APPENDIX C

TOWN OF Dryden 2045 comprehensive plan update

CLIMATE ACTION PLAN

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APPENDIX C: CONTENTS

Climate Action Plan (41 pages)

Town of Dryden Community Greenhouse Gas Emissions Inventory Report (64 pages)

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Town of Dryden
Climate Action Plan

Town of Dryden, New York
Climate Action Plan

Compiled by the Central New York
Regional Planning and Development Board

June 29, 2021

Town of Dryden

93 East Main Street

Dryden, NY 13053

This Climate Action Plan (CAP) was compiled by the Central New York Regional Planning and Development Board (CNY RPDB) in support of the Dryden 2045 Comprehensive Plan Update project. Contributors include:

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I. Introduction

Background

The Climate Smart Communities Program represents a partnership between New York State and local governments to reduce energy use and GHG emissions while working to adapt to a changing climate. The required ten elements of the Climate Smart Communities Pledge are:

1. Build a climate-smart community.
2. Inventory emissions, set goals, and plan for climate action.
3. Decrease energy use.
4. Shift to clean, renewable energy.
5. Use climate-smart materials management.
6. Implement climate-smart land use.
7. Enhance community resilience to climate change.
8. Support a green innovation economy.
9. Inform and inspire the public.
10. Engage in an evolving process of climate action.

The Town of Dryden adopted the ten-element Climate Smart Communities Pledge as a commitment to greenhouse gas (GHG) emission reduction and climate change adaptation, and it became a Bronze Certified Climate Smart Community in September of 2019. The Climate Smart Communities Certification program recognizes communities that have gone beyond the ten pledge elements by completing and documenting mitigation and adaptation actions at the local level. Certified communities, like the Town of Dryden, are the foremost leaders in the state in terms of climate action. Communities can achieve certification at the Bronze, Silver, or Gold level (under development).

As a part of the update of the town comprehensive plan and building upon the municipal and community GHG inventories, the town decided to compile a Climate Action Plan (CAP). The CAP will use the GHG inventories as a baseline to outline a pathway towards reducing emissions.

It is important to note that local governments like the Town of Dryden do not have direct control over the majority of emissions that are created in the community by businesses and individuals. However, there are actions the Town of Dryden government can take to influence positive change in terms of reducing GHG emissions. This CAP will describe the types of actions the local government can implement to reduce emissions from municipal operations and to encourage emissions reductions within the wider Dryden community.

Climate Change and Greenhouse Gases

Climate change is recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the

United Nations Environment Program to provide objective and up-to-date information regarding the changing climate. In its 2014 Fifth Assessment Report, the IPCC states that there is **a greater than 95 percent chance that rising global average temperatures, observed since the mid-20th century, are primarily due to human activities.**[1]

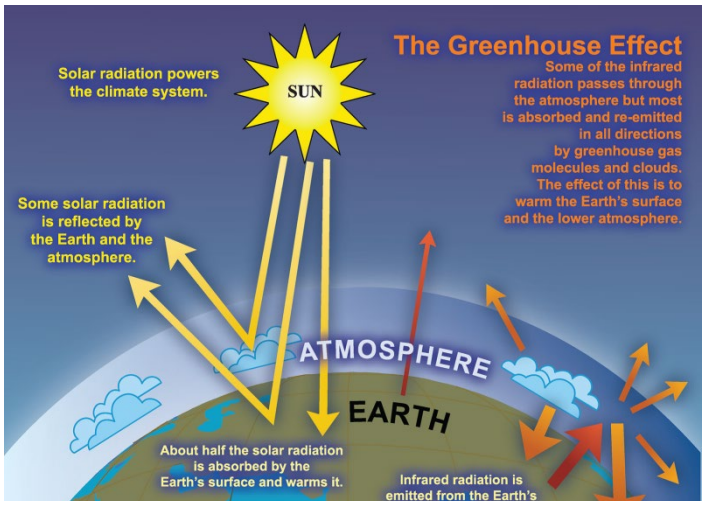

Figure 1: The Greenhouse Effect

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 1).[2] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures to continue efforts to curb emissions contributions to global warming, while simultaneously improving the capacity of communities to adapt to changing conditions so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts.

New York State outlined projected climate impacts and vulnerabilities in its 2011 ClimAid assessment and 2014 supplement (ClimAid Report).[3] The ClimAid report projects changes to ecosystems (e.g., increased presence of invasive species and shifts in tree composition), while water quality and quantity may also be impacted due to changes in precipitation. Potential beneficial economic impacts were also identified, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, more extreme heat events, sea level rise and coastal flooding, more frequent intense precipitation events, and human health risks.

