduction goals that require large amounts of renewable energy to be generated across the State. The CLCPA calls for the decommissioning of all fossil fuel-powered generation plants by 2040, with a dramatic increase in renewable energy generation to offset this loss of generation capacity. Additional renewable energy capacity will be required to meet the increased demand for electrified heating systems and transportation. This dramatic move toward electrification and zero-emissions power generation, paired with NYSERDA incentives under the NY-Sun program, have driven renewable energy development demand in New York State over the past five years.

To date, Broome County has decommissioned all fossil fuel-powered generation facilities. The two decommissioned generation facilities had previously produced approximately 176 MW of electricity. Currently the County produces approximately 141 MW of power through wind, solar, and landfill gas generation. The County is currently producing 35 MW less than it was in 2012, and additional renewable energy generation is needed to make up for this deficit and future demand.

3.6.2 Local Renewable Energy Laws

Most municipalities across Broome County have imposed limited regulation of non-commercial solar energy systems, such as rooftop solar and ground-mounted solar; this review within this plan focused mainly on commercial ground-mount solar energy development. Commercial ground-mount solar energy development within the Towns of Barker, Conklin, Fenton, Lisle, Nanticoke, and Windsor would likely be favorable for implementation due to a lack of solar energy system laws or limited approval criteria. Commercial ground-mount solar energy development within the Towns of Chenango, Sanford, Triangle, Union, and Vestal would be typical with similar projects and town codes found across New York State, with additional approval criteria required for development. Solar energy system development within the Towns of Binghamton, Colesville, Dickinson, Kirkwood, and Maine may be more challenging due to robust solar energy system laws with many stipulations for approval, or because the solar energy system laws have become more recently restrictive. Likewise, public opposition to solar energy systems may also be greater in some of these towns. Ground mount and commercial solar energy systems are challenging to establish across cities and villages, primarily due to a lack of suitable or buildable land. However, if commercial solar energy system development were to occur, the City Binghamton, and Villages of Deposit, Endicott, Johnson City, Lisle, and Windsor would be most favorable.

Since wind energy is largely unregulated across much of Broome County, further opportunities for installation may exist especially in more rural towns. However, wind energy development may be

challenging across cities and villages, primarily due to a lack of suitable or buildable land, aesthetics, and noise. Typically, public opposition to wind energy projects is also substantial. However, it should be noted that commercial wind energy systems have recently been installed in the Towns of Sanford and Windsor, despite opposition from the public, litigation, and an initial rejection of wind energy tax incentives by the Broome County Industrial Development Agency.

Since battery energy storage systems are largely unregulated across much of Broome County, further opportunities for installation may exist especially in less populated areas with limited infrastructure. Municipalities such as the Towns of Binghamton, Dickinson, Kirkwood, and Maine would be least favorable either due to robust battery energy storage system laws or bans of such systems. Battery energy storage system implementation can be challenging across cities and villages, due to public health and safety concerns in densely populated areas with abundant infrastructure and recent thermal events in New York State (Suffolk County fire in May 2023[3.20], Orange County fires in June 2023[3.21], and Jefferson County fire in July 2023[3.22]).

Geothermal energy regulation was mentioned in code of the Towns of Binghamton, Sanford, and Union, but appears to be largely unregulated across Broome County. Should opportunities exist for geothermal energy development, they would be largely unregulated at the municipal level.
The Towns of Binghamton, Colesville, Dickinson, Fenton, Kirkwood, Nanticoke, and Sanford, as well as the Bainbridge-Guilford and Cincinnatus Central School Districts (district coverage overlaps portions of Broome County) have opted out of the real property tax exemption (RPTL 487) for solar, wind, and/or battery energy storage systems. Therefore, payment in lieu of taxes (PILOT) agreements should be directed towards the municipalities and school districts not mentioned in the above list.

Solar Energy

Most municipalities across Broome County have imposed limited regulation of non-commercial solar energy systems, such as rooftop solar and ground-mounted solar; therefore, this review focused mainly on commercial ground-mounted solar energy system regulations often termed “community solar”. Utility scale solar energy system (25MW+ or 20MW+ if opting in) regulations at the municipal level were also not evaluated in detail as the process is largely regulated at the state level.

Based on a review of solar energy regulation, several towns either have no current solar law, or solar laws with limited review or stipulations for approval. The Town of Barker has no solar law and solar is allowed in most of the town in the Agricultural-Residential District. The Town of Conklin has no solar law but is currently considering a moratorium to develop one. A solar farm is currently operational in the Town of Conklin that provides Broome County with an estimated savings of $140,000 in the first year[3.23]. The Towns of Fenton and Windsor also do not have solar laws. The Towns of Lisle and Nanticoke have solar laws with limited review or stipulations for approval likely due to limited updates since their original creation in 2017. As such, commercial ground-mount solar energy development within the Towns of Barker, Conklin, Fenton, Lisle, Nanticoke, and Windsor would likely be favorable for implementation.

Several towns have moderately restrictive solar energy system laws, with more substantial review and stipulations for approval that are considered typical for similar projects and town codes across New York State: the Towns of Chenango, Sanford, Triangle, Union, and Vestal. Several solar energy systems are in development or have already been installed in these towns. As such, solar energy development within these towns would likely be somewhat favorable for implementation.

Towns with more robust or recently more restrictive solar energy system laws were also identified. The Town of Binghamton appears to have the most robust solar energy system law across Broome County. The Town of Binghamton does not appear to be against solar, but the robust solar energy

system law would require substantial effort by a developer to obtain the necessary approvals for construction. In addition, public opposition regarding solar energy systems within the Town of Binghamton has been mixed, with at least one solar project (Ingraham Hill) abandoned in 2022 as a result[3.24]. Likewise, the Town of Colesville has a robust solar energy system law with language in the code that appears to be geared more towards protecting the town rather than balancing that with the benefits of solar energy systems. The Town of Dickinson has recently amended its code to be more restrictive regarding solar energy systems, such as including a solar overlay district and ¾ mile buffer from existing solar energy systems. This appears to be due an influx of solar energy system applications, especially along Glenwood Road[3.24]. Like the Town of Colesville, the language in the Town of Dickinson code appears to be geared more towards protecting the town rather than balancing that with the benefits of solar energy systems. The Towns of Kirkwood and Maine have also recently adopted more restrictive solar energy system language, with the Town of Maine attempting to ban utility scale solar energy systems with a nameplate generating capacity of 20MW or more. Public opposition to solar energy system development within the Town of Kirkwood has increased, with residents signing a petition regarding proposed development along Trim Street[3.24]. Thus, solar energy system development within the Towns of Binghamton, Colesville, Dickinson, Kirkwood, and Maine would be more challenging due to robust solar energy system laws with many stipulations for approval, or because the solar energy system laws have become more recently restrictive. Likewise, public opposition to solar energy systems may also be greater in some of these towns.

Solar energy regulation was also evaluated in the code of the City of Binghamton as well as the seven villages (Deposit, Endicott, Johnson City, Lisle, Port Dickinson, Whitney Point, and Windsor). Generally, solar laws were not overly restrictive nor robust, with the City of Binghamton most positive towards solar, while the Village of Whitney Point had the most robust solar law, and the Village of Port Dickinson is currently under a solar moratorium. In fact, the City of Binghamton is proud to be the first city in the Southern Tier of New York to be designated as a Clean Energy Community by the New York State Research and Development Authority[3.25]. The Village of Endicott appears to be in favor of a proposed brownfield solar energy system on the Endicott Landfill[3.26]. However, while rooftop solar opportunities may be viable across these municipalities, ground mount and commercial solar is challenging to implement across cities and villages, primarily due to a lack of suitable or buildable land. If commercial solar energy system development were to occur, the City Binghamton, and Villages of Deposit, Endicott, Johnson City, Lisle, and Windsor would be most favorable.

The Towns of Binghamton, Colesville, Dickinson, Fenton, Kirkwood, Nanticoke, and Sanford, as well as the Bainbridge-Guilford and Cincinnatus Central School Districts (district coverage overlaps portions of Broome County) have opted out of the real property tax exemption (RPTL 487) for solar energy systems. Therefore, payment in lieu of taxes (PILOT) agreements should be directed towards the municipalities and school districts not mentioned in the above list.

Wind Energy

Wind energy regulation is found or mentioned in the code of the Towns of Barker, Binghamton, Colesville, Conklin, Kirkwood, Sanford, Triangle, and Union, as well as the Village of Whitney Point. The Towns of Barker and Union mainly mention wind energy but include limited regulation. The code of the Town of Colesville prohibits commercial wind energy while the Village of Whitney Point prohibits all wind energy projects. In general, wind energy regulation in these municipalities appears to have been created many years (or even decades) ago with limited amendments or updates. Commercial wind energy systems have recently been installed in the Towns of Sanford and Windsor, despite opposition from the public, litigation, and an initial rejection of wind energy tax incentives by the Broome County Industrial Development Agency[3.27]. Since wind energy is largely unregulated across much of Broome County, further opportunities for installation may exist especially in more

rural towns. However, wind energy development may be challenging across cities and villages, primarily due to a lack of suitable or buildable land, aesthetics, and noise. Typically, public opposition to wind energy projects is also substantial.

The Towns of Binghamton, Colesville, Dickinson, Fenton, Kirkwood, Nanticoke, and Sanford, as well as the Bainbridge-Guilford and Cincinnatus Central School Districts (district coverage overlaps portions of Broome County) have opted out of the real property tax exemption (RPTL 487) for wind energy systems. Therefore, payment in lieu of taxes (PILOT) agreements should be directed towards the municipalities and school districts not mentioned in the above list.

Battery Energy Storage Systems (BESS)

Battery energy storage systems are regulated in the code of the Towns of Binghamton, Colesville, Dickinson, Kirkwood, Maine, Sanford, and Union, as well as the Villages of Johnson City and Whitney Point. The Town of Binghamton has the most robust battery energy storage system law, while battery energy storage system regulations in many of the other municipalities are limited to standard language (container specifications, electrical standards, etc.). The Town of Dickinson has prohibited battery energy storage systems across the town, while battery energy storage systems are prohibited for commercial solar energy systems in the Towns of Kirkwood and Maine. Since battery energy storage systems are largely unregulated across much of Broome County, further opportunities for installation may exist especially in less populated areas with limited infrastructure. Battery energy storage system implementation can be challenging across cities and villages, due to public health and safety concerns in densely populated areas with abundant infrastructure and recent thermal events in New York State (Suffolk County fire in May 2023, Orange County fires in June 2023, and Jefferson County fire in July 2023).

The Town of Binghamton, as well a" the Bainbridge-Guilford and Cincinnatus Central School Districts (district coverage overlaps portions of Broome County) have opted out of the real property tax exemption (RPTL 487) for battery energy storage systems. Therefore, payment in lieu of taxes (PILOT) agreements should be directed towards the municipalities and school districts not mentioned in the above list.

Geothermal Energy Regulation

Geothermal energy regulation was mentioned or regulated in code of the Towns of Binghamton, Sanford, and Union however, it appears to be largely unregulated across Broome County. Should opportunities exist for geothermal energy development, they would be largely unregulated at the municipal level.

3.6.3 Current Renewable Energy Development Patterns

There are two major siting factors that are critical for renewable energy projects: location near a substation that has the capacity to accept the additional electrical input, and distance to an acceptable interconnection location. Typically, the smaller a renewable energy project is the closer it must be to both siting factors. Larger renewable energy projects can typically be located further away from both factors, as they are financially able to offset these costs with the energy their project will produce.

Broome County has seen a significant uptick in solar and wind energy development, as noted in Sections 3.1.2 and 3.1.3. All solar arrays in the County have been limited to either smaller rooftop installations or distributed/community-scale solar (i.e. solar arrays that are less than 20 MW in size). As a result, solar development in the County is centered around existing transmission and distribution infrastructure. The highest concentration of solar facilities is in the City and Town of Binghamton, Johnson City, Vestal, Endicott, and Union, where substations with additional capacity to

accept renewable energy inputs are located. This is a function of smaller solar energy development projects, as they need to be located close to existing substations with the capacity to accept energy inputs. These smaller projects are not economically feasible when substation upgrades are needed or they are located too far from interconnection points, which explains why these municipalities have been inundated with solar development requests.

There has been one (1) wind energy project completed in Broome County, which includes 26 total wind turbines, located in the Towns of Windsor and Sanford. This wind array is in a relatively remote area of the County and covers a large area. However, due to the scale of the project it was financially viable to invest in interconnection and substation upgrades. This allowed the project to be constructed in an area where it would have a relatively small impact on neighboring communities and land uses.

3.6.4 Municipal Siting Challenges

Municipalities in Broome County have faced significant challenges trying to regulate and review renewable energy projects. Many municipalities, such as the Towns of Union, Chenango, Vestal, Kirkwood, and Maine, have submitted solar development projects to County Planning in the form of Land Use (Section 239) Reviews. These Towns have moderate to restrictive solar development laws, but due to their locations near existing substations they remain attractive for solar developers.

Many Towns have concerns about stormwater management, long-term operation and maintenance, solar array aesthetics, and utilization of farmland or existing forest to host renewable energy projects. Solar arrays in particular tend to use large areas of land, and on average produce approximately 1 MW of solar per every five (5) acres of land utilized. Without solar and wind-specific zoning and siting laws, dedicating large areas of land to renewable energy generation can quickly change the makeup of a municipality. NYSERDA offers a model solar energy local law to help counties and municipalities develop their own solar laws that can be tailored to municipal needs and restrictions[3.28].

3.6.5 Alternative Fuel Generation

Broome County currently utilizes traditional natural gas pipelines and service lines to provide natural gas to residential, commercial, and industrial customers. As noted above, propane fuel is also utilized by all three of these sectors for heating purposes. There are currently no alternative fuel production facilities, such as hydrogen, in the County. The County also does not have any hydrogen fueling stations that are available to the public.

Alternative, zero-emissions fuels such as hydrogen are typically delivered to customers in two ways: through pipeline and service line delivery (i.e. how natural gas is delivered to homes) or via tanker trucks (i.e. how gasoline is delivered to fueling stations). Currently, there are studies being conducted to determine whether hydrogen fuel can be delivered to end users using existing natural gas pipelines. This would greatly reduce delivery costs for the fuel, allow for hydrogen fuel cell cars to become more economical, and could potentially allow for home HVAC systems to be powered by hydrogen. However, there are concerns about hydrogen's effect on metal piping and resistance from natural gas companies to switch their infrastructure from natural gas to hydrogen[3.29]. At the moment, any industries in Broome County that could utilize hydrogen fuel would need to rely on deliveries in the form of liquid ammonia. Further discussion of the potential for hydrogen production and consumption in Broome County is provided in Section 4.0.

<u>Regional and Local Examples</u>

Hydrogen production facilities are still relatively limited in the northeastern United States, but several of these facilities are expected to be operational in the near future. Air Products is currently

investing $500 million to build, own, and operate a hydrogen production facility in Massena, NY using available hydropower in that region. This facility is expected to provide hydrogen fuel to the mobility market in NYS[3.30].

Genesee County and Batavia, NY have begun developing the Science, Technology & Advanced Manufacturing Park (STAMP), which is a 1,250-acre manufacturing park centered around a proposed hydrogen production facility to be owned and operated by Plug Power. Construction of the facility and significant electrical substation upgrades at the Site are currently underway. STAMP is designed to be a manufacturing park complete with its own enclosed hydrogen fuel pipeline where businesses that utilize hydrogen fuel can have it delivered directly to their operations via pipeline. This eliminates the need for hydrogen deliveries in the form of liquid ammonia, which is expensive to refrigerate and transport. Plug Power expects its hydrogen production plant to be fully operational by 2028[3.31].

3.7 Regional Energy Plans

Energy production and consumption is a regional process that is affected by other surrounding communities and large consumption centers. Local, state, and regional energy and climate action plans have been developed outside of Broome County and are currently being implemented. It is important for the County to understand the recommendations of these plans and to use them to help shape how renewable energy is sited, developed, and generated in the County.

Presented below are short summaries of local, state, and regional plans that will affect Broome County energy production and consumption. These plans are utilized to help shape the recommendations presented in Section 5.0.

3.7.1 Binghamton Climate Action and Resiliency Plan

The City of Binghamton developed and successfully implemented a Climate Action Plan in 2011, and recently developed the 2024 Climate Action & Resiliency Plan (CARP) as a continuation and extension of the original actions and goals[3.32]. The CARP guides the City to help prepare for flooding and extreme storm events, extreme heat, and wildfires. The CARP also sets specific goals for all City-owned buildings to be net zero carbon and energy efficient, reduce community fossil fuel consumption due to transportation, and to increase collaboration among regional agencies, institutions, and regional governments. The County has worked closely with the City of Binghamton to help develop the CARP, which is currently in the beginning stages of implementation.

3.7.2 Southern Tier Regional Plans

There have been several different energy-focused plans developed for the Southern Tier in recent years. The Cleaner Greener Southern Tier Regional Sustainability Plan (CGSTP) was developed in 2013 and was funded by NYSERDA's Cleaner, Greener Communities program. This plan included general goals for the region such as an overall reduction in GHG emissions; development, production, and deployment of renewable energy sources across the region; and creation of a regional multi-modal transportation system[3.33].

The Southern Tier Regional Economic Development Council's Strategic Plan was developed in 2023 with input from the Southern Tier Regional Economic Development Council (REDC) members. This plan lays out a roadmap to not only guide the REDC's investment, but also to build the foundation for enduring and resilient growth for decades to come. The Southern Tier REDC identified five pillars to guide investment in support of economic development over the next five years. The first goal is to "position the Southern Tier as a dynamic, ever-evolving hub for cleantech", and calls for addressing challenges in the electric grid to increase power capacity in the region and ensure a fast and reliable transition to clean energy and energy storage solutions[3.34].

Finally, the Southern Tier Clean Energy Industry Cluster Study (ICS) was completed in 2021 by the Southern Tier 8 Regional Board. The purpose of the ICS was to document the existing clean energy industry cluster in the Southern Tier and identify recommended actions and strategies to leverage public and private resources to advance clean energy technology and economic development. The five primary clean energy technology areas identified by NYSERDA include energy efficiency, renewable electric power generation, alternative transportation, renewable fuels, and grid modernization and storage. Broome, Tompkins, and Chemung Counties were identified as the "Innovation Triangle" where existing clean energy technology startup companies are currently located[3.35]. The Battery NY laboratory at Binghamton University has helped advance Broome County as a leader in BESS technology advancement[3.7].