We have already experienced the effects of a changing climate in New York State and abroad,[4] and the need for action to address climate mitigation and adaptation is imperative. The goal of

[1] IPCC. 2014. Fifth Assessment Report. https://www.ipcc.ch/report/ar5/syr/

[2] IPCC Working Group. https://wg1.ipcc.ch/publications/wg1-ar4/faq/wg1_faq-1.3.html

[3] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York

[4] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Envi

building community resilience in order to protect the health and livelihood of residents and natural systems serves as a motivating factor in the assessment of greenhouse gas contributions and effective sustainability planning.

The Purpose of a Climate Action Plan

Using municipal and community-wide emissions inventories as a baseline, a CAP evaluates ways a community can reduce greenhouse gas emissions, sets emissions reduction targets, and prioritizes actions to help mitigate climate change. This CAP also identifies the extent to which local actions support New York State's goal for a clean-energy economy.

In July 2019, Governor Cuomo signed the Climate Leadership and Community Protection Act (CLCPA) into law. The CLCPA is New York State's ambitious emissions reduction plan with the goal of making electricity 70% renewable by 2030 and 100% carbon neutral by 2040, reducing GHG emissions 40% below 1990 levels by 2030 and 85% below 1990 levels by 2050, implementing 6,000 MW of solar by 2025, 3,000 MW of energy storage by 2030, and 9,000 MW of offshore wind by 2035 (see Figure 2).

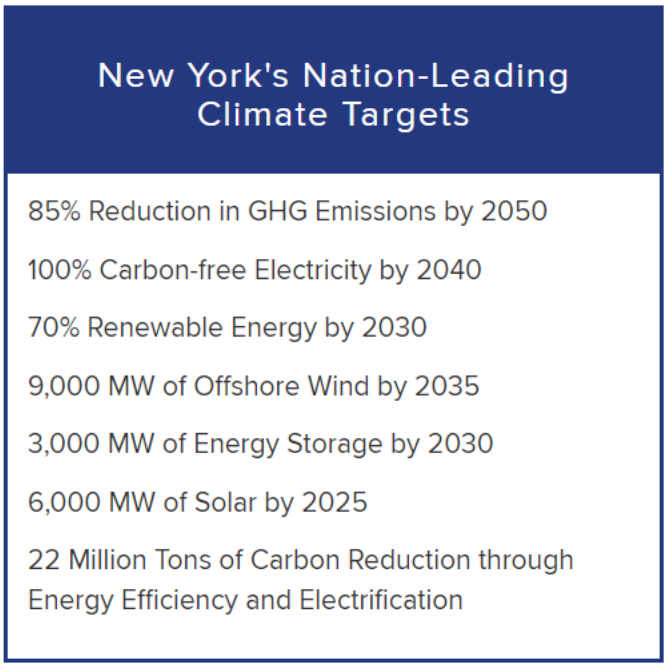

Figure 2: Overview of the CLCPA targets

Municipal governments play an important role in helping to reach these targets through local action and influence. This CAP provides goals for reducing emissions from municipal operations and from the Dryden community as a whole and includes specific recommendations for sectors such as transportation, building energy efficiency, solid waste disposal, and agriculture. The objectives of this Climate Action Plan are to:

ronmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York; and National Climate Assessment. 2014. Climate Change Impacts in the United States. https://nca2014.globalchange.gov/.

(1) Provide municipal elected officials, community leaders, and residents with information and support to advance sustainability programs throughout the community;
(2) Identify opportunities for emission reduction programs and initiatives; and
(3) Engage and encourage local participation in greenhouse gas emission reduction strategies.

An Advisory Committee composed of municipal representatives and community leaders met during the spring of 2021 to discuss emission reduction goals and specific strategies for reaching them. The committee agreed on a short-term goal of reducing municipal greenhouse gas emissions by 30% (247 $MTCO_2e$) and reducing community emissions by 30% (36,563 $MTCO_2e$) from the 2018 year by 2030, and a long-term goal of reducing municipal greenhouse gas emissions by 100% (822 $MTCO_2e$) and reducing community emissions by 85% (103,594 $MTCO_2e$) from the 2018 year by 2045.

Framework for this CAP

As noted previously, local governments like the Town of Dryden do not have direct control over the majority of emissions that are created in the community. However, local governments do have the ability to exert important influence in areas that indirectly impact community-wide emissions, as described below.

- **Municipalities have power over land use.**
  - The permitting of renewable energy facilities, like solar and wind farms, and battery energy storage is critical to meeting the state's clean energy targets and municipalities play a critical role in defining rules and processes for local development.
  - While it is hoped that we will transition to zero-emission vehicles (primarily battery-electric light- and medium-duty vehicles but probably also hydrogen fuel cell heavy-duty vehicles like buses and long-haul freight trucks), the "smart growth" agenda is still critical to facilitate public transit and non-motorized forms of travel by allowing/incentivizing mixed-use and higher density development.
- **Municipalities have police powers to address public health and safety.**
  - Municipalities can pass a local law to enforce green building codes such as the NYStretch Energy Code in their community, which is one cycle ahead of the current state energy code and results in an average reduction in building energy use of more than 10%.
- **Municipalities control vital public infrastructure.**
  - Some municipal facilities (e.g., wastewater treatment facilities or street lights) are very energy-intensive and upgrades to more efficient technology can provide substantial cost savings as well as emissions reductions.
  - Some municipal facilities (e.g., waste-to-energy facilities or the wastewater plants) can be leveraged to provide lower-carbon forms of electrical and thermal energy to the community.
- **Municipalities purchase lots of energy and energy-intensive materials and employ lots of people.**

    - By installing renewable energy on their facilities or properties, or subscribing to community solar projects, or purchasing Renewable Energy Certificates, they can lower the carbon footprint of their energy purchases.
    - Municipalities can implement enforceable green purchasing policies which require the use of lower-carbon products as long as the green alternative does not cost more than a certain percentage more than the standard product.
    - Municipalities can encourage or incentivize (e.g., free bus passes or free parking) their employees to take public transit, carpool or use a zero-emission vehicle, and can offer remote working and meeting options.
- **Municipalities set the local economic development agenda and policies.**
    - Municipalities can enact policies that encourage or even require the use of clean energy technologies (e.g., PILOTs or "density bonuses" or waivers of minimum parking requirements) by commercial businesses.
    - Municipalities can establish partnerships with local educational institutions, businesses, and non-profit organizations to address the workforce development needs for emerging clean energy markets, especially for disadvantaged communities.
- **Municipalities can "walk the talk" and set a powerful example for residents and businesses in the community.**
    - By organizing local Community Choice Aggregation programs, including those with opt-out community distributed generation (CDG), municipalities can provide an affordable alternative for residents in the community to purchase green electricity and they can earn points through the NYSERDA Clean Energy Communities Program for doing so.
    - Municipalities can support local education efforts (e.g., the HeatSmart Tompkins campaign) to promote electric vehicles or community solar, heat pumps and other clean technologies and earn points and grants through the NYSERDA Clean Energy Communities Program for doing so.
    - Municipalities can purchase electric vehicles and install charging stations and other clean technologies on their own property to demonstrate their viability.

Finally, municipalities like the Town of Dryden can create climate action plans such as this one that address these and other policies. It is very important that local elected officials support these measures, not only for their own communities but also to send an important signal to state and federal policy makers that they must do what is necessary at those levels to facilitate local action.

In addition, the Town of Dryden also recognizes the importance of incorporating fairness and affordability considerations in climate change mitigation efforts. It is important that the cost of certain actions be borne by those who can afford it to mitigate the cost burden on those who cannot and who otherwise would be disproportionately impacted by the effects of climate change. The emissions reduction strategies noted within this CAP are structured in a way to incorporate these considerations.

II. Greenhouse Gas Inventory Summaries

Community Inventory Summary

In 2013, the Town of Dryden's community emissions totaled 131,154 $MTCO_2e$, with the transportation sector contributing to 49% of the community's total emissions.