3.7.3 NYS Disadvantaged Communities Barriers and Opportunities Report

Disadvantaged communities across New York State are going to be impacted by the CLCPA, and NYSERDA developed the New York State Disadvantaged Communities Barriers and Opportunities Report (December 2021) to evaluate its impact on these communities. The report identified three energy-related "barriers" experienced by disadvantaged communities across the State:

1. **Distributed Renewable Energy Generation**: Building ownership is a prerequisite for receiving financial incentives for renewable energy generation, which is not an option for many in disadvantaged communities. Renters may not receive the benefits of renewable energy tax credits, and community-scale renewable energy projects have typically not been focused on traditionally underserved and under-resourced communities.
2. **Energy Efficiency, Weatherization, and Electrificatio**n: Deployment of these strategies can be a major challenge in disadvantaged communities, where improving energy efficiency and investing in weatherization can place an additional strain on households with limited resources. These strategies cannot be deployed at houses that have structural issues, requiring residents to make costly structural investments before energy efficiency improvements can be made. Additionally, landlords have limited motivation to invest in improvements since they will not recoup the investment.
3. **Zero-Emission and Low-Emission Transportation:** Vehicle electrification may not be financially viable for many in disadvantaged communities due to the costs associated with purchasing new vehicles and investing in charging infrastructure.

Disadvantaged communities in Broome County include portions of Endicott, Endwell, Johnson City the City of Binghamton, Port Dickinson, and Kirkwood. These barriers are all likely to impact the above disadvantaged communities, and steps must be taken to help these communities equitably transition to using clean, renewable energy in the most efficient manner possible.

3.8 Conclusions

Broome County currently has enough operating solar arrays in the County to generate approximately 28% of its solar generation goal of 89.88 MW. To meet the CLCPA mandate, an additional 64.7 MW of solar electricity generation capacity will need to be constructed in the County by the end of 2025. However, the County currently produces 141 MW of all renewable energy in the form of landfill gas recovery, solar, and wind. This renewable energy generation is 157% higher than the solar generation goal stated above and meets the CLCPA goal of achieving 70% renewable energy, 30% fossil fuel energy by 2030.

The County is currently producing approximately 35 MW less electricity than it was in 2012 with the closure of two former fossil fuel-powered generation plants. As a result, Broome County imports just over 70% of the energy that it consumes. Most of this energy is currently imported in the form of fossil fuels but will be largely replaced with electricity demand by 2050. Broome County has nearly

achieved its 2030 GHG emissions target and will likely be ahead of that CLCPA's GHG emissions reduction timelines. However, significant reductions in GHG emissions will be required on a community-wide basis by 2050 to do its part in achieving the State's final emissions goal.

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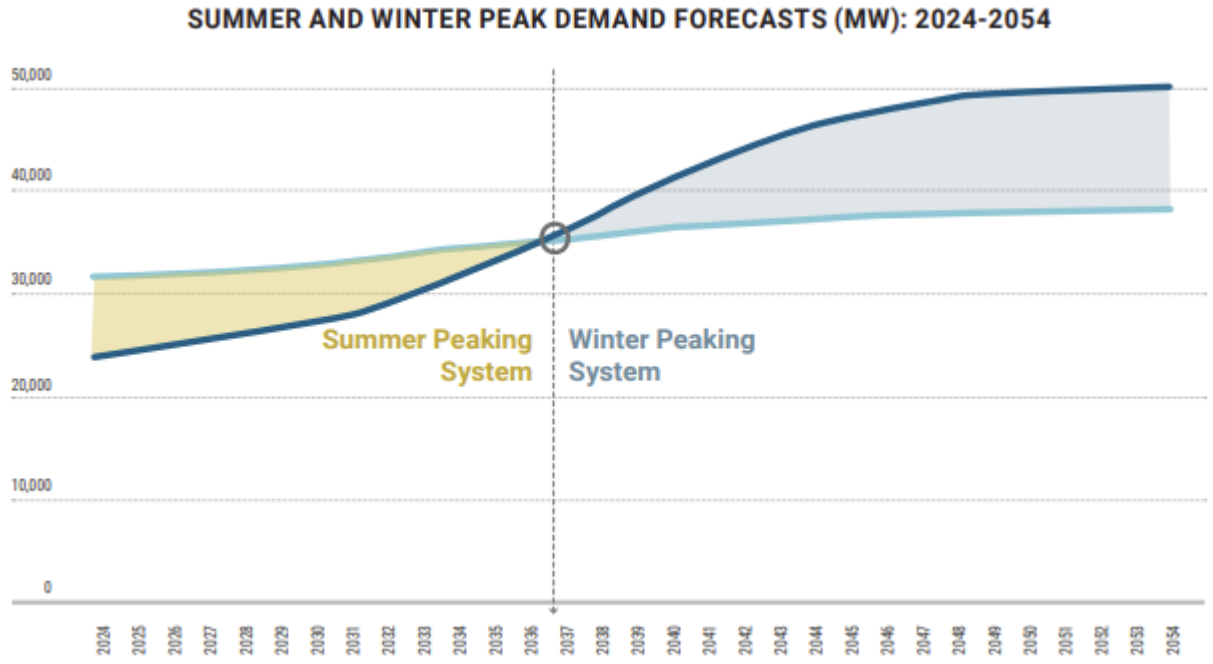
4.0 Broome County Energy Projections

Electrification of transportation and building systems, paired with projected increases in heat waves and ambient temperatures, are going to change how energy is consumed in Broome County. Demand for traditional fuel sources such as natural gas, propane, distillate fuel oil, gasoline, and diesel are projected to be replaced with electricity. This increased demand for electricity means that there will need to be significant investments in renewable energy generation and transmission and distribution system upgrades. Presented below are projected energy demands for Broome County and a discussion of what these mean for the Broome County community.

4.1 Projected Energy Consumption

As Broome County works toward meeting New York State's CLCPA targets, the landscape of energy is evolving as emissions-intensive energy resources are replaced with "cleaner" technologies with lower greenhouse gas emissions. The predominant shift that is taking place is the replacement of fossil fuel combustion technologies such as a gas boiler or gas stove with all-electric options, which is termed as "electrification". This shift in energy resources because of recent legislation has a significant impact on building owners and utility infrastructure.

As facilities transition from fossil fuels for heating, gas stoves, and gas-powered vehicles to electric alternatives, building owners are required to pay for the replacement, which also results in a significant increase in electric demand. The increased demand is expected to be particularly noticeable during the winter and summer months when heating and cooling needs peak. With the transition to electric heating systems, peak demand has been forecasted to become higher in winter months than the traditional summer months according to NYISO's most recent projections as indicated in the figure below[4.1].



Graph 4-1: NYSIO 2024 Power Trends

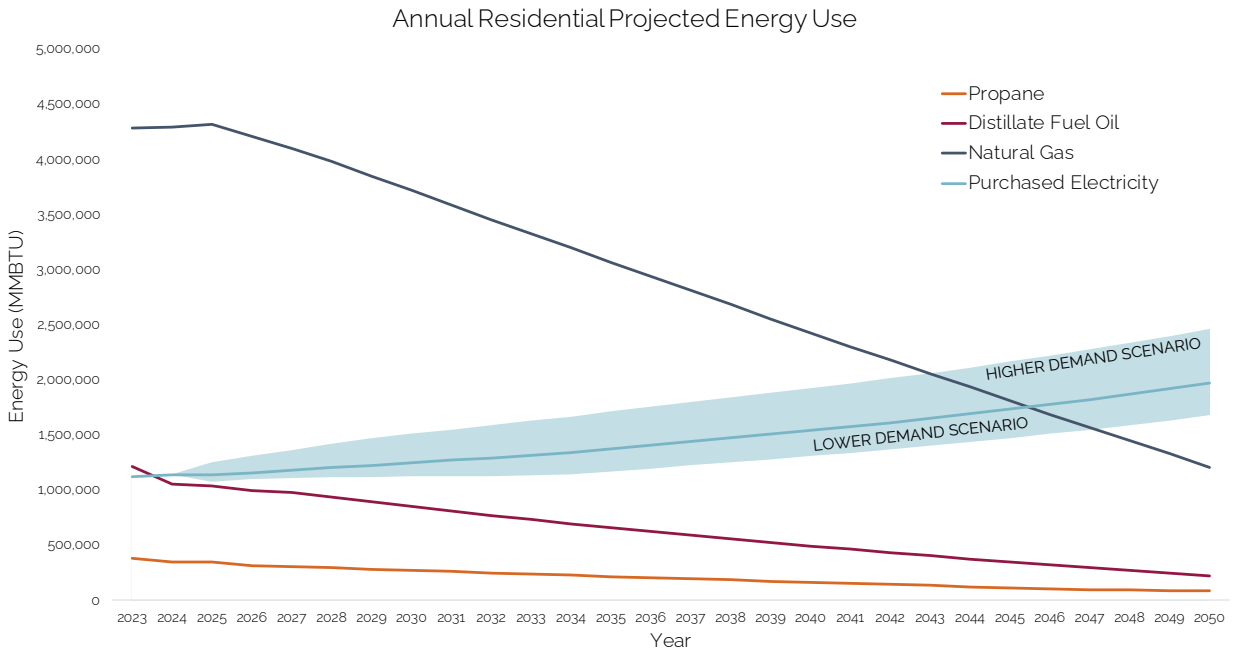
The rise in electric consumption presents the need for more renewable energy generation technologies such as solar PV, wind, hydropower, and geothermal energy to facilitate a transition away from fossil fuels. Engagement with local utilities is paramount to accommodate economic

growth, electrification of facilities, and electric vehicles as the energy landscape shifts in the coming years.

4.1.1 Projected Residential Energy Consumption

Overall, electricity demand (compared to 2022 consumption) is expected to increase by 11.1% by 2030, 37.2% by 2040, and 75.7% by 2050 within the residential sector. The transition to electric heating, cooling, and appliances means homes that previously relied on natural gas, oil, or propane will consume more electricity year-round, particularly during the winter for heating. With a look out to 2050 there are many factors that can affect total electrical usage. There is potential to limit the electrical usage and demand on the grid while staying within CLPCA guidelines of achieving zero emissions by using renewable energy sources such as roof-top solar and geothermal heating and cooling.

Natural gas demand will also decrease, most noticeably in winter when natural gas has traditionally been relied on heavily for heating. A short-term increase in natural demand can be expected through 2027, with demand expected to taper off as new buildings in New York State must electrify their heating systems past that date. Retrofitting older homes with electric heat pumps and appliances will play a large role in phasing out natural gas reliance across the county. As a result, natural gas utilities will face a gradual decline in residential demand to meet CLPCA requirements. Graph 4-2 below shows projected residential energy use in Broome County through 2050.



Graph 4-2: Annual Residential Projected Energy Use (Broome County)

The transition to electric heating, cooling, and appliances means homes that previously relied on natural gas, oil, or propane will consume more electricity year-round, particularly during the winter for heating. Graph 4-1 demonstrates a typical home's daily electric demand on an hourly basis with traditional gas heating systems compared to all electric systems. There is potential to limit the electric demand increases using geothermal or energy storage technologies, although this currently comes at a higher cost to building owners.

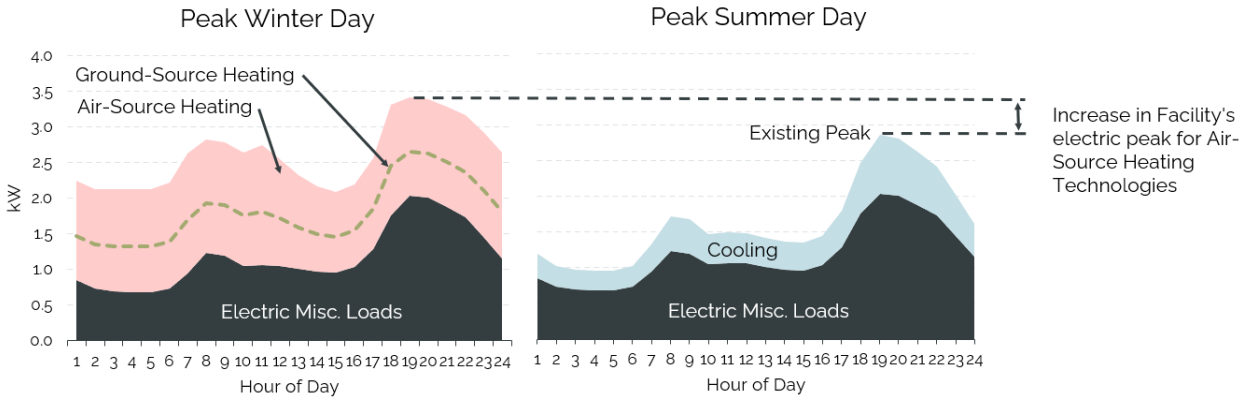
Looking out to 2050, there are many factors that can affect total electrical usage in residential buildings including new legislation, advances in technology, and the cost of energy. Current projections anticipate that facilities will continue to consume natural gas well into the future with a

gradual decrease because of legislation and the discontinuation of new gas services. The graphic below indicates a projection specific to Broome County's residential buildings that reflect a gradual decrease in fossil fuel consumption and a range of electric increases that are dependent on market conditions and the adaptation of various electric technologies.

4.1.2 Projected Commercial Energy Consumption

Electrification is expected to have a significant impact on the commercial sector as well, as buildings move to electrified heating systems. Similar to the residential sector, electricity demand (compared to 2022 consumption) is expected to increase 10% by 2030, 30% by 2040, and 60% by 2050. Most of this demand is attributed to the expected electrification of building heating systems. Like the residential sector, some of this demand can be offset by installation of rooftop solar panels and use of battery energy storage to manage peak energy demands.

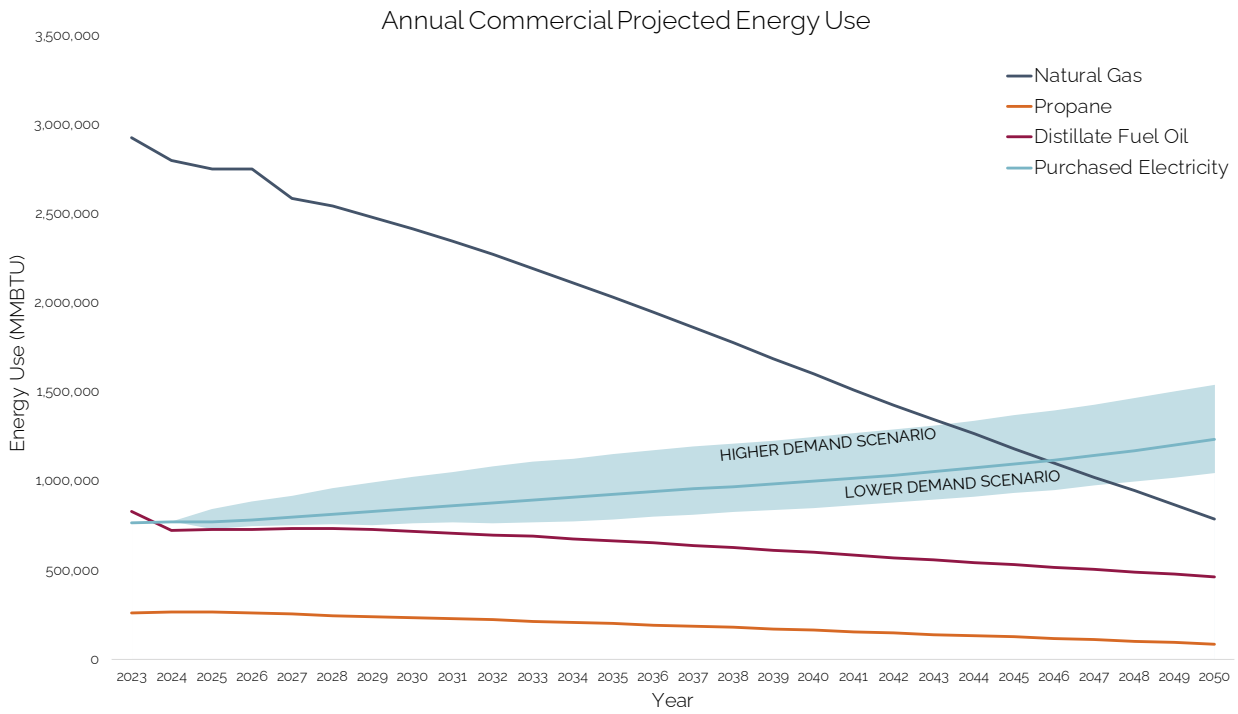
Natural gas consumption is expected to decrease significantly by 2050, as the demand for natural gas for heating drops. Unlike residential consumption, natural gas demand in the commercial sector has declined as commercial businesses are incentivized to electrify their heating systems through NYS program incentives. Similarly, distillate fuel oil and propane consumption are expected to decline as demand for electricity replaces these energy sources. Graph 4-3 shows projected commercial energy use in Broome County through 2050.



Graph 4-3: Peak Summer and Winter Day Energy Consumption

Broome County's commercial sector is projected to see a shift in energy use due to CLCPA regulations, driving a transition from fossil fuels to electricity for heating, cooling, and other operational needs. In addition, the potential growing presence of commercial data servers which are critical for supporting digital infrastructure will likely contribute to higher electricity demand, further impacting the grid. To meet the established state targets, a focus should be placed on the adaptation of energy efficient technologies that are replacing fossil fuel combustion to limit the increases in electric demand.

Natural gas consumption throughout Broome County is expected to decrease over the next 25 years as a direct correlation to the increasing electric demand. This reduction will primarily occur as buildings replace traditional gas-powered heating systems with electric heat pumps and switch to electric water heaters and cooking appliances, gradually phasing out gas reliance. It is expected that many businesses will retain some form of gas service due to challenges with maintaining operations, grid reliability, and the high costs of electrifying some commercial systems.