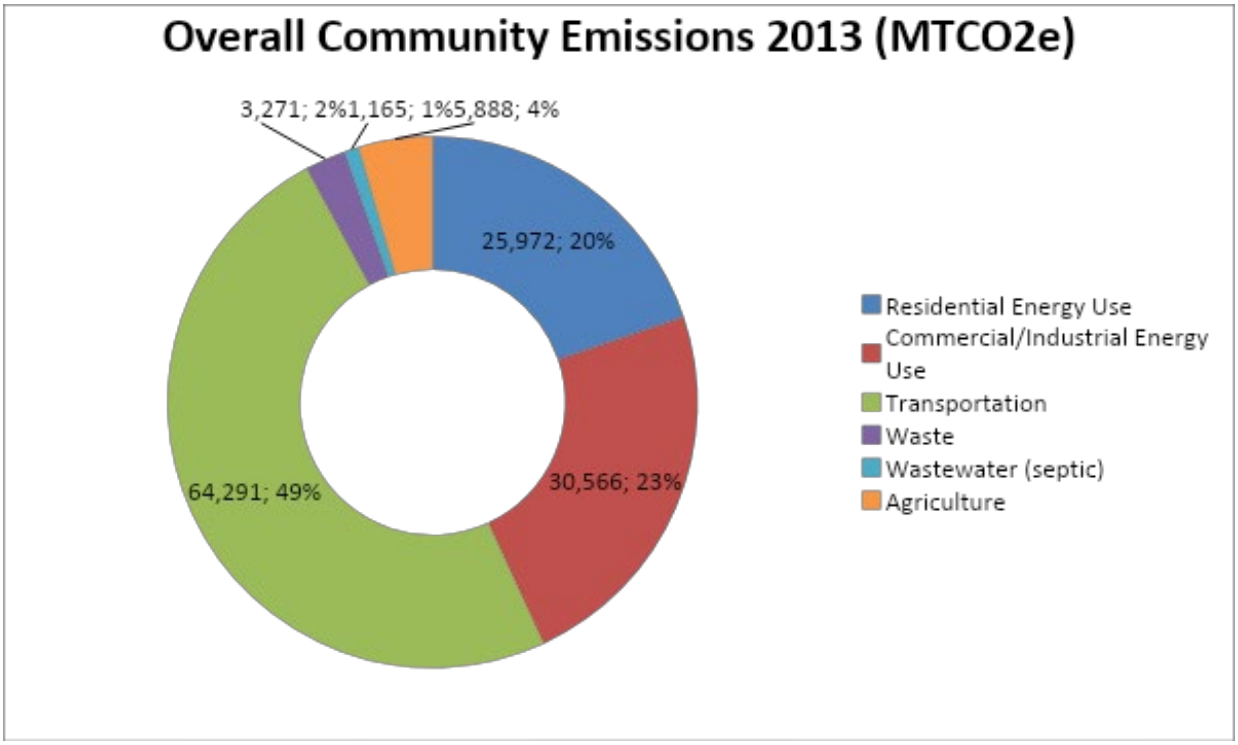

Figure 3: 2013 Community Emissions by Sector

In 2018, the Town of Dryden's community emissions totaled 121,875 $MTCO_2e$, with the transportation sector contributing to 51% of the community's total emissions.

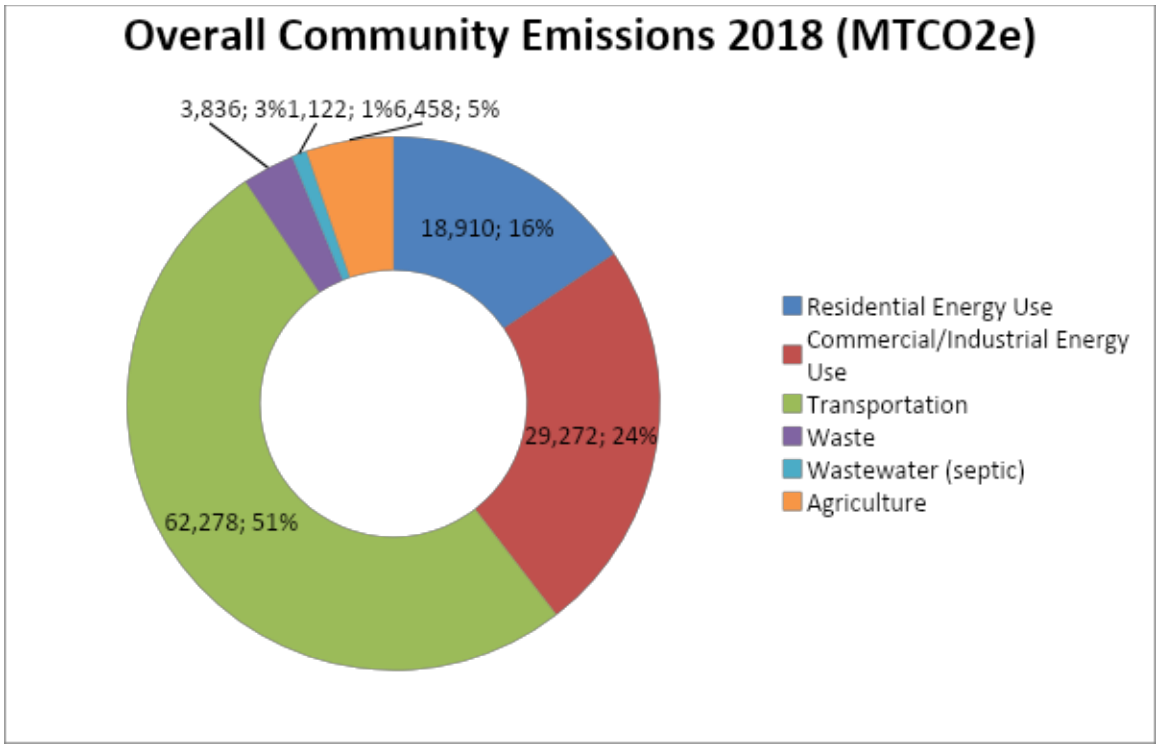

Figure 4: 2018 Community Emissions by Sector

Community Emissions Forecast

Assuming a business-as-usual scenario, emissions in the Town of Dryden are expected to decrease from 121,875 $MTCO_2e$ in 2018 to 109,988 $MTCO_2e$ in 2030 and to 95,450 $MTCO_2e$ in 2045, a decrease of about 9.8% and 21.7%, respectively. Emissions are expected to decrease in the residential, transportation, and wastewater sectors and increase in the commercial/industrial, waste, and agricultural sectors.

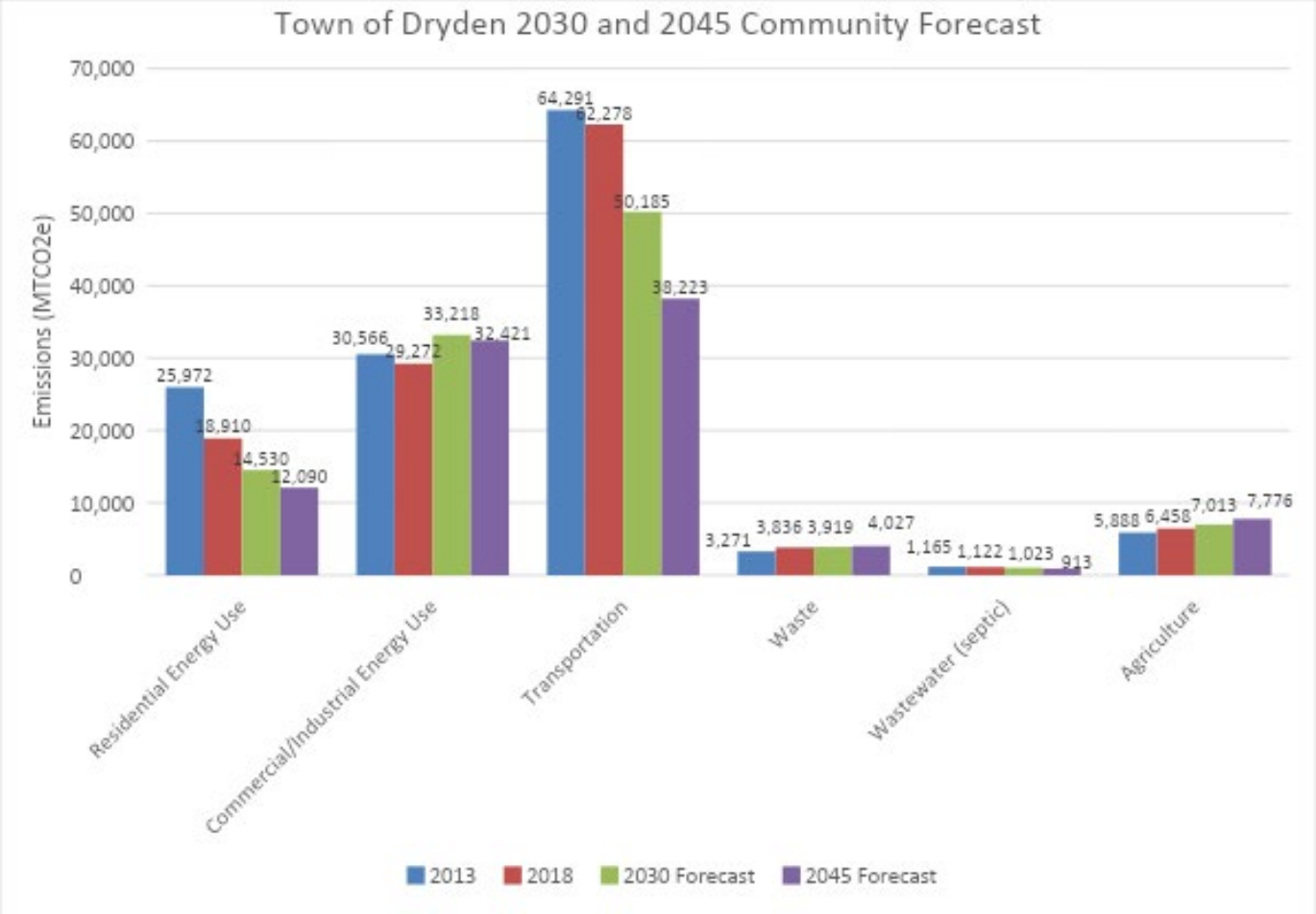

Figure 5: Town of Dryden 2030 and 2045 Community Emissions Forecast

Municipal Operations Emissions Inventory Summary

According to the municipal greenhouse gas inventory, emissions for the Town of Dryden municipal operations in 2013 totaled 750 $MTCO_2e$ compared to 822 $MTCO_2e$ in 2018. The vast majority of emissions resulted from mobile combustion from the municipal vehicle fleet both years.