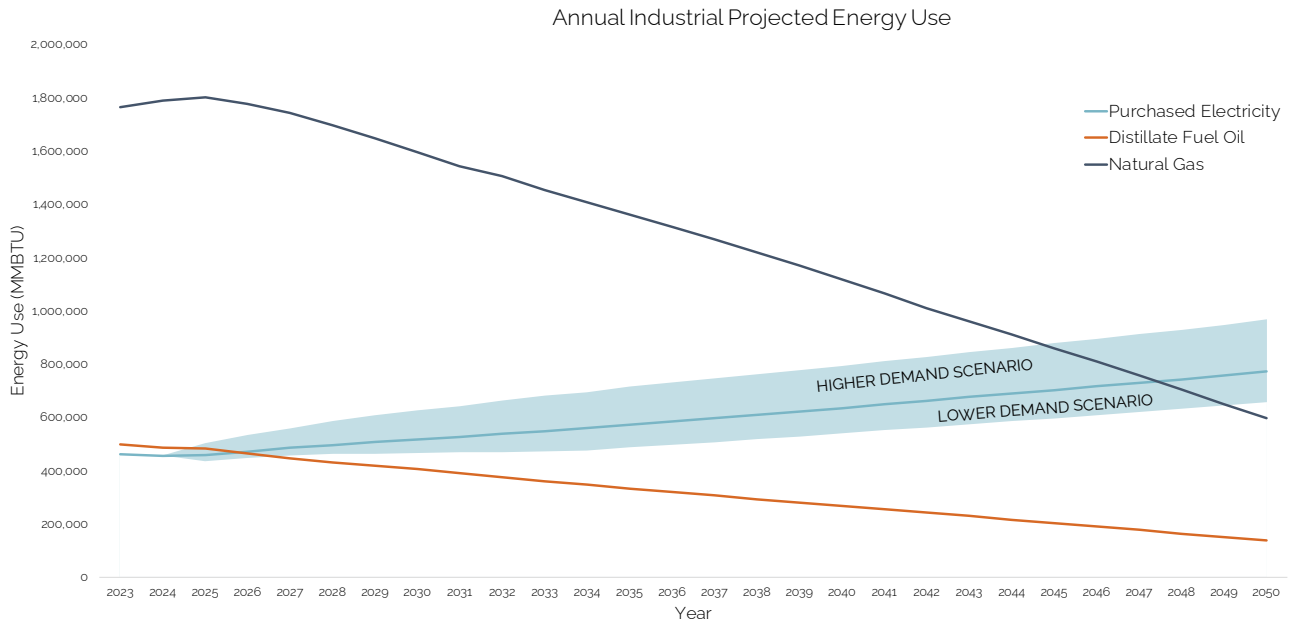


Graph 4-4: Annual Commercial Projected Energy Use (Broome County)

4.1.3 Projected Industrial Energy Consumption

Electricity consumption in Broome County's industrial sector is expected to rise as facilities transition from natural gas and other fossil fuels to electric systems, in line with New York State's CLCPA mandates. This shift will involve replacing gas-powered machinery, heating, and processing equipment with electric alternatives, increasing demand on the county's grid. Additionally, as more data centers and energy-intensive manufacturers are established, offsetting this increase with generation technologies will be paramount.

Natural gas consumption in Broome County's industrial sector is projected to decline as facilities phase out gas systems in favor of electric options to meet CLCPA regulations. The decrease will come primarily from replacing natural gas-powered heating, process heat, and machinery with electric technologies, reducing fossil fuel reliance. Many industrial facilities with high temperature process equipment in excess of 200°F may elect to retain fossil fuel service for as long as possible in order to limit utility costs, retain the reliability of service that they currently have with gas, and to avoid significant capital investments that would be associated with replacing these heating systems and the electric systems in the building.

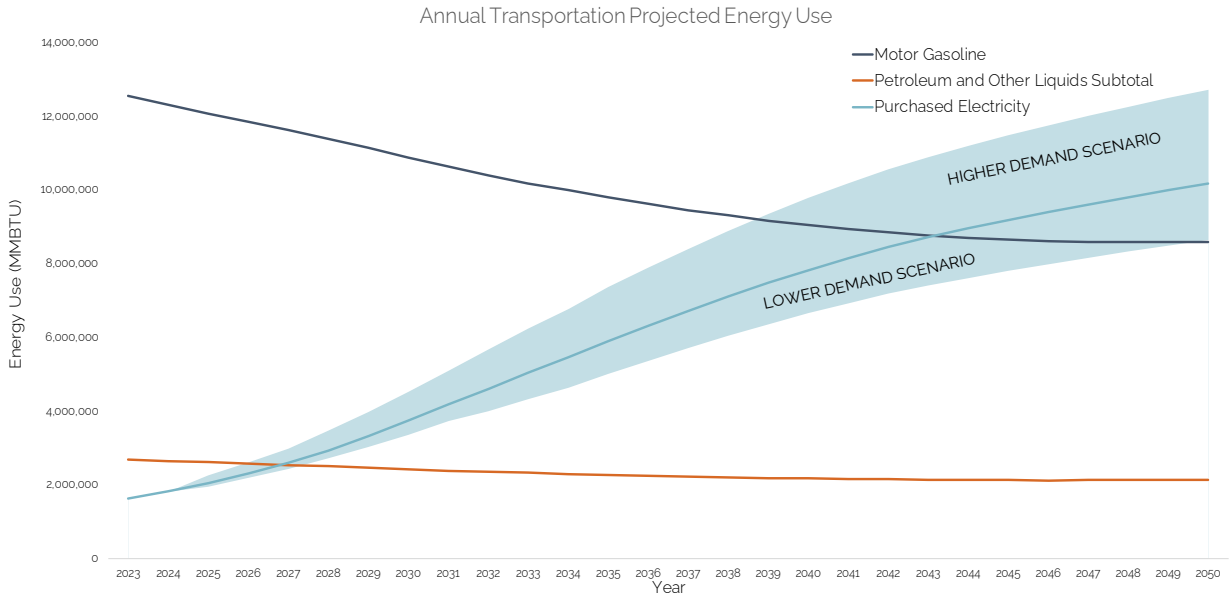


Graph 4-5: Annual Industrial Projected Energy Use (Broome County)

4.1.4 Projected Transportation Energy Consumption

Within Broome County's transportation sector, electricity consumption is expected to increase as electric vehicles (eVs), including personal cars and public transit buses, are adopted to meet New York State's CLCPA requirements. The integration of EV buses by local transit systems and the shift toward electric cars will contribute to a growing demand for public and private charging infrastructure, which will place additional load on the county's electrical grid. Investments in fast-charging stations and grid upgrades will be essential to support this transition, particularly in high-traffic areas and public transit hubs.

Gasoline consumption in Broome County's transportation sector is projected to decline as eVs replace traditional gas-powered vehicles and transit options. Public transit systems in the county are expected to switch to electric buses, which will reduce greenhouse gas emissions and fuel costs over time. Private adoption of electric cars will similarly reduce gasoline demand, particularly as eVs become more affordable and charging infrastructure more accessible. The graphic below represents the anticipated transition for the vehicle mix in Broome County as this paradigm shift occurs.



Graph 4-6: Annual Transportation Projected Energy Use (Broome County)

4.2 Statewide CLCPA Impacts

Energy consumption is expected to increase significantly by 2050 as building heating and cooling systems and traditional passenger cars begin to move away from fossil fuel consumption. To make up for this increase in demand, renewable energy projects have sprung up across New York State and Broome County. However, many of the current forms of renewable energy generation are "distributed" generation, which presents major challenges for a power grid that was developed to handle "point-source" electricity generation. Although new alternative fuels (i.e. hydrogen fuel cells, etc.) are necessary to meet the State's zero-emissions energy infrastructure by 2040, this section focuses on the State's efforts to upgrade and expand its existing electricity grid to meet projected electricity demands and allow for greater input of distributed, renewable energy sources. Discussion of alternative fuels is provided later in this section.

4.2.1 Required Statewide System Upgrades

The NYISO conducts periodic reviews of the State's electricity grid to evaluate congestion areas, project future electricity needs, and recommend capital improvements projects to improve grid reliability over the next decade. NYISO published the "2023 – 2042 System & Resource Outlook" study in July 2024. This study evaluated five (5) future demand scenarios, outlined the necessary upgrades for meeting future electricity demand, and provided insights on the impacts that increase electricity demand will have on Broome County[4.2].

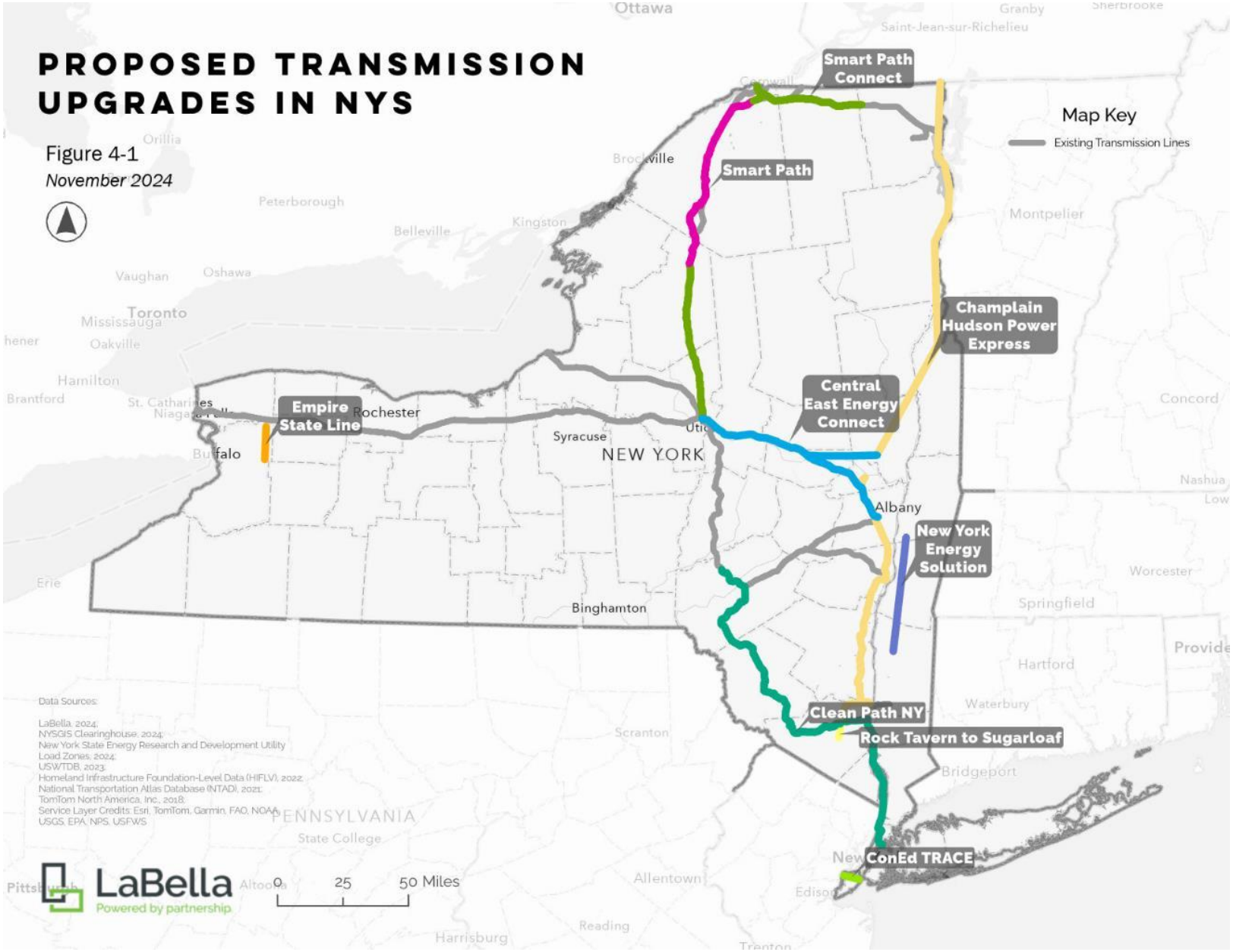
Of the five (5) demand scenarios evaluated, the "System & Resource Outlook" report concluded that the "State Scenario" was the most likely scenario to occur. This scenario is based on inputs from the New York State Department of Public Service (NYDPS) and NYSERDA and is based on utility providers and NYISO conducting transmission and distribution upgrades across the State to align with CLCPA demands. This scenario is designed to achieve the CLCPA mandates, which include total electricity generation from 70% renewable energy sources by 2030 and a zero-emissions grid by 2040. The other four scenarios evaluated as part of this plan include:

- *Base Case*: This scenario represents a "business-as-usual" future, where existing demand, generation, and transmission infrastructure are retained. This scenario excludes new policy-driven resource developments and focuses on maintaining system reliability without achieving CLCPA mandates.
- *Contract Case:* This scenario incorporates approximately 16 gigawatts (GW) of additional renewable energy capacity, sourced from New York's financial commitments like renewable energy certificate (REC) contracts. It evaluates a future where the State's contracted projects are fully realized.
- *Higher-Demand Scenario:* This scenario assumes a future with higher energy consumption, driven by accelerated electrification of sectors like heating and transportation. It evaluates capacity requirements to support this increased demand.
- *Lower-Demand Scenario*: This scenario assesses a future with relatively lower demand, considering more conservative growth in electrification and renewable energy integration.

To meet the demands of the State Scenario, several different transmission infrastructure upgrades are planned across New York State:

1. *Central-East Interface Upgrades:* The Central-East Interface has been a historically limiting path for energy transfer between upstate and downstate New York. This interface runs from near Plattsburgh in northern New York State to central New York in the Mohawk Valley. Investments are currently proposed to add dynamic reactive power support to maintain voltage stability and alleviate congestion.
2. *Western and Northern New York Upgrades:* These two areas are poised for significant renewable energy development and require transmission system upgrades to support this energy production. Transmission constraints in these regions, particularly along the 230 kV transmission paths in the Buffalo-Erie area and zones in Northern New York, need to be addressed. Projects like the Empire State Line and Smart Path Connection are already underway, but further upgrades are recommended to enhance energy transfer capabilities[4.3].
3. *Local Transmission Projects (Phases 1 and 2):* The New York Public Service Commission (NYPSC) has approved Phases 1 and 2 of local transmission upgrades across the State, which are effective at solving near-term congestion and improving the deliverability of renewable energy to the bulk grid. This investment helps reduce renewable curtailment and enhance the overall efficiency of energy transfer to meet State policy targets.
4. *Long Island Offshore Wind Projects:* The NYISO Board of Directors selected a new project to address Long Island's offshore wind needs, aimed at integrating at least 3,000 MW of offshore wind energy. This project will play a key role in meeting the State's offshore wind energy goals by 2035.
5. *Bulk Transmission Projects and Ongoing Monitoring:* Continuous monitoring and expansion of bulk transmission is necessary to ensure the delivery of renewable energy to load centers across the State. Flexible planning is needed to accommodate future changes in demand, renewable energy development, and new energy policies.

Figure 4-1 shows proposed transmission infrastructure upgrades across NYS[4.4].


PROPOSED TRANSMISSION UPGRADES IN NYS
Figure 4-1
November 2024
Map Key
Existing Transmission Lines
Smart Path Connect
Smart Path
Champlain Hudson Power Express
Central East Energy Connect
Empire State Line
New York Energy Solution
Clean Path NY
Rock Tavern to Sugarloaf
ConEd TRACE
NEW YORK
PENNSYLVANIA
Ottawa
Toronto
Rochester
Buffalo
Syracuse
Albany
Binghamton
Montpelier
Hartford
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TomTom North America, Inc., 2018;
Service Layer Credits: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS
LaBella
Powered by partnership
0
25
50 Miles

4.2.2 Statewide Electrification Challenges

Under the State Scenario, the "System & Resource Outlook" report identified the following challenges to realizing the State's CLCPA goals[4.2]:

- *Reliability During the Energy Transition:* The full achievement of New York's zero-emissions mandate involves retiring all fossil fuel generation plants by 2040. However, maintaining reliability during this transition presents serious challenges, as fossil fuel generation plants currently provide essential grid services like voltage support, reserves, and black start capabilities. To replace these systems, Dispatchable Emission-Free Resources (DEFRs) are required. DEFRs are larger-scale electricity generation plants that can be "turned on" and "turned off" quickly while delivering a reliable flow of electricity in the process. Traditional renewable energy sources (i.e. solar and wind) provide unreliable flows of electricity, which poses a serious challenge in bringing an electricity grid back online following a system interruption. DEFRs are not yet commercially viable at scale, which creates uncertainty in the transition to a zero-emissions grid.
- *Increased Congestion and Renewable Curtailment:* The significant addition of renewable energy, including large-scale solar and wind arrays, will lead to greater congestion in certain transmission corridors. This could result in curtailment of renewable resources, especially in Long Island and certain areas of upstate New York.
- *Dependence on New Technologies:* Achieving State policy mandates depends heavily on technologies like hydrogen-powered generators and long-duration energy storage, which are still in the development phase. This dependency on future technologies increases the risk of delays or setbacks in achieving policy goals.

While transmission system upgrades require significant capital investment by individual utility companies, it is likely that the development and future demand for DEFRs is the biggest challenge to meeting the State's energy production goals. By 2040, DEFRs are expected to play a significant role not only in providing peak capacity but also in supplying hourly energy needs. This increased reliance on DEFRs is driven by the forecasted hourly demand profiles and the limitations of energy storage technologies.

Potential DEFR options include long-duration batteries, small modular nuclear reactors, and hydrogen-powered generators. The hydrogen-powered units could be either new combustion turbines or retrofitted systems using low- or zero-carbon hydrogen produced through electrolysis using renewable energy. Small modular reactors, which currently have lower operating costs, are seen as providing consistent generation and flexibility. Currently, hydrogen-powered DEFRs have high operating costs and additional demand on the grid from electrolysis. The lack of cost-effective, readily available hydrogen fuel is a significant limiting factor for hydrogen-powered electrical generation facilities at the current time.

4.3 Broome County CLCPA Impacts

Transitioning our energy, buildings, and transportation systems to all electric or zero-emissions alternative fuels will come with financial implications for all New York residents. While the CLCPA is designed to "phase in" electrified heating systems and ZEVs, this transition will still require that local electrical systems be upgraded and for charging infrastructure to be installed at homes and businesses. Additionally, the projected increase in electricity demand will likely mean higher electricity costs. This is especially true if renewable energy generation goals and grid upgrades cannot be completed on schedule.

4.3.1 Required Broome County Upgrades

In order to meet projected increases in demand as well as additional renewable energy inputs, Broome County will need to undergo grid upgrades as well. NYSEG has identified "Areas of Concern" throughout the Southern Tier region and is currently in the process of designing upgrades to the 230 kV and 115 kV transmission networks in the region, including in Broome County. These upgrades are expected to be in service by 2030 and should enhance energy deliverability and address regional transmission limitations[4.4].