Sector	2013 Emissions ($MTCO_2e$)	2018 Emissions ($MTCO_2e$)
Buildings and Facilities (electric and natural gas consumption)	116	98
Vehicle Fleet	604	694
Employee Commute	30*	30
Total Emissions	**750**	**822**

*Proxy for 2013 based on 2018 findings

Table 1: Town of Dryden Municipal Operations Emissions

Municipal Operations Emissions Forecast

Assuming a business-as-usual scenario, emissions in the Town of Dryden are expected to decrease in all sectors, with total emissions decreasing from 822 $MTCO_2e$ in 2018 to 692 $MTCO_2e$ in 2030 and to 572 $MTCO_2e$ in 2045, a decrease of about 15.8% and 30.4%, respectively.

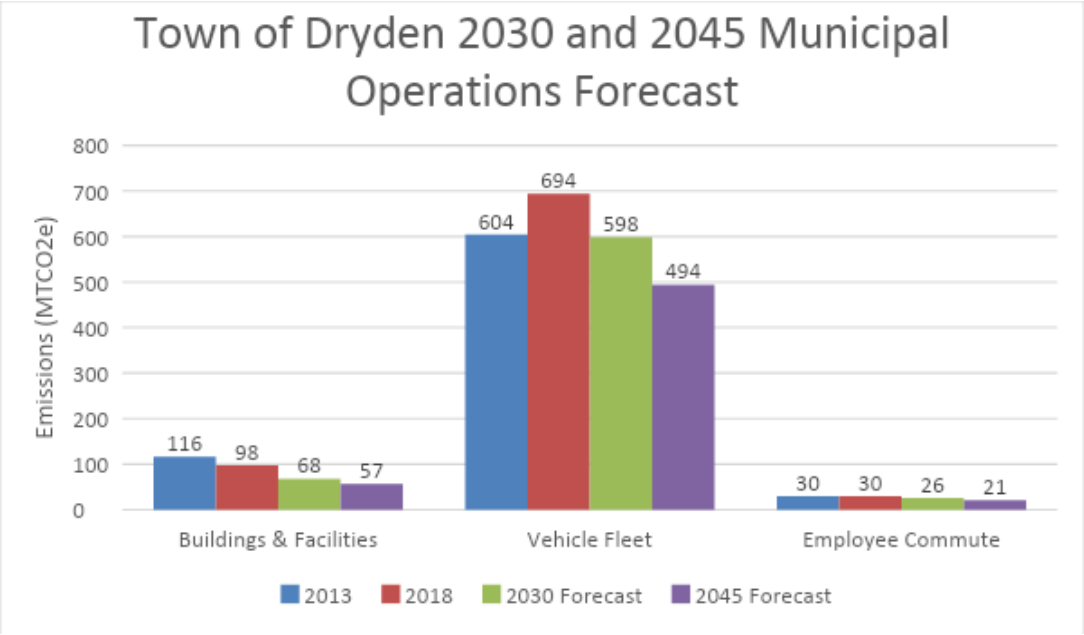

Figure 6: Town of Dryden 2030 and 2045 Municipal Operations Forecast

III. Emissions Reduction Target

The Town of Dryden Comprehensive Planning and Climate Action Planning Committee has set short-term and long-term goals for emissions reductions from both municipal operations and the larger community as described in the table below. The town plans to reassess the long-term goal within 5-10 years to be consistent with statewide emissions reduction goals moving forward.

	Short-Term Goal: 2030	Long-Term Goal: 2045
Municipal Operations	Reduce emissions from municipal operations by 30% from 2018 levels by 2030, or 247 $MTCO_2e$.	Reduce emissions from municipal operations by 100% from 2018 levels by 2045, or 822 $MTCO_2e$.
Community	Reduce emissions from the community by 30% from 2018 levels by 2030, or 36,563 $MTCO_2e$.	Reduce emissions from the community by 85% from 2018 levels by 2045, or 103,594 $MTCO_2e$.