Transmission upgrades in Broome County are part of a larger effort to alleviate transmission congestion and increase energy transfer capabilities in the Southern Tier. This improvement is critical, as NYISO projects that the Mohawk Valley region will begin to see an increase in congestion-related energy costs starting in 2035. The report indicates that the region should expect to see an increase in electricity costs as the existing electrical grid struggles to deliver electricity downstate to the high-energy demand centers of New York City and Long Island[4.2].

4.3.2 Rural Electrification Challenges in Broome County

Vehicle and building electrification in urban and suburban areas tends to be less of a challenge than in rural communities due to the presence of a large existing customer base and existing electrical infrastructure. Urban and suburban electrification will require significant electrical infrastructure upgrades, but these upgrades are more cost effective than in rural communities. The largest challenge is vehicle electrification and "range anxiety" in rural areas for both individuals and large vehicle fleets, including school buses for rural school districts.

Most rural areas currently lack the extensive charging infrastructure seen in urban locations, including DC fast chargers and Level 2 chargers. DC fast chargers are required for larger vehicle fleets or for vehicles that need to be charged quickly, such as first responders. These require significant electrical upgrades, including 3-phase service which is costly to install. Level 2 chargers will be required for most rural residents' needs to ensure that vehicles are charged overnight, as rural communities tend to have to travel longer distances than urban or suburban residents daily.

Expanding EV infrastructure requires coordination with NYSEG to ensure that the electrical grid in rural areas can handle the additional load from home and public charging stations as well as for building systems. Many rural areas will need grid upgrades to support high demand charging needs, especially for DC fast chargers. Additionally, building and maintaining charging infrastructure in low-density areas tends to be costly. This requires significant investment from rural school districts, which will require DC fast charging stations to charge electric school bus fleets that travel long distances to transport students. Rural school districts looking to invest in electric buses and associated charging infrastructure will likely face high front-end costs, will need to coordinate closely with NYSEG on local grid upgrades, and will need to secure long-term grant funding for both building and maintaining charging infrastructure.

Finally, there are concerns with EV performance during cold weather periods. While battery ranges are improving, the increased driving distances typical in rural areas are likely to be an issue. Inclement winter weather can also reduce EV range, which negatively impacts EV reliability. This is a major concern for school buses, as students need to be safely and reliably transported to and from school on a daily basis[4.5].

4.3.3 Disadvantaged Communities in Broome County

An increase in electricity costs will impact Broome County's disadvantaged communities disproportionately. Many households cannot afford the added costs associated with electrical service upgrades, electrical charging infrastructure, installation of electrified heating systems, or,

residential renewable energy infrastructure (i.e. solar panels or small wind turbines). Broome County and New York State must take steps to help these disadvantaged communities transition to electrified systems by providing additional resources and programs for residents that cannot afford these systems on their own.

There are several existing programs in Broome County that can be built upon to help County residents transition to fully electrified heating and transportation systems. Broome County Office for the Aging currently runs the Weatherization & Home Repair Programs for low-income residents. These programs include funding for building weatherization, major repairs to roofs and foundations, and furnace repair and replacement. These programs could potentially be expanded to help low-income families install electrified heating systems and rooftop renewable energy as part of upgrades and repairs.

4.3.4 Vehicle Electrification

The CLCPA mandates that by 2030, 100% of all light-duty vehicles sold in New York State will be eVs or ZEVs while all vehicles sold by 2050 will be ZEVs. eVs are the most advanced ZEV technology as of the date of this Plan and are likely to be the most popular ZEV option over the next decade. While the CLCPA does not provide target ZEV goals, it is important for Broome County to understand whether the community is moving towards ZEVs or if it is falling behind.

As of December 2023, approximately 5% of all LDVs registered in the County are ZEVs. The CLCPA mandates that 3,000,000 ZEVs (30% of all vehicles in the State) be in service in NYS by 2030. When scaled down for Broome County, the County should expect to see approximately 3,625 registered ZEVs by this time (if the total number of registered vehicles in the County remains static). By 2050, the County should expect that 100% of all registered LDVs are ZEVS. These target values are presented as part of Appendix A.

4.3.5 Opportunities in Broome County

Challenges to achieving this scenario also present significant opportunities for communities across New York State, and Broome County is no exception. The "System & Resource Outlook" report identified the following opportunities for energy production across the State which align closely with opportunities in Broome County:

- *Renewable Generation and Growth:* The expansion of renewable resources presents opportunities for new economic development, particularly in regions like Western and Northern New York, where the integration of wind and solar resources is prioritized. Successful transmission upgrades will enable greater energy deliverability from these regions, reducing curtailment risks and optimizing resource utilization. Although Broome County is not included in these regions, its central location near projected congestion areas makes it a strategic location for renewable energy production now and in the future.
- *Strategic Siting of Large Loads:* Demand for energy in the commercial and industrial sectors has grown significantly in recent years, from traditional sources such as manufacturing facilities to newer developments such as data centers and hydrogen production operations. These high-demand facilities are defined as "large loads", and New York State has seen a dramatic increase in large load interconnection requests since 2005. Coordinating the location of large new energy loads with nearby renewable energy projects can significantly help reduce grid congestion and increase overall grid efficiency. Large loads could be sited in areas that are "upstream" of known transmission constraints and near renewable energy production facilities. Broome County currently does not experience significant grid congestion, but the Report notes that the Mohawk Valley region is likely to experience significant grid congestion by 2042 driven by downstate development. Broome County's

position “upstream” of higher demand areas makes it an ideal candidate for large energy consumption facilities. Siting “large load” facilities in Broome County would both help alleviate congestion compared to siting these “downstate” and would help create jobs within the County’s economy.

- *DEFR and Alternative Fuel Production Siting Opportunities*: When paired with renewable generation and growth and strategic siting of large loads, Broome County has a significant opportunity to play host to both modular nuclear reactors and hydrogen-powered electrical generation plants. The County’s location “upstream” of high demand areas and central location within the State makes it a logical location to both produce and use hydrogen fuel for power generation and as an alternative fuel. Hydrogen production and electrical generation plants are critical to re-starting the electrical grid in the event of large-scale outages, and Broome County has an opportunity to host these types of facilities moving forward.

4.4 Renewable Energy Siting Analysis

As part of this Plan, parcels throughout the County were evaluated for their potential to host parking lot of ground-mounted solar arrays. These sites were also evaluated on a high-level basis to for their potential to host wind energy arrays. Sites were evaluated based on potential area available for solar installation, which includes parcels that are 15 acres or larger, contain slopes than are less than 15%, and sites that are less than 1 mile away from apparent interconnection. Sites with apparent wetlands, railroads, streets, and other rights-of-way were also eliminated from this analysis due to challenges with permitting and construction. Preference was given to parcels that contained New York State Department of Environmental Conservation (NYSDEC) or United States Environmental Protection Agency (US EPA)- listed Superfund or Brownfield sites and former landfills, as these sites typically cannot be used for other beneficial purposes. Parcels that contained apparent United States Department of Agriculture (USDA) Prime Agricultural Farmland were given lower preference to avoid dedicating prime farmland to solar energy production. Full screening parameters can be found in Appendix C, “Community Renewable Energy Siting Analysis.”

In total, eleven (11) high-priority sites, 505 medium-priority sites, and 91 low-priority sites were identified as part of this process. Additionally, 428 “no-go” sites were identified to provide recommendations to the County addressing properties where solar development should not be considered moving forward.

Site Number	Municipality	Maximum Generation Potential (MW)
1	Town of Union	7.9
2	Town of Union	5.2
3	Town of Maine	13.2
4	Town of Union	6.1
5	Town of Lisle	3.4
6	Town of Fenton	3.0
7	Town of Barker	5.6
8	Town of Union	3.0
9	Town of Union	3.0
10	Town of Union	3.0
11	Town of Conklin	3.9

Table 4-1: Renewable Energy Siting High Priority Sites

Nine of the 11 high priority parcels are in municipalities with generally favorable renewable energy siting laws. One site, Site #3: Town of Maine, is the only parcel located in a municipality with generally restrictive renewable energy laws. However, this parcel is in a NYSDEC-listed remediation site, making it more favorable for renewable energy development. A full breakdown of high-, medium-, and low-priority sites, "no-go" sites, and siting criteria is presented in Appendix C.

4.5 Conclusions

Energy usage is expected to sharply increase by 2050, with Broome County likely to experience as much as a 500% increase in electricity demand (2,880 MW required generation capacity) over the next 25 years. This is mainly attributed to vehicle electrification, with remaining demand increase attributable to building system electrification. This significant increase in electricity demand will be paired with a significant decrease in fossil fuel utilization as traditional petroleum-based fuels and natural gas are phased out of the residential, commercial, industrial, and transportation sectors. As it currently stands, New York State is relying on significant utility upgrades and a major increase in renewable energy production to meet the increased demand for electricity.

To accommodate this demand, regional utilities are working to upgrade existing electrical transmission and distribution systems to alleviate grid congestion and help the grid accept electricity generated from renewable energy sources. NYSEG is responsible for electrical transmission and distribution systems in Broome County, and there is limited insight into the status of their planned future grid upgrades. However, there are other major projects being undertaken across New York State to help alleviate grid congestion and transfer issues between the Southern Tier region and downstate. Grid congestion is expected to worsen by 2050 in Broome County, and the area may experience increased electricity costs as a result if local renewable energy generation is not increased.

Broome County has an opportunity to establish itself as a renewable energy and alternative fuel production hub due to its location "upstream" of known electrical grid congestion areas. Existing opportunities such as the Battery NY laboratory, transportation-based shipping facilities in Conklin, and the Greater Binghamton Airport all provide opportunities for the County to grow as an energy production center by leveraging existing innovation centers and customer bases to attract renewable energy and alternative fuel production. Encouraging renewable energy development in areas provided as part of the community renewable energy siting analysis could open the door for additional energy production opportunities in the future. These opportunities and recommendations are discussion in Section 5.0.

4.6 References

4.1 2024 Power Trends: The New York ISO Annual Grid and Markets Report (NY ISO, 2024)
2024 Power Trends Report

4.2 2023 – 2042 System & Resource Outlook (The Outlook): A Report from the New York Independent System Operator (NY ISO, July 2024)
2023-2042-System-Resource-Outlook.pdf

4.3 National Transmission Needs Study (U.S. Department of Energy, October 2023)

4.4 2023/2024 New Capacity Zone Study: A Report by the New York Independent System Operator (NY ISO, December 2023)
5b65aa29-8fb5-8b3e-512b-24246389fd01

4.5 Electric Vehicles in Rural Communities (Electrification Coalition, February 2022)

rural-guide.pdf
4.6 New York State Transportation Electrification Report – Report Number 21-06 (NYSERDA, February 2021)

5.0 Recommendations and Resources

Energy demand across Broome County is expected to increase over the next 25 years for numerous reasons: changes to the County's regional climate, especially the demand for cooling during the summer; New York State mandates under the CLCPA to eliminate GHG emissions from building systems, transportation, and energy generation; and advances to electrical generation and energy storage technology. All of these changes present challenges and opportunities for Broome County to navigate and capitalize upon. Presented below are recommendations to position Broome County as a zero-emissions, energy production hub, and provides resources to help the community navigate CLCPA mandates.

5.1 Renewable Energy Production and Storage

Developing a robust system of renewable energy production and storage across New York State is the cornerstone of the CLCPA's goal to reduce GHG emissions to 85% of 1990 levels by 2050. Without a significant increase in renewable energy generation and storage, there will not be sufficient infrastructure to meet the increased demand for zero-emissions heating systems and electrified transportation. Broome County is well-positioned in New York State to establish itself as a renewable energy leader, both in terms of technological innovation and potential generation capacity. Presented below are recommendations for how Broome County can become a renewable energy production hub.

5.1.1 Renewable Energy Recommendations

Recommendation 1: Continue Investment into Battery NY

The future Battery NY laboratory at Binghamton University is set to become an innovation hub for energy storage technology and should continue to receive support from Broome County. It is recommended that Broome County consider partnering with the Battery NY laboratory, including helping to connect local businesses to volunteer for pilot energy storage projects and provide County facilities for pilot studies. Specifically, BC Transit should work closely with Battery NY to develop systems that are capable of quickly charging large, heavy duty vehicle fleets like the electric buses currently being utilized.

This recommendation aligns closely with the Southern Tier REDC Strategic Plan as well as the Southern Tier Clean Energy Industry Cluster Support (ICS). Close County collaboration with an innovation center such as Battery NY will help establish both the County and Binghamton University as leaders in the clean energy industry.

Recommendation 2: Develop a Renewable Energy Production Hub

Currently, Broome County's CLCPA solar energy generation target is 89.88 MW by 2025. Renewable energy projects within Broome County produce approximately 141 MW in renewable energy (landfill gas, solar, and wind), but still has approximately 35 MW less generation capacity than it did in 2012. Additionally, electricity demand is expected to increase by nearly 500% (from 2022 demand) by 2050 mainly due to the demand created by EV charging. This increase equates to a need for up to 2,880 MW of electricity generation capacity by 2050 just to meet Broome County's future needs. It is recommended that Broome County encourage significant investment in solar and wind energy generation across the County to meet projected local increases in electricity demand. Investment in renewable energy across the County will also have major economic impacts, as it opens opportunities for alternative fuel development (i.e. green hydrogen production) to support other industries.

To meet projected demands and open alternative fuel production opportunities, it is recommended that Broome County set the following goals for renewable energy generation capacity, energy storage capacity, and dispatchable energy sources located in the County:

- Renewable Energy Generation Capacity: 719 MW (2050 Target)
  - 800% higher than CLCPA target for 2025
- Energy Storage Capacity: 45 MW (2030 Target)
  - 150% higher than CLCPA target
- Dispatchable Energy Sources: 337 MW (2040 Target)
  - 150% higher than CLCPA target

The proposed renewable energy generation goals are aggressive but achievable based on recent renewable energy development. To achieve this goal, 23.12 MW of renewable energy generation capacity would need to be installed in the County on an annual basis over the next 25 years. This progress would allow Broome County to generate large quantities of renewable energy locally, make the County less susceptible to grid congestion issues, and would make the County more attractive for electricity-consumption industries. Larger community-scale (>20 MW) and utility-scale (<25 MW) renewable energy generation would need to be closely coordinated with NYSEG to ensure that the local grid can handle additional electricity inputs. Much of this development should be "behind the meter" development (e.g. rooftop wind and solar generation) that does not require significant electrical grid upgrades. Local generation will also help reduce transmission and distribution losses during extreme heat events, which are expected to increase significantly by 2050 and by nearly 4,000% by the 2090s. Additionally, setting this target for 2050 would allow the region to evaluate and invest in renewable energy technologies that are not as land use intensive as solar and wind generation facilities.

The proposed energy storage and dispatchable energy capacity goals are set at 150% of the target CLCPA values for the County. The County is well-positioned to take advantage of the Battery NY laboratory to become a leader in energy storage capacity and should leverage this resource to install more energy storage facilities that will help keep electricity prices down. Encouraging additional renewable energy development will also help attract alternative fuel production facilities, which can utilize excess renewable energy to produce hydrogen that can later be used for dispatchable energy generation facilities. It is recommended that these goals be set at 150% of the CLCPA targets for the County due to the condensed target timeframes and reliance on new, underdeveloped dispatchable technologies.

<u>Recommendation 3: Focus Renewable Energy Development</u>

Renewable energy development and production is critical to meet the electrical demands of both Broome County and Statewide due to changes from the CLCPA. It is recommended that Broome County encourage additional renewable energy development to help meet local electricity demands and help drive down energy costs in the future. Local grid congestion is expected to increase sharply near 2040, and local energy production and consumption is a way to help keep costs down for residents.

Site Number	Municipality	Maximum Generation Potential (MW)
1	Town of Union	7.9
2	Town of Union	5.2
3	Town of Maine	13.2
4	Town of Union	6.1
5	Town of Lisle	3.4
6	Town of Fenton	3.0
7	Town of Barker	5.6
8	Town of Union	3.0
9	Town of Union	3.0
10	Town of Union	3.0
11	Town of Conklin	3.9

Renewable energy development should be focused in areas where new commercial and industrial development can take place. The Town of Maine is considering restrictive solar laws, but the Towns of Barker, Chenango, Nanticoke, and Union all have favorable to moderately restrictive ground-mount solar laws. Additionally, Barker and Union have limited restrictions on wind energy development. These relatively favorable siting laws make it possible to develop a renewable energy production area around the Greater Binghamton Airport and Broome County Landfill. Development of a renewable energy production area allows new industries to move to the area to take advantage of the renewable energy being produced and creates new job opportunities for the region. Siting these renewable energy production centers away from currently developed residential centers also reduces issues with siting renewable energy near residential neighborhoods.

Recommendation 4: Consider Renewable Energy Centers in Conklin and Kirkwood

Although the Towns of Conklin and Kirkwood have relatively robust and prohibitive renewable energy siting laws, these areas should also be considered as potential renewable energy generation hubs. Siting renewable energy facilities near potential high-consumption businesses reduces the need for transmission and distribution investment, helps prevent electrical grid congestion, and allows these businesses greater energy reliability. Renewable energy production in these areas is further discussed in **Recommendations 6 and 7**.

Recommendation 5: Consider Renewable Energy Siting Evaluation Program

Providing renewable energy access to disadvantaged communities is critical to ensure that these communities can afford the transition from fossil fuels to electrified systems. This is especially important when considering the transition from traditional vehicles to EVs. Broome County should consider expanding upon its existing Weatherization & Home Repair Programs to include the following:

- **Weatherization**: Include a free evaluation of a building's existing electrical service and provide electrical upgrades to help accommodate a projected increase in residential demand from building heating electrification and EV charging.
- **Major Repairs**: When major home repairs are necessary, include an evaluation of whether the structure can support installation of rooftop solar panels as part of the existing structural evaluation. Expand this service to include renewable energy installation to help offset existing and projected electricity costs.

In addition to the expansion of these programs, the County should consider partnering with rooftop solar developers to provide free renewable energy siting evaluations at residential rental units. This program should focus on splitting the benefits of renewable energy installation equitably between landlords and renters, so that renters can offset some of their electricity costs and lower their overall monthly costs.

5.1.2 Renewable Energy Resources

- ***U.S. EPA Climate Pollution Reduction Grant***: This grant program, established under the Inflation Reduction Act, provides funding for projects that reduce overall GHG emissions in communities across the United States. It is worth noting that funding availability through this program may be reduced or eliminated by a Federal administration change.
    - Applicable Recommendation(s): **Recommendation 5**
- ***NYSERDA Clean Energy Communities – Action Grants for Community Campaigns***: Clean Energy Communities offers grant funding to communities that complete actions, such as installation of community solar, purchasing of EVs, and installation of air- or ground-source heat pumps. This funding is provided after these different features are purchased or installed, which incentivizes municipalities and government agencies to track progress in these areas.
    - Applicable Recommendation(s): **Recommendations 2, 3, 4, and 5**
- ***NYSERDA FlexTech Program***: This program connects commercial and industrial businesses as well as multi-family buildings and institutions with consultants who can conduct energy audits and recommend specific building energy efficiency upgrades. The program also offers financial assistance to offset some or all of the costs associated with these audits.
    - Applicable Recommendation(s): **Recommendation 5**
- ***NY-SUN 25% Renewable Energy Tax Credit***: NYSERDA currently offers a 25% tax credit on solar panels installed at personal residences. This tax credit is applicable only to residential, "behind the meter" solar panels.
    - Applicable Recommendation(s): **Recommendations 2 and 5**

5.2 Alternative Fuel Production

Alternative, zero-emissions fuel will be necessary to diversify our energy systems and ensure electrical grid and transportation reliability in the long-term. Hydrogen fuel is the most developed low- or zero-emission fuel and provides the most promise for transportation systems moving forward. Presented below are recommendations for how Broome County can leverage existing innovation to become an alternative fuel production hub.

5.2.1 Alternative Fuel Recommendations

Recommendation 6: Conduct In-Depth Alternative Fuel Siting Study for Greater Binghamton Airport

Proper siting and investment in an alternative fuel production facility and consumer hub requires that the County closely study where best to locate a facility. It is recommended that the County conduct an in-depth study to determine the viability of blue hydrogen (i.e. hydrogen produced using electricity that uses a mix of fossil fuels and renewable energy) or green hydrogen (i.e. hydrogen produced using electricity generated from entirely renewable sources) production, focusing on answering the following:

- Potential siting locations;
- Potential land acquisition requirements or local partners for this type of project;
- Potential production company or companies to attract;
- Local renewable energy sources (existing or required) to help power production;

- Potential primary and secondary consumers that would invest in development near this production hub.

The Greater Binghamton Airport should be considered for hydrogen production for the following reasons:

- Many large commercial airlines, including Delta Airlines (the only commercial provider currently at the Greater Binghamton Airport) are considering investing in hydrogen-fueled airplanes moving forward. Delta could be a major hydrogen production hub partner if a production facility was established nearby.
- An alternative fuel production hub should be considered in conjunction with the Renewable Energy Development described in **Recommendation 3**. Zero-emission, renewable energy would allow for the production of green hydrogen, which is preferable to blue hydrogen.
- The area around the Greater Binghamton Airport is relatively undeveloped or utilized for agricultural purposes, which would allow for the development of commercial and industrial parks that consume hydrogen fuel. Siting these facilities near a hydrogen production center would allow for the construction of hydrogen pipelines, allowing fuel to be delivered to consumers without having to ship liquid ammonia via tanker trucks. This would effectively create an alternative fuel "hub" for production and businesses.
- Siting of a production hub around the airport also affords opportunities for the airport to expand as a shipping hub.

This study should consider engaging the following hydrogen production companies to determine the exact parameters that are required to establish an alternative fuel production hub:

- PlugPower
- Linde, PLC
- First Hydrogen
- Air Products
- Air Liquide
- AMEA Power
- Nel Hydrogen

<u>Recommendation 7: Consider Hydrogen Production Center in Conklin</u>

Building upon Recommendation 6, it is recommended that the Broome Corporate Parkway corridor in Conklin be evaluated as a potential hydrogen fuel production hub. This area should be considered for the following reasons:

- Broome County has already invested in a 5.2-MW solar array in this area. While the Town of Conklin is currently considering a moratorium on renewable energy development, additional renewable energy development and production in the area could be used to help power hydrogen production.
- The area currently hosts numerous logistics and distribution centers, including Amazon Flex, FedEx Ground, Dick's Sporting Goods, Universal Instruments Corporation, Lineage, and several other smaller manufacturing facilities. These centers ship goods from these warehouses, and large, long-range vehicle fleets could potentially be converted to hydrogen fuel generated by a local plant. This diversified commercial base could provide sufficient demand to support a hydrogen production plant.
- The Towns of Conklin and Kirkwood have areas that can be developed for both additional logistics and distribution centers, as well as capacity for new manufacturers that could use hydrogen fuel as part of their operations. Siting of these industries around a hydrogen production facility could allow for creation of a hydrogen production hub like the one described in Recommendation 6.

An alternative fuel siting study should include this area as well as determine the viability of the area for these types of uses.

5.2.2 Alternative Fuel Resources

- ***NYSERDA Clean Hydrogen R&D Investment***: NYSERDA recently provided $16 million in funding opportunities to address five (5) technical challenges related to hydrogen fuel cell technologies. While this funding round expired on September 26, 2024, it is likely that additional funding for clean hydrogen R&D will be available in the future.
    - Applicable Recommendation(s): **Recommendations 6 and 7**
- ***NYSERDA Clean Hydrogen Investment Plan***: The NYSERDA Clean Energy Fund Compiled Investment Plans has allocated $4.8 million in funding for engineering design and safety studies for hydrogen fuel cell technology. This funding could potentially be utilized to advance a hydrogen production hub following completion of the siting studies recommended above.
    - Applicable Recommendations: **Recommendations 6 and 7**
- ***Hydrogen Strategy Study with National Renewable Energy Laboratory (NREL):*** NYSERDA and NREL are currently undertaking a hydrogen strategy study to better understand potential opportunities for hydrogen in New York State's CLCPA strategy. This study can be used as a resource for Broome County when advancing **Recommendations 6 and 7.**
    - Applicable Recommendations: **Recommendations 6 and 7**

5.3 Transportation Systems

The transition from fossil fuel-powered transportation to zero-emissions vehicles will have major impacts on Broome County. The transportation sector currently is almost entirely reliant on fossil fuels and the transition to all-electric vehicles will create a major strain on existing electrical infrastructure. Broome County must plan for these future demands, invest in infrastructure and land use changes to offset some of these energy demands, and continue to invest in public transportation. Presented below are recommendations on how the County can reduce its transportation energy demands moving forward through investments in public and active transportation alternatives.

5.3.1 Transportation Systems Recommendations

Recommendation 8: Continue Investment in Zero-Emissions Bus Fleets

Continued investment in zero-emissions public transit is required by the CLCPA but is also an extremely effective way to reduce community GHG emissions. BC Transit should continue to invest in electric buses and charging infrastructure, using the initial seven (7) electric buses as a pilot study to determine the viability of an all-electric or hybrid electric/alternative fuel fleet. BC Transit should also evaluate the potential to install renewable energy (i.e. rooftop solar and BESS) at its facilities to help reduce the costs associated with bus charging. For example, the Broome County Sustainable Operations Plan (SOP) recommends conducting a feasibility study for installation of rooftop solar at the Broome County Transit Bus Depot (22 Prospect Ave., Binghamton). Additional renewable energy and BESS installation at BC Transit facilities would allow for greater recharging flexibility.

Additionally, BC Transit should confer with the City of Rochester and the New York City MTA regarding the viability of hydrogen-fueled buses. Hydrogen buses currently offer longer service ranges and shorter refueling times, allowing these buses to return to service more quickly and for longer than electric buses. In conjunction with **Recommendations 6 and 7**, hydrogen-fueled buses would provide hydrogen production companies with an additional consumer base, making hydrogen production more attractive in the long-term.

Finally, urban and suburban school districts should consider applying for available funding to electrify school bus fleets. Rural school districts should consider this funding as well but are less likely to apply due to challenges with electrical service upgrades and system capacity.

Recommendation 9: Invest in Active Transportation-Focused Infrastructure

Electrification of the transportation sector is expected to drive the largest shift in demand for electricity in Broome County by 2050. Offsetting some of this demand by encouraging active transportation (i.e. walking, cycling, etc.) for shorter trips is an effective way to reduce overall electricity usage and make neighborhoods more attractive in the future. Investing in active transportation infrastructure will encourage the public to utilize active transportation rather than personal vehicles more often. Active transportation is expected to become more viable moving forward, with average temperatures in Broome County expected to increase

Active transportation infrastructure investments should include the following:

- Protected bike lanes, including dedicated lanes that have physical barriers between vehicle travel lanes and bicycle lanes;
- Protected pedestrian routes, including intersection "bump outs" and physical space between vehicle travel lanes and pedestrian spaces;
- Bicycle racks and storage areas;
- Investment in street trees and green infrastructure in these areas to help manage stormwater and improve aesthetics; and
- Installation of charging stations for "e-bikes" to encourage their use for intermediate- or long-range commutes.

Active transportation infrastructure is most cost-effective when located in urban and suburban areas, where typical commutes are shorter and development is dense. Investments in active transportation infrastructure should be focused on the more heavily populated areas in the County, including the City of Binghamton, Endicott, Vestal, Endwell, and Johnson City.

Investment in this updated street infrastructure should be integrated into existing public transportation routes. It is recommended that a study be led by BC Transit to determine priority locations for active transportation infrastructure to encourage pedestrians to utilize public transit for longer commutes. Integrating active transportation options with public transportation routes will help reduce per capita energy demand and place less strain on the local electrical grid. This will also help increase mobility for residents in disadvantaged and low-income communities and improve access to public transportation.

Recommendation 10: Encourage Municipalities to Invest in Smart Growth/Compact Development

Moving forward, it is recommended that the County and its urban and suburban communities encourage compact and "smart growth" principles for new development. Encouraging compact, mixed-use development in urban and suburban areas affords the following opportunities:

- Microgrid Development: Compact, mixed-use development makes the development of microgrids more cost-effective and provides greater utility reliability for these areas. Compact development allows utilities to be located belowground, insulating the electrical grid from flooding, severe storms, and extreme heat events that negatively impact aboveground utilities. Microgrids also provide more flexibility to receive inputs from renewable energy generation.
- Improved Public Transportation Access: Dense, mixed-use development is most appropriate in areas where public transportation access is already available. Encouraging smart growth

development along existing bus routes makes access to these routes easier for new residents and provides BC Transit with enough riders to improve the frequency and reach of public transportation routes.
- Walkable Communities: Dense, compact development allows residents the opportunity to walk or cycle rather than use passenger cars for short trips. As noted in **Recommendation 9**, use of active transportation for short trips helps reduce transportation energy demand and makes neighborhoods more attractive for residents.

Smart growth and compact development areas are not appropriate for every community, and many residents prefer to rely on passenger cars as their main method of transportation. However, urban, suburban, and rural villages across Broome County should consider re-evaluating existing zoning laws and land use policies to allow for compact, mixed-use development in densely populated and developed areas. It is recommended that the following municipalities evaluate smart growth and compact zoning law modifications:

- City of Binghamton
- Johnson City
- Endicott
- Windsor
- Deposit
- Whitney Point
- Union
- Vestal
- Conklin

5.3.2 Transportation Systems Resources

- *NYSERDA FlexTech Program*
  - Applicable Recommendation(s): **Recommendation 8**
- ***NYSERDA NY School Bus Incentive Program (NYSBIP):*** The NYSBIP has $300 million in available funding for school districts to purchase new electric school buses and associated charging infrastructure.
  - Applicable Recommendation(s): **Recommendation 8**
- ***Federal Transit Administration Grants for Buses and Bus Facilities Program:*** This grant program provides grant funding to public transit systems looking to upgrade their existing bus fleets, including technological changes or innovations to modify low or no emission vehicles or facilities. This includes funding for electric and hydrogen fuel cell buses. It is worth noting that funding availability under this program may be limited by Federal administration change.
  - Applicable Recommendation(s): **Recommendation 8**
- ***NYS Smart Growth Programs***: The NYSDEC and NYS Department of Transportation (DOT) provide annual grant funding for projects that incorporate smart growth principles and active transportation infrastructure into overall project design.
  - Applicable Recommendation(s): **Recommendations 9 and 10**

5.4 Building Electrification

Building system electrification will be the second largest driver of electricity demand by 2050, trailing only transportation system electrification. Heating systems will move from natural gas to air- or ground-source heat pumps, which is expected to shift peak electricity demand from cooling to heating around the winter of 2036. This increased electricity demand for building systems requires upgrades to existing insulation, building electrical service, and large-scale transmission and distribution system upgrades. Presented below are recommendations on how Broome County and its communities can transition smoothly to fully electrified building systems over the next decade.

5.4.1 Recommendations

Recommendation 11: Push NYSEG to Invest in Climate-Resilient Transmission Upgrades

Electricity demand is expected to increase significantly by 2050 as fossil fuel-powered building systems are replaced with electrified heating systems. In Broome County, NYSEG will need to complete significant upgrades to its transmission and distribution systems to both increase system capacity to meet increased demand and to ensure reliable transmission of electricity during inclement weather. It is recommended that the County work with NYSEG to ensure that the following work is completed:

- **Upgrade Existing 230 kV and 115 kV Transmission Networks:** The existing 230 kV and 115 kV transmission networks, concentrated in Vestal, Endicott, Johnson City, and the City and Town of Binghamton, have been identified as corridors that need to be upgraded in terms of both capacity and redundancy. These projects include:
  - Re-routing of two (2) miles of new 34.5 kV and 115 kV lines;
  - Rebuilding of three (3) existing 115 kV lines, eleven (11) 34.5 kV lines, and four (4) 4.8 kV lines;
  - Resiliency upgrades to the Vestal 623 circuit; and
  - Upgrades to 230 electrical poles throughout the County.

  The County should work with NYISO and NYSEG to ensure that these transmission corridors are upgraded to meet future electricity demands.

- **Upgrade and Relocate Critical Substations:** Several major substations in the County are located in flood-prone, vulnerable areas and also require significant upgrades to meet future electrical demands. The County should work with NYISO and NYSEG to monitor progress on these upgrades, which include the following projects:
    - Upgrading the Oakdale substation in Johnson City;
    - Relocating the Westover substation in Union; and
    - Replacing the Willet substation in Cortland County.
- **Continued Transmission Corridor Maintenance**: The threat of extreme heat, drought, and wildfires is expected to increase throughout the 21st century in Broome County, and transmission lines in remote areas can be a potential cause of wildfires (i.e. Camp Fire due to Pacific Gas & Electric equipment in 2018). NYSEG conducts annual inspections of its systems and conducts routine vegetation maintenance, and the County should work with NYS and NYSEG to ensure that these inspections are routinely taking place. Additional oversight and coordination should be conducted when high fire danger and high energy demand periods overlap, typically in the later summer months.
- **Encourage Climate Resilient Transmission Upgrades**: A projected increase in extreme heat days will have the greatest impact on both electrical transmission and distribution systems and energy demand in the future. The County should work with NYSEG to facilitate relocating overhead electric lines underground, making them less susceptible to flooding, severe weather, and extreme heat events.

Recommendation 12: Provide Resources for Low-Income Households to Electrify Building Systems

Programs to offset building electrification costs for disadvantaged communities are critical to ensure that these communities can afford the transition from fossil fuels to electrified systems. In addition to the program expansions proposed in **Recommendation 5**, Broome County should consider expanding upon its existing Weatherization & Home Repair Programs to include the following:

- **Furnace Repair and Replacement**: Begin replacing defunct furnaces with air-source heat pumps as part of this program. The program should include an evaluation of the building's existing electrical service and conduct necessary upgrades to accommodate the additional electricity demand. This service should also include home weatherization to improve the heating system's efficiency and could potentially include a renewable energy structural analysis to help the homeowner offset electrical costs associated with heating.
- **EV Charging Evaluation and Installation**: Consider expanding these existing programs to include a free evaluation of residences for electric vehicle charging. This program should include an evaluation of a residence's existing electrical service and provide funding for charging infrastructure installation.

Recommendation 13: Provide Community with Resources for Rebates

Building system electrification will take a phased approach and will largely be dependent on costs to homeowners and businesses. New York State and the Federal government currently offer tax breaks and financial incentives for the evaluation and installation of electrified heating systems and energy efficiency upgrades to help offset these costs. Broome County can help accelerate energy efficiency upgrades and electrification efforts by providing the public with resources and assistance to obtain these incentives. The following steps are recommended to help advance community building electrification:

- **Direct Community Towards Existing Incentives:** Using the County website and existing education programs, Broome County can help direct interested residents and businesses towards existing financial incentive programs to help offset the costs associated with building electrification. These existing incentives include the following:

    - NYSERDA FlexTech Program (commercial, industrial, and multifamily facilities);
    - IRS Energy Efficiency Home Improvement Credit (single family homes and some businesses); and
    - NYSERDA Comfort Home Program (single family homes).
- **Develop and Provide Incentives for Landlords**: Disadvantaged and low-income communities typically have lower home ownership rates than financially stable communities, and landlords have little financial incentive to invest in building efficiency upgrades. The County should consider developing an incentive program to encourage landlords to invest in energy efficiency upgrades (i.e. energy audits, insulation upgrades, window and door upgrades, heat pump installation) at their properties. This incentive program could be paired with the existing Weatherization & Home Repair program to cover any residual efficiency upgrade costs not covered by NYSERDA incentives and Federal tax credits. This would help lower utility costs for tenants and improve building value for landlords at no additional cost. Costs could potentially be offset utilizing grant funding from the U.S. EPA Climate Pollution Reduction Grant (CPRG) program to cover what existing NYSERDA incentives and IRS tax credits do not.
- **Partner with Local Institutions**: The County should consider partnering with local education institutions, such as Binghamton University, to help develop educational materials to describe and identify existing energy efficiency incentives for residents and businesses. Partnering with these institutions would free up the County to work towards advancing other recommendations, would provide students with valuable learning opportunities, and would improve overall public access to available energy efficiency upgrade programs.

5.4.2 Resources

- ***U.S. EPA Climate Pollution Reduction Grant (CPRG) program***
    - Applicable Recommendation(s): **Recommendations 12 and 13**
- ***NYSERDA FlexTech Program***
    - Applicable Recommendation(s): **Recommendation 13**
- ***Internal Revenue Service (IRS) Energy Efficiency Home Improvement Credit***: Building efficiency upgrades, including insulation, window, and door upgrades, heat pump installation, and costs associated with home energy audits are eligible for federal tax credits. These tax credits are available to single family homes and some businesses.
    - Applicable Recommendation(s): **Recommendation 13**
- ***NYSERDA Comfort Home Program***: This program offers financial incentives to homeowners to perform attic and roof insulation upgrades, wall insulation upgrades, and window retrofit upgrades. Additional incentives are available through this program for heat pump installation.
    - Applicable Recommendation(s): **Recommendation 13**

5.5 Conclusions

The transition from fossil fuel-based transportation and building systems to electrified and alternative fuel-powered systems will have a significant impact on everyday life in New York State over the coming decades. Shifts in energy demand and types of energy consumed will require major upgrades to our existing electrical infrastructure system, many of which would be required with or without major electrification. However, Broome County has a significant opportunity to establish itself as a prosperous clean energy leader in the 21st century. By taking advantage of the opportunities ahead, the County can help mitigate the effects of climate change and ensure a just, affordable transition away from fossil fuels for all Broome County residents.