Table 2: Town of Dryden Emissions Reduction Goals

IV. Emissions Reduction Strategies

As noted previously, during the spring of 2021, the Dryden Comprehensive Planning Advisory Committee met to discuss emissions reduction strategies from both municipal operations and from the community as a whole. As was acknowledged above, local governments do not have direct control over the majority of emissions that are created in the community; however, there are actions the Town of Dryden government can take to influence positive change in terms of reducing GHG emissions. The emissions reduction strategies below are therefore focused on actions the local government can implement to reduce emissions from municipal operations and to encourage emissions reductions within the wider Dryden community.

Municipal Operations Reduction Strategies

The table below explains the emissions reduction strategies the Town is either currently undertaking or is interested in considering in the future related to reducing emissions from municipal operations.

Sector	Strategy	Implementation Path	Partners	Notes
Buildings and Facilities	Building energy efficiency retrofits	The town can work with HeatSmart Tompkins and participating installers or other state and utility programs to implement insulation/air sealing, LED lighting, water conservation measures, variable frequency drives (VFDs) for water/sewer system, etc.	NYSEG; HeatSmart Tompkins; NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	If a 10% reduction in building emissions is achieved, the town can become eligible for Clean Energy Upgrades action as part of the Clean Energy Communities program. This is also a CSC Certification action - PE3 Action: Clean Energy Upgrades. The town has already converted lighting to LED in the Highway/DPW garage and office, and all outdoor lighting has been converted to LED. The town has adopted a municipal benchmarking resolution, so if benchmarking-advanced reporting is completed through the CEC program, building energy use reports from Portfolio Manager can be used to inform decision-making on which buildings might have highest potential for energy efficiency upgrades.
Buildings and Facilities	Building electrification (heat pumps)	The town can work with HeatSmart Tompkins and participating installers or other state and utility programs to implement insulation/air sealing	HeatSmart Tompkins; NYSEG; NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	The town hall is already using geothermal for heating and cooling (installed in 2007), although the town will be replacing the existing geothermal system and supplementing with air source heat pumps in certain areas as needed. This project will make the building operate more efficiently and is already approved by the Town Board to move forward in the near-term. If

Sector	Strategy	Implementation Path	Partners	Notes
		and heat pump projects		a 10% reduction in building emissions is achieved through new heat pump installations, the town can become eligible for Clean Energy Upgrades action as part of the Clean Energy Communities program. If a public building open to the public year-round is converted to heat pumps for all heating/cooling and hot water needs, the town could also be eligible for Clean Heating and Cooling Demo action. The town could therefore receive credit for CSC Certification action PE3 Action: Clean Energy Upgrades. The town already has received credit for CSC Certification PE4 Action: Heat Pumps.
Buildings and Facilities	LED streetlights	The town can work through the utility's program or work with NYPA or another contractor through the municipal purchase option to convert to LED streetlights. Free technical assistance provided by CEC coordinator to help consider options.	NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	The town has decided to work with NYPA on implementing this action. This is one of NYSERDA's Clean Energy Communities actions and also CSC Certification action PE3 Action: LED Street Lights.
Buildings and Facilities	Renewable energy installations	The town can consider other locations for installing solar.	NYSERDA Clean Energy Communities Coordinator (CCE-Tompkins); NY-Sun resources	Solar installed on the town hall and highway garage roofs already; If a 10% reduction in building emissions is achieved from new solar installations, the town can become eligible for the Clean Energy Upgrades action as part of the Clean Energy Communities program. This is also associated with CSC Certification actions PE3 Action: Clean Energy Upgrades and PE4 Action: Solar Energy Installation or PE4 Action: Power Purchase Agreement for Renewables (depending on if the solar array is owned by the solar installer or the local government). The town has already received 14 points through CSC Certification action and PE4 Action: Solar Energy Installation for the existing solar array but could achieve additional points for additional solar installations.