Broome County
Community Energy Action Plan
APPENDIX

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Appendices

Appendix A: Broome County Target Values

Appendix B: Community GHG Analysis

Appendix C: Community Renewable Energy Siting Analysis

APPENDIX A
Broome County Target Values

Broome County Energy Action Plan
Scaled Targets for Broome County

Table A-1: CLCPA Target Scaling Metrics

Metrics	New York State	Broome County	% of State
Population (July 1, 2023 Est.)[1]	19,673,200	196,077	1.00%
Land Area (mi²)[2]	47,111.30	705.70	1.50%
Households[3]	7,604,523	81,339	1.07%
Businesses[3]	535,758	4,003	0.75%
1990 GHG Emissions (Million Metric Tons [mmt])[4,5]	409.78	4.08	1.00%
LDVs[6,7]	10,000,000	12,083	0.12%
MHDVs[7]	--	965	--

NOTES:
1. Value obtained from 6 NYCRR Part 496, "Statewide Greenhouse Gas Emission Limits."
2. Land area obtained from United States Census Bureau (2020).
3. Number of households and businesses in NYS and Broome County obtained from 2023 U.S. Census Bureau.
4. 1990 NYS GHG Emissions Value obtained from 6 NYCRR Part 496, "Statewide Greenhouse Gas Emission Limits."
5. Broome County 1990 GHG emissions are estimated and assume that Broome County's emissions have decreased proportionally with NYS.
6. Total number of registered LDVs obtained from NYS Climate Action Council Scoping Plan (December 2022).
7. Indicates light-, medium-, and heavy-duty electric vehicles registered in Broome County, obtained from NYS DMV (2024).

Table A-2: Broome County CLCPA Targets

NYS Goals	*Timeline*	*New York State Goals*	*Broome County Targets*	*Units*
Greenhouse Gas Emissions				
60% of 1990 Levels[1,2]*:*	2030	245.87	2.45	Million Metric Tons (mmt)
15% of 1990 Levels[1,2]*:*	2050	61.47	0.61	mmt
Renewable Energy Production				
Solar Generation Capacity[3,4]*:*	2025	6,000	89.88	MW
Energy Storage Capacity[3,4]*:*	2030	3,000	29.90	MW
Dispatchable Energy Sources[3,4]*:*	2040	15,000	224.69	MW
ZEVs				
100% LDVs sold; 30% LDVs In Service[5,6]*:*	2030	3,000,000	3,625	LDVs
100% LDVs Vehicles In Service[5,6]*:*	2050	10,000,000	12,083	LDVs
Building Emissions				
Home Electrification[7,8]*:*	2030	2,000,000	21,392	homes
20% Business Electrification[8,9]*:*	2030	107,152	801	businesses
85% Home Electrification[7,8]*:*	2050	6,463,845	69,138	homes
85% Business Electrification[8,9]*:*	2050	455,394	3,403	businesses

NOTES:
1. Value obtained from 6 NYCRR Part 496, "Statewide Greenhouse Gas Emission Limits."
2. Broome County target value calculated based on proportion of County population to total State population.
3. NYS Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Section 1.4, "Sector Summaries."
4. Broome County target value calculated based on proportion of County land area to total State land area.
5. NYS LDV Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Chapter 11, "Transportation."
6. Broome County target values calculated based on proposed State targets for LDVs.
7. NYS Home Electrification Goals obtained from NYS Climate Action Council Scoping Plan (December 2022), Section 1.4, "Sector Summaries."
8. Broome County target values calculated based on proposed State targets for home and business electrification.
9. NYS Business Electrification Goals are based on square footage, not individual businesses.

"Million Metric Tons" is denoted by "mmt".

APPENDIX B
Community GHG Analysis

Prepared for:
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Broome County Sustainability Plan and Energy Action Plan

BINGHAMTON, NY

JUNE 19, 2024 – REVISED DECEMBER 2024

Broome County GHG Analysis

Processes and Methodology

This analysis follows the protocols set forth in the document "New York Community and Regional GHG Inventory Guidance" (September 2015, Version 1.0) published by NYSERDA's Climate Smart Communities program. Greenhouse Gas (GHG) analyses were performed for Broome County from two perspectives: Municipal (consisting of county owned facilities) and Community (consisting of Broome County as a whole).

The information gathered and analyzed was used in order to fill out a Detailed GHG Inventory Report for the Municipality, Broome County -owned properties and for the Community, Broome County as a whole (Figures 1,2) per guidance established in the New York Community and Regional GHG Inventory Guidance. All greenhouse gasses are reported in units of metric tons carbon dioxide equivalent (MTCDE), which is an industry standard that weighs the global warming potential (GWP) of each greenhouse gas compared to a baseline of the GWP of Carbon Dioxide (CO_2). The GWP weighting utilized in this analysis is based on the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC) published in 2014. The three primary contributors to greenhouse gas emissions in building operations are: Carbon Dioxide with a GWP of 1, Methane (CH_4) with a GWP of 21, and Nitrous Oxide (N_2O) with a GWP of 310, per the IPCC's report.

GHG Emissions Scope

When municipalities aim to make plans to reduce their greenhouse gas emissions through policy changes and operational improvements, it is important to understand the sources of greenhouse gas emissions. GHG emissions are divided into four "Scopes." Scope 1 includes direct emissions that occur physically with in the boundary of the county, for example emissions from fossil fuels burned within facilities and facility owned equipment. Scope 2 includes indirect emissions, such as those produced by power plants due to the electricity from the grid that is used within the county, regardless of where the power plants themselves are located. Scope 3 includes indirect, upstream, or lifecycle emissions that are attributed to county affiliated activities, regardless of where they occur. The last scope is "Biogenic" which are CO_2 emissions that are considered to be "carbon neutral" as the carbon produced through burning biomass materials is considered to have been withdrawn from the atmosphere during growth of the biomass substance(s).

Community GHG Inventory

The Community GHG Inventory presented in Figure 1, is a representation of the emissions and energy for the entirety of Broome County. For residential, commercial, and industrial energy consumption, the starting point was gathering available utility statistics for New York State. Utilizing NYSERDA published data in the Utility Energy Registry (UER), The US Energy Information Administration (EIA) databases were researched in order to find the New York State Energy total consumption data for published fuel types. The EIA additionally has published information partitioning the total energy per each sector: Residential, Commercial,

Industrial, and transportation. The total GHG Emissions of the Broome County community comes to 2,295,051 MTCDE.

For determining MTCDE for propane, fuel oil, and wood; CO2 equivalent emissions per MMBTU as published by the EPA were utilized. Research found that the Broome County Landfill is the only active electrical generation facility in the county, so MSW and Landfill gas emissions for the community are the same as for the municipality. Note that data was not readily available for Industrial processes within Broome County. Emissions of Sulfur Hexafluoride (SF6) are reported on a national level in the GHG Inventory Guidance as a ratio of MTCDE/MMBTU of electricity consumed annually, which was scaled to Broome County per their annual MMBTU of electricity established earlier. Ozone depleting substitutes from sources such as refrigerant leaks and fire retardants are reported in the GHG Inventory Guidance on a national level as a ratio per capita and was scaled to Broome County based upon the population of Broome County as of July 1, 2023, per the United States Census Bureau.

For on-road transportation emissions, total vehicle miles traveled (VMT) for Broome County was taken from the provided Broome County vehicle list provided by the county. Then the same methodology utilized in the Municipal Inventory Report was used for the Community Inventory Report. Transport data for Rail, Marine, and Off-Road were taken from the GHG Inventory's Tables A-3: "2002 Diesel Consumption (Gallons) by Rail Mode by County" and Table A-4: "2010 GHG Emissions by Off-road Vehicles and Pleasure Craft." The data for Gallons of diesel used by rail were converted to MMBTU per conversion rate published by the Unites Stated Department of Transportation: Bureau of Transportation Statistics, and to MTCDE per EPA reported GHG emissions Factors.

In order to determine the sewage treatment MCTDE, the first step was to find the emissions for New York State through utilizing the EPA's State Inventory and Projection Tool: "Wastewater Module." This tool provided the output emissions for New York state, which was then scaled to Broome County based on population ratios. For Agriculture emissions, the same methodology was used as for Wastewater, however the EPA's "Ag Module" of the State Inventory and Projection Tool was used. Most of the data utilized in the Community GHG Inventory was based on scaled data reported at the state or national level, as county specific data was not readily available. Accuracy of this report could be improved in the future if the county establishes community protocols to record and analyze relevant data that the GHG Inventory utilizes.

Detailed GHG Inventory Report - Broome County					
Broome County GHG Emmisions (2023)					
Sector/Source	**GHG Emissions (MTCDE)**				**Energy Use**
	Scope 1	**Scope 2**	**Scope 3**	**Biogenic**	**(MMBTU)**
Residential Energy Consumption					
Electricity / Steam	-	14,782	-	-	1,121,750
Natural Gas	226,931	-	-	-	4,281,711
Propane / LPG	23,326	-	-	-	381,248
Distillate Fuel Oil (#1, #2, #4, Kerosene)	89,335	-	-	-	1,209,730
Coal	0	-	-	-	0
Wood	32,062	-	-	-	337,258
Commercial Energy Consumption					
Electricity / Steam	-	10,103	-	-	766,667
Natural Gas	155,097	-	-	-	2,926,362
Propane / LPG	15,942	-	-	-	260,566
Distillate Fuel Oil (#1, #2, #4, Kerosene)	61,057	-	-	-	826,797
Coal	0	-	-	-	0
Wood	21,913	-	-	-	230,501
Industrial Energy Consumption					
Electricity / Steam	-	6,089	-	-	462,055
Natural Gas	93,474	-	-	-	1,763,660
Propane / LPG	9,608	-	-	-	157,038
Distillate Fuel Oil (#1, #2, #4, Kerosene)	36,798	-	-	-	498,294
Residual Fuel Oil (#5 & #6)	-	-	-	-	-
Coal	-	-	-	-	-
Petroleum Coke	-	-	-	-	-
Motor Gasoline (E-10)	-	-	-	-	-
Other Oils	-	-	-	-	-
Wood	13,207	-	-	-	138,918
Energy Generation and Supply					
Natural Gas	0	-	-	-	0
Distillate Fuel Oil (#1, #2, #4, Kerosene)	0	-	-	-	0
MSW	71,888	-	-	91,493	1,802,263
Landfill Gas	94	-	-	18,647	357,467
Electricity T&D Losses	0	-	-	-	-
Natural Gas T&D Losses	8,559	-	-	-	-
Industrial Processes					
Cement Production	*	-	-	-	-
Pulp and Paper Manufacturing	*	-	-	-	-
Product Use (HFC, ODS)					
Use of SF6 in the Utility Industry	2,165	-	-	-	-
All Refrigerantes except SF6	73,166	-	-	-	-
Transport: On-Road					
Motor Gasoline (E-10)	777,554	-	-	86,286	12,258,278
Diesel	148,522	-	-	-	2,009,773
Ethanol (E-85)	-	-	-	-	-
Biodiesel	-	-	-	-	-
Transport: Rail, Marine, Off-Road, Air					
Motor Gasoline (E-10)	20,113	-	-		285,412
Diesel	49,691	-	-	-	672,409
Residual Fuel Oil (#5 & #6)	-	-	-	-	-
Natural Gas	1,108	-	-	-	20,862
Propane / LPG	17,177	-	-	-	272,132
Jet Kerosene (Air)	-	-	-	-	-
Waste Management					
Landfill Methane	71,888	-	-	91,493	-
MSW Incineration	94	-	-	18,647	-
Sewage Treatment	23,952	-	-	-	-
Agriculture					
Enteric Fermentation / Manure	70,487	-	-	-	-
Soile / Fertilizer	24,425	-	-	-	-
Totals by Scope	2,139,631	30,974	0	306,568	33,041,155
Total GHG Emissions	2,477,173				
* Information was not available for these items					

Figure 1: Community GHG Inventory Report

Rollup GHG Inventory Report - Broome County							
Broome County GHG Emmisions (2023)							
Sector/Source	**GHG Emissions (MTCDE)**						
	CO2e	**CO2**	**CH4**	**N2O**	**PFC**	**HFC**	**SF6**
Residential Energy Consumption							
Electricity / Steam	14,782	14,782	-	-	-	-	-
Natural Gas	226,931	-	-	-	-	-	-
Propane / LPG	23,326	-	-	-	-	-	-
Distillate Fuel Oil (#1, #2, #4, Kerosene)	89,335	-	-	-	-	-	-
Coal	0	-	-	-	-	-	-
Wood	32,062	-	-	32,062	-	-	-
Commercial Energy Consumption							
Electricity / Steam	10,103	10,103	-	-	-	-	-
Natural Gas	155,097	-	-	-	-	-	-
Propane / LPG	15,942	-	-	-	-	-	-
Distillate Fuel Oil (#1, #2, #4, Kerosene)	61,057	-	-	-	-	-	-
Coal	0	-	-	-	-	-	-
Wood	21,913	-	-	21,913	-	-	-
Industrial Energy Consumption							
Electricity / Steam	6,089	6,089	-	-	-	-	-
Natural Gas	93,474	-	-	-	-	-	-
Propane / LPG	9,608	-	-	-	-	-	-
Distillate Fuel Oil (#1, #2, #4, Kerosene)	36,798	-	-	-	-	-	-
Residual Fuel Oil (#5 & #6)	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-
Petroleum Coke	-	-	-	-	-	-	-
Motor Gasoline (E-10)	-	-	-	-	-	-	-
Other Oils	-	-	-	-	-	-	-
Wood	13,207	-	-	13,207	-	-	-
Energy Generation and Supply							
Natural Gas	0	-	-	-	-	-	-
Distillate Fuel Oil (#1, #2, #4, Kerosene)	0	-	-	-	-	-	-
MSW	163,381	-	-	-	-	-	-
Landfill Gas	18,741	-	-	-	-	-	-
Electricity T&D Losses	0	-	-	-	-	-	-
Natural Gas T&D Losses	8,559	-	-	-	-	-	-
Industrial Processes							
Cement Production	*	-	-	-	-	-	-
Pulp and Paper Manufacturing	*	-	-	-	-	-	-
Product Use (HFC, ODS)							
Use of SF6 in the Utility Industry	2,165	-	-	-	-	-	2,165
All Refrigerantes except SF6	73,166	-	-	-			
Transport: On-Road							
Motor Gasoline (E-10)	863,841	-	-	-	-	-	-
Diesel	148,522	-	-	-	-	-	-
Ethanol (E-85)	-	-	-	-	-	-	-
Biodiesel	-	-	-	-	-	-	-
Transport: Rail, Marine, Off-Road, Air							
Motor Gasoline (E-10)	20,113	-	-	-	-	-	-
Diesel	49,691	-	-	-	-	-	-
Residual Fuel Oil (#5 & #6)	-	-	-	-	-	-	-
Natural Gas	1,108	-	-	-	-	-	-
Propane / LPG	17,177	-	-	-	-	-	-
Jet Kerosene (Air)	-	-	-	-	-	-	-
Waste Management							
Landfill Methane	163,381	-	163,381	-	-	-	-
MSW Incineration	18,741	-	18,741	-	-	-	-
Sewage Treatment	23,952	-	-	-	-	-	-
Agriculture							
Enteric Fermentation / Manure	70,487	-	-	-	-	-	-
Soile / Fertilizer	24,425	-	-	-	-	-	-
Totals by Scope	2,477,173	30,974	182,122	67,182	0	0	2,165
Total GHG Emissions	2,477,173						
* Information was not available for these items							

Figure 2: Community GHG Inventory Rollup

APPENDIX C
Community Renewable Energy Siting Analysis

Broome County
Community Renewable Energy
Siting Analysis

Table of Contents

Community Renewable Energy Siting Analysis

Parcels (Sites) within Broome County were evaluated during the renewable energy siting analysis for the possibility of installing solar to reduce greenhouse gas emissions and help New York State meet their renewable energy production goals. Sites were ranked on a scale from 1 to 3, with 1 being the most promising, based on numerous factors including, but not limited to land usage, buildable area, and land classifications such as superfund sites or floodplains.

Siting Evaluation Parameters and Rationale

Parameters for the renewable energy siting were developed with the option for community (under 20 megawatts, alternating current [MW_{AC}]) or utility-scale solar (20 MW_{AC} or greater). Based on LaBella's experience designing and permitting renewable energy projects, an average of five (5) acres per one (1) megawatt, alternating current (MW_{AC}) was used to determine potential buildable area and estimated energy generation. The estimated energy production of each site may vary depending on the type of energy generation or storage potentially chosen for development in future, as well as swiftly advancing efficiency in renewable energy technologies. Sites were held to a minimum of 15 buildable acres to achieve a minimum project generation of 3 MW_{AC}. Sites underwent a two-tiered screening process (described below) and were categorized into High-, Medium-, and Low-Priority Sites.

Solar generation was the main source of renewable energy considered throughout the screening process. Solar installation can consist of fixed-tilt or tracker systems. A tracker system increases the efficiency of energy generation as they are able to fully utilize the daylight, but they come with an added cost in terms of product purchasing and maintenance. A fixed-tilt system is cheaper to purchase and maintain but typically takes up less space than a tracker system. This makes it possible to install more fixed-tilt panels within a given area. In addition, these systems are more suitable to steeper slopes. Sites will need further evaluation on an individual basis to determine if the potential for an increase in potential energy production of a tracker system outweighs the added cost over a less-expensive fixed-tilt system.

Screening Parameters and Rationale

In addition to the screening parameters described below, recommended sites are typically in areas that are considered undesirable for other types of development (e.g., residential development on brownfield) and are not active agricultural land.

Sites were categorized into four groups: High-Priority, Medium-Priority, Low-Priority, and "No-Go" Areas (further described below). Parcel size, land use types, and prior uses of the Site were used as parameters to determine which properties are best suited for renewable energy installation. Presented below is a description of each set of screening parameters:

<u>Parcel Size and Tree Cover</u>

- A minimum parcel size of 15 acres was selected to achieve a minimum project generation of 3 MW_{AC} as preferred by solar developers.
- Tree clearing was limited to 10 percent of the buildable acreage with a maximum of 10 acres.

<u>National Land Cover Database (NLCD) and USDA Soils</u>

- The U.S. Department of Agriculture defines Prime Farmland as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses." This consists of non-urbanized land that possesses qualities such as proper soil health, dependable precipitation, low sloping areas that does not frequently flood.
- The National Land Cover Database provides satellite-based data on the current land usages of a specific area. These land coverages include 16 different classifications including: open

water, developed open space, developed low intensity, developed medium intensity, developed high intensity, barren land, deciduous forest. Evergreen forest, mixed forest, shrub/scrub, herbaceous, hay/pasture, cultivated crops, woody wetlands, emergent herbaceous wetlands, and unclassified.

- For this screening, the USDA Soils and NLCD were evaluated together to avoid proposing renewable energy development on active prime agricultural land. Areas that consisted of prime farmland and consisted of a land coverage of hay/pasture or cultivated crops were ranked significantly lower than sites of hay/pasture or cultivated crops that are not in a prime farmland area.

NYSDEC/USEPA-Listed Superfund Sites

- New York State Department of Environmental Conservation Superfund Sites are polluted areas that have been identified for hazardous material clean-up. These registry sites are classified 1 through 5 based on the status of their remediation efforts. Class 3, 4, and 5 sites were considered for solar installation as they do not pose a significant threat to the environment or public health and therefore are unlikely to require additional work that could require the renewable energy installation to be temporarily or permanently removed to accommodate site remediation. Classes 1 and 2 were avoided as these sites pose a significant threat to the environment or public health. To develop these sites, they would have to undergo remediation efforts.
- Sites that are currently being investigated or remediated in a brownfield program are classified as Non-Registry sites. These sites are not currently State Superfund sites and are placed in classes based on their potential to become one. Non-Registry sites C (Completed) and N (No Further Action at this Time) were considered for this renewable energy screening as these sites do not currently and are unlikely to in the future require remediation efforts. Classes A (Active), P (Potential), and PR (Potential Resource Conservation and Recovery Act Corrective Action) were avoided for this screening. These sites are either currently undergoing remediation or have the potential to need remediation in the future.

County- or Municipally-Owned Landfills

- Installing solar on old landfills is a great opportunity to use land that cannot be otherwise developed. Landfills that are 15 years or older provide an additional benefit as the potential for settlement due to the waste is significantly decreased.
- Construction and Demolition landfills are the best candidates for solar installation due to type of waste. Traditionally these landfills are the most stable and have lowest potential for contamination.
- Industrial, non-hazardous landfills are the second-best candidates due to stability of waste and lesser settlement potential.
- Municipal solid waste and hazardous waste landfills are not the best candidates due to potential settlement concerns in addition to concerns with the waste disposed and navigating challenges with NYSDEC.

Floodplains and Wetlands

- Using the Parcel Mapper from the County's GIS Portal, sites were evaluated for being in floodplains. Locating sites outside a 500-year floodplain was preferred as they pose less limitations for developments such as an increase in due diligence and permitting needed. These limitations not only can make solar projects more difficult to receive approval but they add an additional cost in both fees and time spent in plan development. This same logic is why screening parameters avoided wetlands. These environmentally sensitive areas not only increase permitting, they present logistical challenges for construction of a solar facility.

Interconnection Availability

- Routing renewable energy projects to viable points of interconnection can be costly and potentially require grid upgrades. For more than one (1) mile of routing required for a project, the price could be over $1 million. Renewable energy developers try to keep customer costs down by cutting back on development spending and avoid sites that are further from potential points of interconnection. For this reason, LaBella utilized a one-mile buffer to find sites within Broome County that are less than one (1) mile away from a substation or transmission line.
- As seen across the State, congestion exists within our electrical grid as interconnection queues are backed up with hundreds of projects looking to connect. Due to some uncertainty and confidentiality around proposed grid upgrades, congestion areas around Broome County were not assessed. However, the recent adoption of the Renewable Action Through Project Interconnection and Deployment (RAPID) Act may bring more electrical grid upgrades in the County at a faster pace, allowing utilities to clear some interconnection queues.

Initial Screening (Tier 1)

During the initial screening, GIS scripts were written and utilized based on the below criteria to screen all properties within the county. The intention of this screening was to eliminate sites that from an overall glance were not feasible for solar installation. If any properties consisted of the following stipulations, they would not pass the tier 1 screening:

- Minimum acreage under 15
- Slopes exceeding 15 percent
- More than 1 mile to apparent interconnection
- Wetlands
- Railroads
- Streets and Right-of-Ways

Secondary Screening (Tier 2)

Concluding the initial screening, a manual secondary screening was conducted to individually evaluate and prioritize the properties as High-Priority, Medium-Priority, Low-Priority, or "No-Go." Sites that were determined to be High-, Medium-, and Low-Priority were assigned a rank of 1, 2, and 3, respectively. Sites that were determined to be "No-Go" Areas were assigned a rank of 0. After completion of the Tier 1 screening (described above), ranks were manually assigned during the Tier 2 screening. Site prioritization is described below for each rank.

High-Priority Sites (Ranking 1)

High-Priority Sites are opportunities were there is a significant benefit for solar installation on the property. These benefits included using land that is less suitable for other development such as NYSDEC Superfund or Brownfield Cleanup Sites, landfills, and mined land. Land usage for these sites typically consist of barren, undeveloped land, developed open space, and shrub/scrub. Hay/pasture land coverage is also included in this priority if the site is also meets one of the criteria above.

- NYSDEC/USEPA-listed Superfund Sites
  - Registry Sites: Class 3, 4, or 5
  - Non-Registry Site: Class C or N
- NYSDEC-listed Brownfield Cleanup Sites
  - Non-Registry Sites: Class C or N
- County- or Municipally-Owned Landfills
  - Closed for minimum of 15 years
  - Highest priority: C&D landfills
  - Medium priority: Industrial, non-hazardous landfills
  - Lowest priority: MSW landfills, hazardous waste landfills

Medium-Priority Sites (Ranking 2)

Medium Priority Sites consist of properties that are good candidates for solar installation and typically have a land usage of developed low intensity and hay/pasture. Sites in this priority may also have up to half of their buildable area classified as Prime Agricultural Farmland and may or may not be located within an Agricultural District.

Low-Priority Sites (Ranking 3)

Low Priority Sites are properties that would be suitable for solar installation but may pose significant environmental or community concerns. Land usage for these sites typically consist of cultivated crops, deciduous, evergreen, and mixed forests, herbaceous areas, and unique areas. Sites in this priority area may also have anywhere from 50-100% of their buildable area be classified as Prime Agricultural Farmland and may or may not be located within an Agricultural District.

No-Go Areas (Ranking 0)

"No-Go" Areas are properties that present no benefits of solar installation. Overall, these properties were not suitable for solar installation and did not receive a high/medium/low priority ranking. "No-Go" Areas consist of Sites that already have solar installed, the buildable acreage consisted of utility rights-of-way (ROWs) or wetlands, there was not enough contiguous buildable acreage, or consisted of the following:

- NYSDEC/USEPA-listed Superfund Sites
  - Registry Sites: Class 1 and 2
  - Non-Registry Sites: Class A, P, and PR
- NYSDEC-Listed Brownfield Cleanup Sites:
  - Non-Registry Sites: Class A, P, and PR
- Environmental Easement Areas
  - Flood control areas
  - Municipal, State, and County parks
  - Land preservation areas
  - 500-year and 100-year floodplains

Findings

At the conclusion of the initial screening, 1,035 Sites were identified and underwent the secondary screening for their potential of solar development. The secondary screening resulted in 11 High-Priority Sites, 505 Medium-Priority Sites, 91 Low-Priority Sites, and 428 "No-Go" Areas. In addition, 8 Sites were not screened due to them being County-owned. The results were as follows:

> The 11 high priority Sites consist of 286.5 acres of buildable area which has the potential for 57.30 MW_{AC} of energy production. The high priority sites consist of 5 superfund sites.
>
> The 505 medium priority Sites consist of 17,686.2 acres of buildable area which has the potential for 3,537.24 MW_{AC} of energy production.
>
> The 91 low priority Sites consist of 3,306.8 acres of buildable area which has the potential for 661.36 MW_{AC} of energy production.

Despite going through the two-tiered screening and being evaluated for the potential of solar development, there is the possibility that there will be municipal limitations or public opposition for solar development at some sites. Public opposition is common when developing agricultural sites, but if the community and municipality is already making an effort to push solar development, it is possible that sites that were screened to be lower priority may be more feasible.

Priority Facilities/Properties

With the conclusion on Tier 1 and 2 screening, 11 high priority parcels were identified to be the most viable for solar development. These sites are described in the tables below.

Priority Site #1 – Town of Union

Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within an Agricultural District and a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
53.839	39.5	39.5	7.90	4.94

Priority Site #2 – Town of Union #2

Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within an Agricultural District and a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
72.272	26.0	26.0	5.20	3.25

Priority Site #3 – Town of Maine

Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
150.565	66.0	66.0	13.20	8.25

Priority Site #4 – Town of Union #3

Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
95.252	30.5	30.5	6.10	3.81

Priority Site #5 – Town of Lisle

Site land coverage is hay/pasture and barren land.

This Site can be combined with three neighboring parcels for a total maximum buildable acreage of 137 acres.

- Parcel 1: Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within an Agricultural District.
- Parcel 2: Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within an Agricultural District.
- Parcel 3: Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within an Agricultural District. This Site also consists of non-buildable area due to being Prime Agricultural Farmland within a floodplain.

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
83.936	17.0	17.0	3.40	2.13
22.149	9.5	9.5	1.90	1.19
66.791	57.5	57.5	11.50	7.19
182.404	70.0	70.0	14.00	8.75
TOTALS:				
355.28	**137**	**137**	**27.40**	**17.13**

Priority Site #6 – Town of Fenton

Site land coverage is shrub/scrub and barren land and consists of Farmland of Statewide Importance.

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
23.465	15.0	15.0	3.00	1.88

Priority Site #7 – Town of Barker

Site land coverage is hay/pasture and barren land, consists of Farmland of Statewide Importance, and is located within an Agricultural District.

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
102.859	28.0	28.0	5.60	3.50

Priority Site #8 – Town of Union #4

Site land coverage is hay/pasture and is located within a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
20.273	15.0	15.0	3.00	1.88

Priority Site #9 – Town of Union #5

Site land coverage is hay/pasture and is located within a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
44.884	15.0	15.0	3.00	1.88

Priority Site #10 – Town of Union #6

Site land coverage is hay/pasture, consists of Farmland of Statewide Importance, and is located within a NYSDEC State Superfund (Class N, Endicott Area-Wide Investigation).

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
58.262	15.0	15.0	3.00	1.88

Priority Site #11 – Town of Conklin

Site land coverage is hay/pasture and barren land, consists of mostly Farmland of Statewide importance.

Total Parcel Size (ac)	Maximum Buildable Area (ac)	Minimum Buildable Area (ac)	High End Production Est. (MW)	Low End Production Est. (MW)
273.549	19.5	19.5	3.90	2.44

Creator: EH Reviewer: JP

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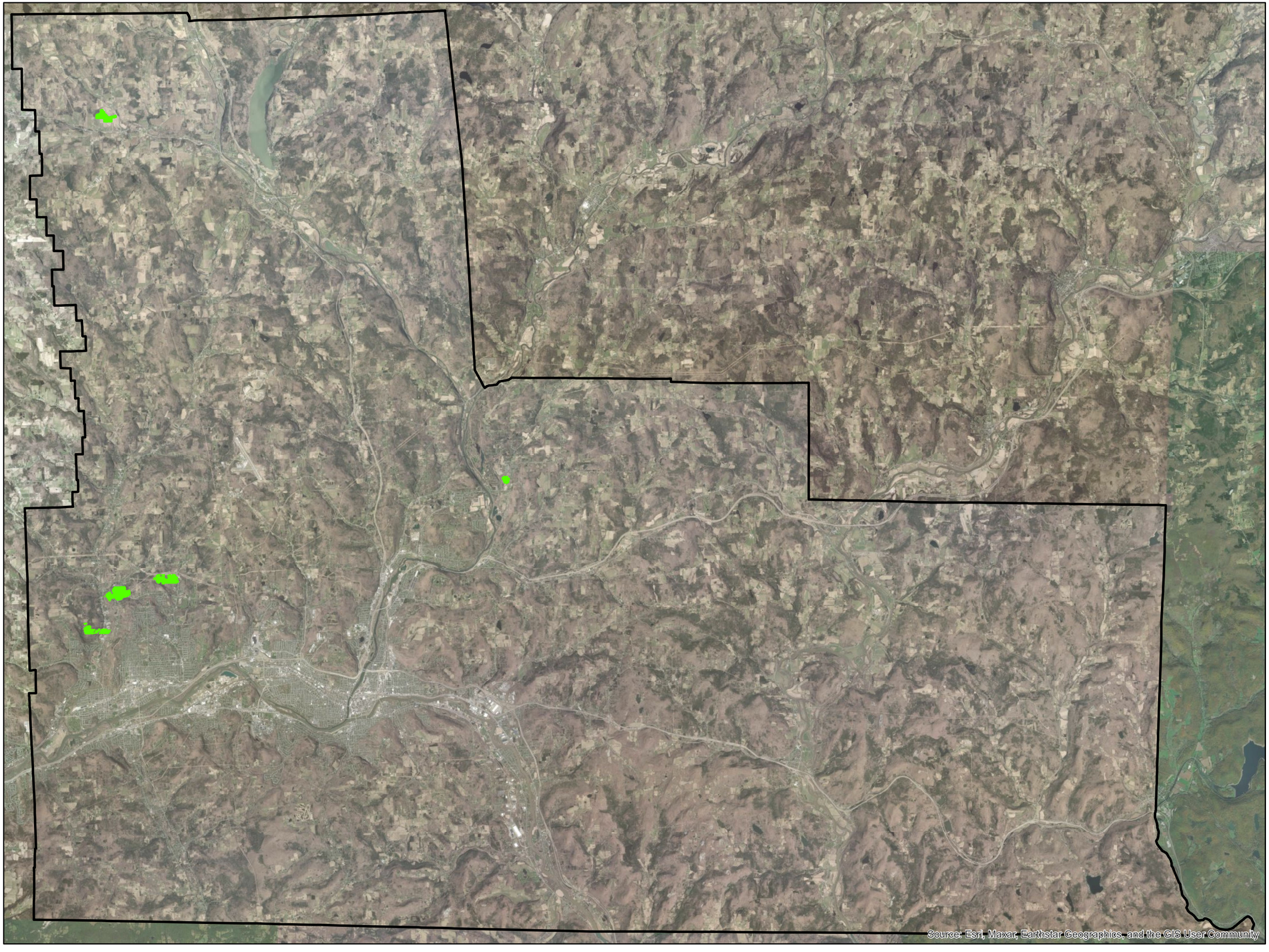

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Broome County

Community Energy Action Plan

N

0 5,000 10,000 15,000 Feet

1 in = 15,000 feet

Legend

Broome County

Tier 2 Screening

High Priority - 1

Number of
High Priority Sites:
11

Total Maximum
Buildable Acreage
286.5

Total High End
Production Estimate:
57.30

Total Low End
Production Estimate:
35.81

Sources:
1. Sites: Created by LaBella using information provided by the client (2024).
2. Basemap: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community (2023).

Renewable Energy High Priority Sites

FIGURE C-1

LaBella Project No: 2232762
Date: December 2024

Creator: EH Reviewer: JP

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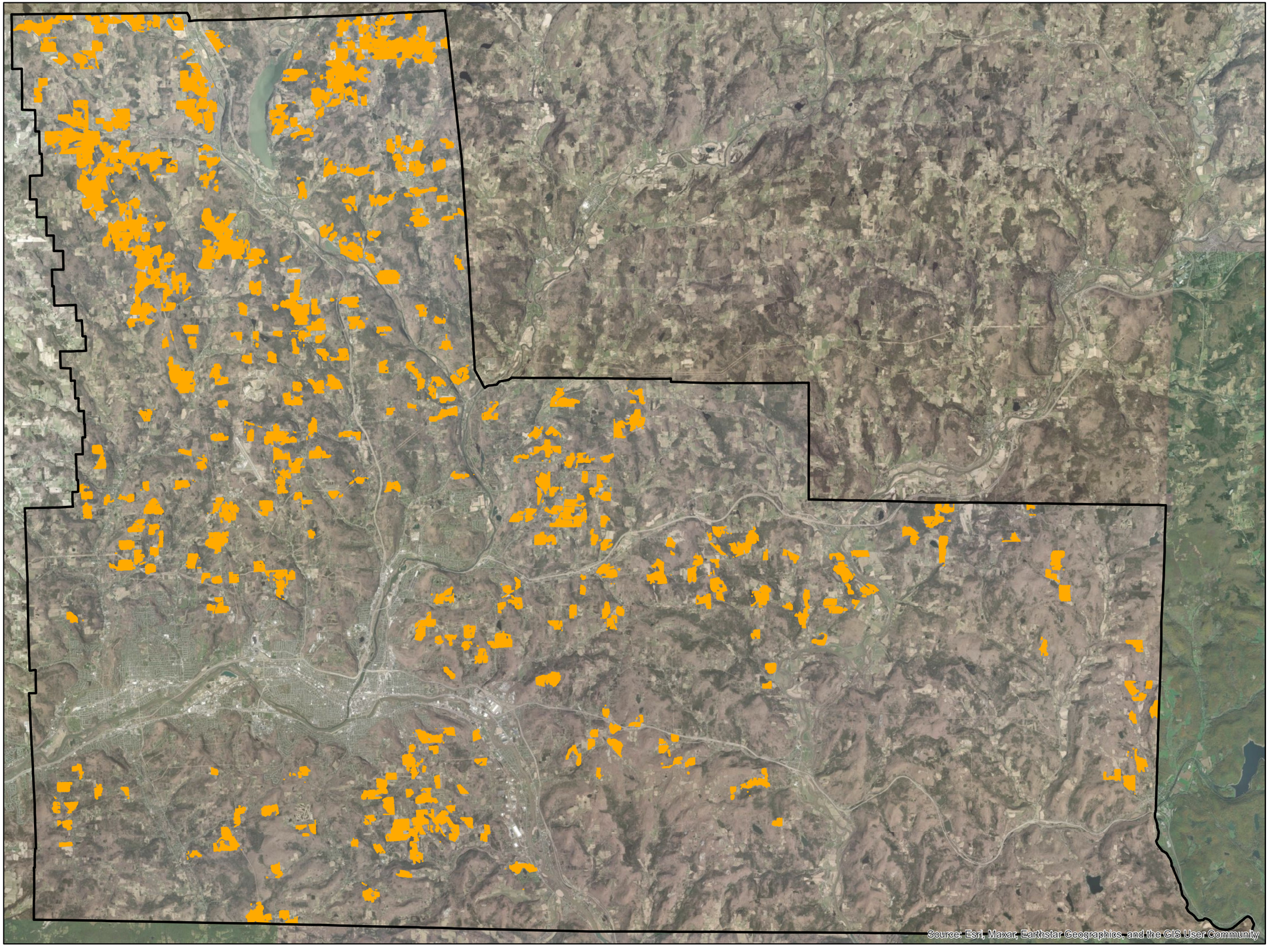

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Broome County

Community Energy Action Plan

N

0 5,000 10,000 15,000 Feet

1 in = 15,000 feet

Legend

Broome County

Tier 2 Screening

Medium Priority - 2

Number of
Medium Priority Sites:
505

Total Maximum
Buildable Acreage
17,686.2

Total High End
Production Estimate:
3,537.24

Total Low End
Production Estimate:
2,210.78

Sources:
1. Sites: Created by LaBella using information provided by the client (2024).
2. Basemap: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community (2023).

Renewable Energy Medium Priority Sites

FIGURE C-2

LaBella Project No: 2232762
Date: December 2024

Creator: EH Reviewer: JP

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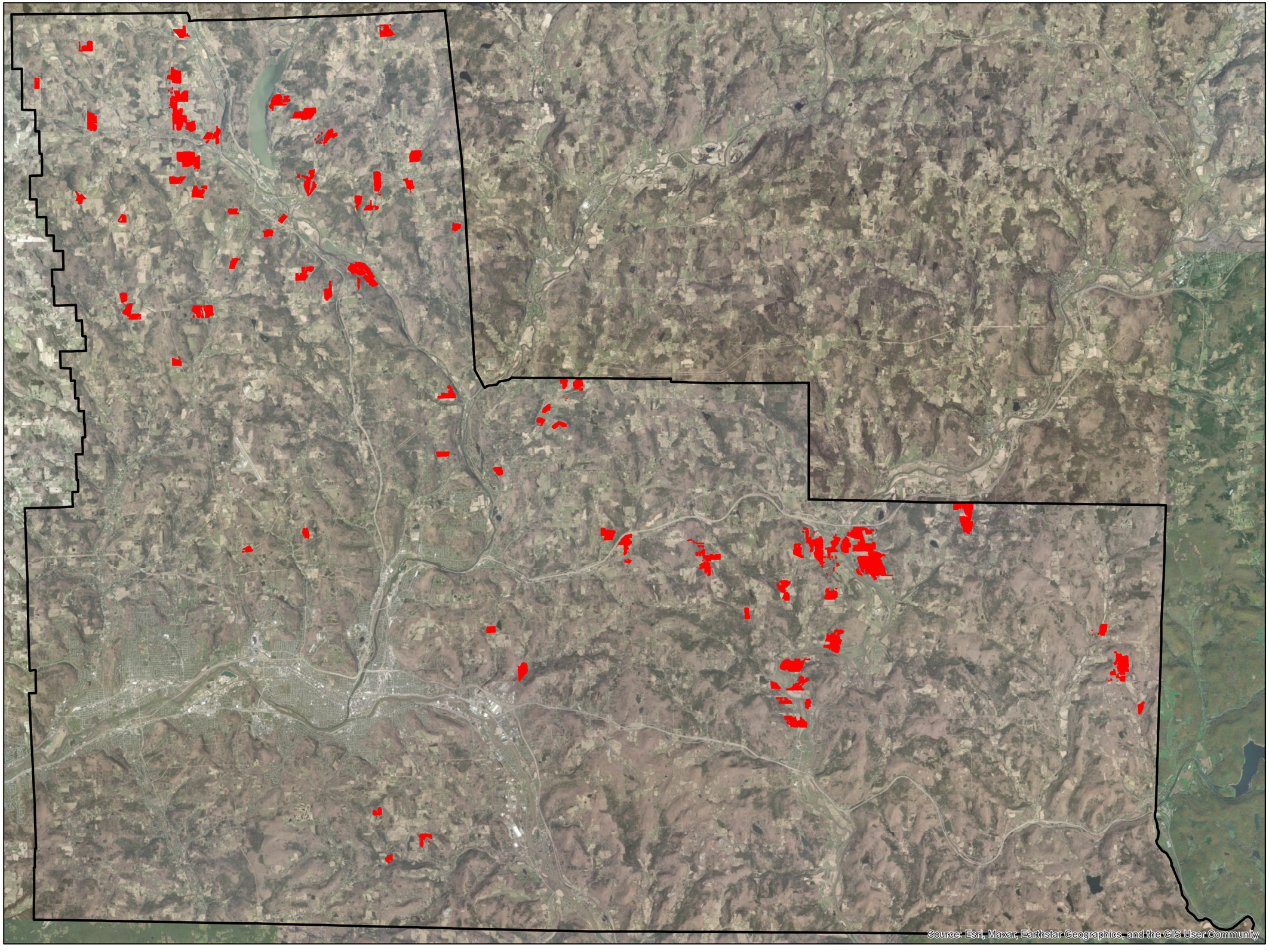

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Broome County

Community Energy Action Plan

N

0 5,000 10,000 15,000 Feet

1 in = 15,000 feet

Legend

Broome County

Tier 2 Screening

Low Priority - 3

Number of
Low Priority Sites:
91

Total Maximum
Buildable Acreage
3,306.8

Total High End
Production Estimate:
661.36

Total Low End
Production Estimate:
413.35

Sources:
1. Sites: Created by LaBella using information provided by the client (2024).
2. Basemap: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community (2023).

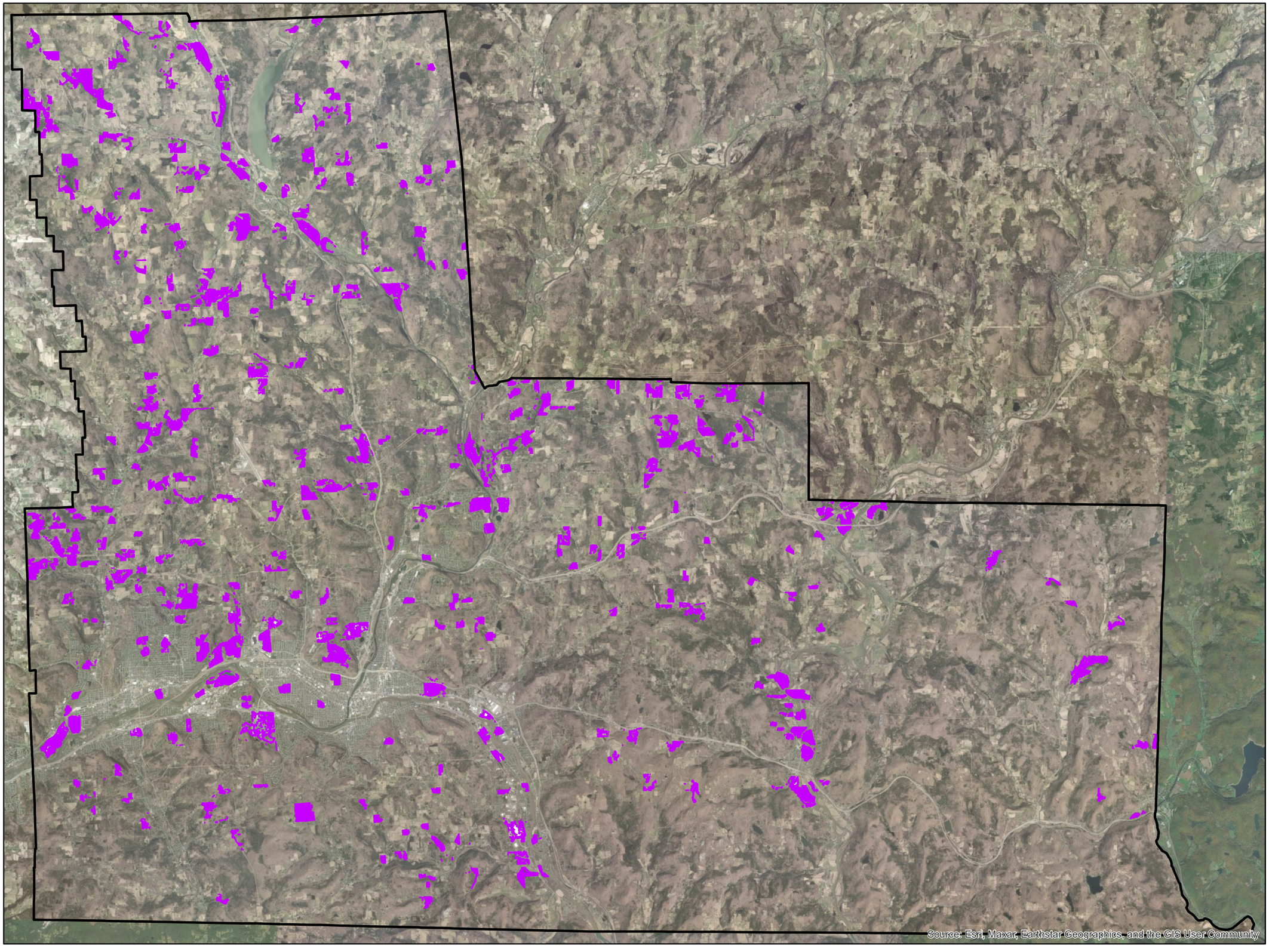
Renewable Energy Low Priority Sites

FIGURE C-3

LaBella Project No: 2232762
Date: March 2024

Creator: EH Reviewer: JP

Path: B:\GLOBAL\Projects\Broome County\2232762 - Sustainability Plan and Energy Action Plan\06_Drawings\DIG\Data\Output\Testing\EAP Drawings\EAP_NoGo.mxd



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Broome County

Community Energy Action Plan

N

0 5,000 10,000 15,000 Feet

1 in = 15,000 feet

Legend

Broome County

Tier 2 Screening

"No-Go" Areas - 0

Number of "No-Go" Areas: 428

Sources:
1. Sites: Created by LaBella using information provided by the client (2024).
2. Basemap: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community (2023).

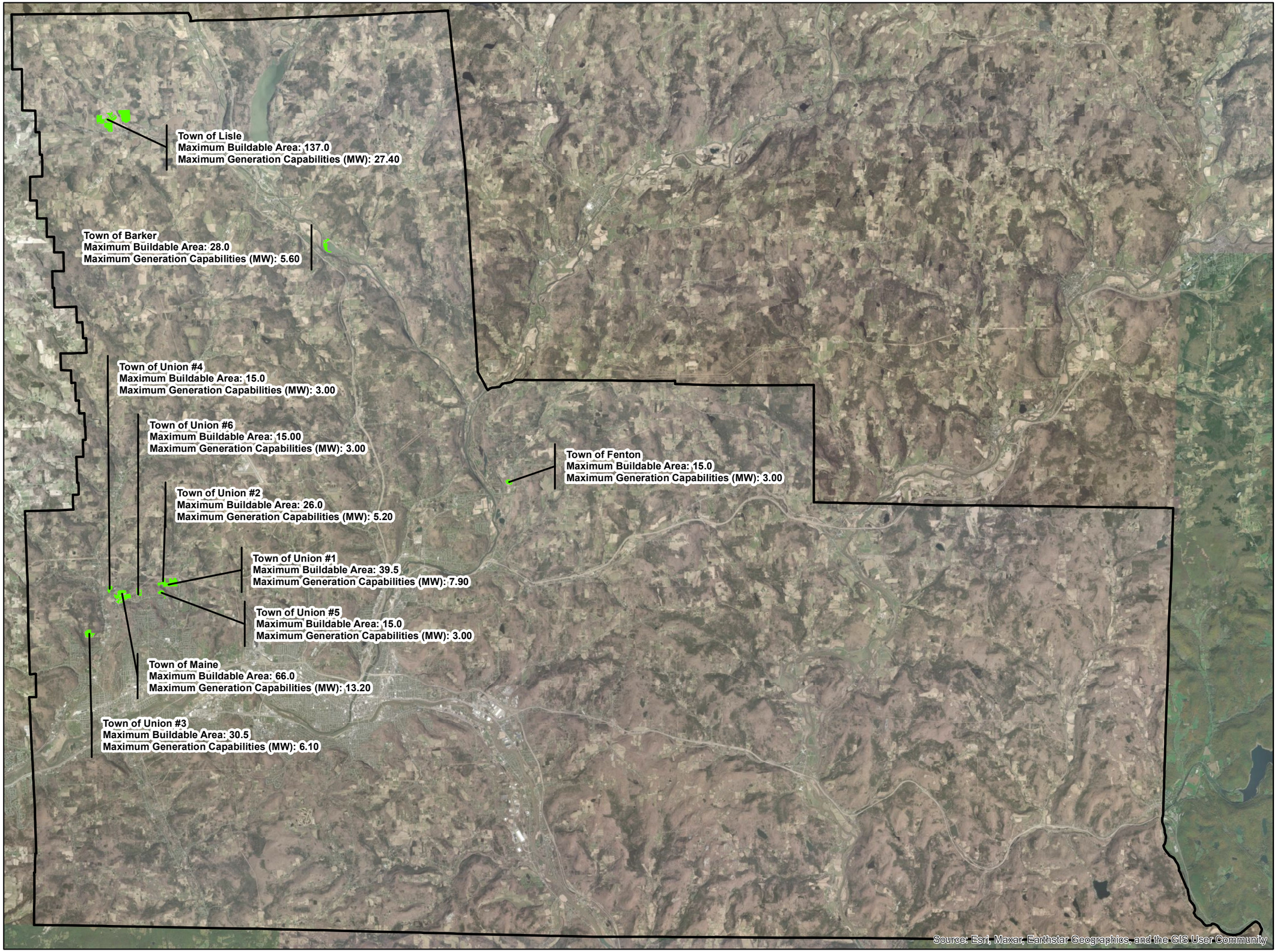
Renewable Energy Low Priority Sites

FIGURE C-4

LaBella Project No: 2232762
Date: December 2024

Creator: EH Reviewer: JP

Path: B:\GLOBAL\Projects\Broome County\2232762 - Sustainability Plan and Energy Action Plan\06_Drawings\DIG\Data\Output\Testing\EAP Drawings\EAP_PrioritySites.mxd



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Broome County

Community Energy Action Plan

N

0 5,000 10,000 15,000 Feet

1 in = 15,000 feet

Legend

- Broome County
- Top 10 Priority Sites' Buildable Areas

Sources:
1. Sites: Created by LaBella using information provided by the client (2024).
2. Basemap: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community (2023).

Top 10 Priority Renewable Energy Sites

FIGURE C-5

LaBella Project No: 2232762
Date: December 2024

Broome County Sustainable Operations Plan

Renewable Energy Siting Parameters

Parameter Rationale:

- Utility-scale solar (i.e. 20 MW or greater) is highly unlikely on County parcels
- No minimum project generation to account for potential rooftop solar
- No maximum distance to interconnection, as arrays may be installed "behind the meter" to offset energy usage at individual properties
- Only County-owned properties will be evaluated as part of this analysis
- Minimum property size selected to eliminate single-family residences, small properties that are unlikely to have high energy demands

Initial Screening Parameters:

Minimum Project/Buildable Area:	0.25 acres
Minimum Project Generation:	No minimum
Maximum Tree Clearing Area (% of Project Area):	10% (up to 10 acres); Up to 100% for areas ≤2 acres
Maximum Distance to Apparent Interconnection:	No maximum
Maximum Acceptable Slopes:	15%

Acceptable Land Use Types (NLCD):

- Barren Land (*High Priority*)
- Cultivated Crops (*Low Priority*)
- Deciduous Forest (*Low Priority*)
- Developed – Low Intensity (*Medium Priority*)
- Developed – Open Space (*High Priority*)
- Evergreen Forest (*Low Priority*)
- Hay/Pasture (*Medium Priority*)
- Herbaceous (*Low Priority*)
- Mixed Forest (*Low Priority*)
- Shrub/Scrub (*High Priority*)

Priority Parcels:

High Priority

- High-usage energy sites (to be determined from energy benchmarking analysis)
  - Top 15% of energy consumption properties
- NYSDEC/USEPA-listed Superfund Sites
  - Registry Sites: Class 3, 4, or 5
  - Non-Registry Site: Class C or N
- NYSDEC-listed Brownfield Cleanup Sites
  - Non-Registry Sites: Class C or N
- County- or Municipally-Owned Landfills
  - Closed for minimum of 15 years
  - Highest priority: C&D landfills
  - Medium priority: Industrial, non-hazardous landfills
  - Lowest priority: MSW landfills, hazardous waste landfills

- Barren, Undeveloped Land
    - Priority to land not listed as "Prime Agricultural Farmland"
- Medium-, and high-intensity sites
- Developed Open Space Sites
- Shrub/Scrub Land (i.e. land that has been cleared within past 10-15 years and not maintained)

Medium Priority

- Medium-energy usage sites (to be determined from energy benchmarking analysis)
    - Next 35% of energy consumption sites
- Developed Low Intensity Sites
- Agricultural Land, Hay/Pasture
    - Land not listed as "Prime Agricultural Farmland"

Low Priority:

- Low-energy usage sites (to be determined from energy benchmarking analysis)
    - Bottom 50% of energy consumption sites
- Agricultural Land, Cultivated Crops
    - Land not listed as "Prime Agricultural Farmland"
- Deciduous, Evergreen, Mixed Forests
- Herbaceous Areas
- Unique Natural Areas
- 500-year floodplains

"No-Go" Areas:

- Agricultural Land
    - Listed as "Prime Agricultural Farmland"
- NYSDEC/USEPA-listed Superfund Sites
    - Registry Sites: Class 1 and 2
    - Non-Registry Sites: Class A, P, and PR
- NYSDEC-Listed Brownfield Cleanup Sites:
    - Non-Registry Sites: Class A, P, and PR
- Environmental Easement Areas
    - Flood control areas
    - Municipal, State, and County parks
    - Land preservation areas
    - 100-year floodplains
- Utility rights-of-way
- Wetland areas