Sector	Strategy	Implementation Path	Partners	Notes
Buildings and Facilities	Renewable energy subscriptions	The town can consider supporting a local community solar farm by subscribing.	NYSERDA Clean Energy Communities Coordinator (CCE-Tompkins); NY-Sun resources	If a 10% reduction in building emissions is achieved through community solar subscriptions covering municipal accounts not already offset by solar installed on town property, the town can become eligible for the Clean Energy Upgrades action as part of the Clean Energy Communities program. This is also associated with CSC Certification actions PE3 Action: Clean Energy Upgrades.
Buildings and Facilities	100% Renewable Energy Commitment	The town could make a commitment to purchasing Renewable Energy Certificates (RECs) to cover 100% of its electricity needs that are not met by on-site renewable energy.	NYSERDA Clean Energy Communities Coordinator (CCE-Tompkins)	If RECs are purchased to offset 100% of municipal electric use, the town can also qualify for the CEC 100% Renewables action. The town is considering this through various pathways. The CSC Certification program also has an action for purchasing RECs, PE4 Action: Renewable Energy Certificates is available on a sliding scale if RECs are purchased for at least 25% of municipal electric use.
Buildings and Facilities	Green building policy	The town can implement a green building policy for capital improvement projects (i.e., LEED certification or other) as long as the lifecycle cost is no more than 10% higher than standard construction.	LEED, other green building programs	This is also an action through the CSC Certification program: PE3 Action: Green Building Standard for Government Buildings
Transportation	Alternative fuel vehicles	The town can create an EV and Fuel-Efficient Vehicle Purchasing Policy to mandate converting town vehicles to biodiesel, all electric, or plug-in hybrid, as long as the clean vehicle alternative is no more than 10% more costly when considering Total Cost of Ownership (TCO).	NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	Electric options for medium and heavy duty vehicles can currently be cost-prohibitive. The town can look into the NYS Truck Voucher Program and future opportunities to help pay for more costly electric medium and heavy duty vehicles. In the meantime, the town can consider biodiesel as an alternative. This is one of NYSERDA's Clean Energy Communities actions and also CSC Certification action PE3 Action: Advanced Vehicles.

Sector	Strategy	Implementation Path	Partners	Notes
Transportation	Right-sizing vehicle fleet/fleet efficiency policy	The town can ensure the municipal fleet is appropriately sized and efficient by implementing a fleet efficiency policy with minimum efficiency requirements and ensuring the most appropriate vehicle is used for tasks	NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	The town has already completed a fleet inventory, CSC Certification action PE3 Action: Fleet Inventory. The town can use this information to inform a right-sizing effort and/or fleet efficiency policy. The Climate Smart Communities Certification Program has resources for right-sizing vehicle fleet and/or creating a fleet efficiency policy through PE3 Action: Fleet Efficiency Policy, and PE3 Action: Fleet Rightsizing.
Transportation	Flexible schedules	The town can establish alternative work schedules including telecommuting options to reduce employee commute.		
Transportation	Flexible meeting options	The town can consider holding town meetings in Zoom or hybrid formats if state requirements allow.		
Transportation	Alternative transportation: electric vehicle charging stations	The town can install Level 2 charging stations as needed to accommodate employee use of EVs.	NYSERDA, NYSEG, NYS DEC	The town has already installed a level 2 charging station at the town hall and could receive points through CSC Certification PE6 Action: Alternative-fuel Infrastructure. ChargeReady NY and NYSEG Make-Ready programs provide funding for installation of Level 2 charging stations open to the public; DEC ZEV Rebate Program also available now
Transportation	Alternative transportation: bicycle infrastructure	The town can install bicycle parking and/or bicycle shelter as needed to accommodate employees and visitors. The town already has a few bicycles available for employee use around town.	NYSERDA, NYSEG, NYS DEC	There is currently a CSC Certification action related to this - 6.12 Implement Strategies That Increase Public Transit Ridership and Alternative Transport Modes, which may be removed or updated after July 2, 2021.

Sector	Strategy	Implementation Path	Partners	Notes
Transportation	Alternative transportation: subsidy for public transit use and/or ride-sharing	The town can provide a modest subsidy for public transit use and promote the county-wide ride-share program to reduce the impact of employee commuting.	TCAT, Way2Go	There is currently a CSC Certification action related to this - 6.12 Implement Strategies That Increase Public Transit Ridership and Alternative Transport Modes, which may be removed or updated after July 2, 2021.
Waste	Environmentally preferred purchasing policy-waste reduction	The town can implement a sustainable purchasing policy that mandates recycled and low-packaging waste products as long as the cost is no more than 10% higher than the standard option.		Such a policy should include specific language that the town shall purchase the green alternative as long as it is no more than 10% more expensive compared to the traditional product.

To assist in considering strategies moving forward, a number of strategy metrics were considered for each strategy, including impact of implementation, achievability, estimated cost, timeframe of implementation, and priority to the town. The priority scores noted in the table below reflect feedback from the committee in terms of whether the strategy should be a high, medium, or low priority for the town moving forward. High responses received a score of 3, medium responses received a score of 2, and low responses received a score of 1. Scores were averaged to provide the priority score seen in the table.

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium =2, high=3)
Buildings and Facilities	Building energy efficiency retrofits	moderate	moderate effort	medium	short-term to medium-term	2.5
Buildings and Facilities	Building electrification (heat pumps)	moderate	moderate effort	medium to high	short-term to medium-term	2.25

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium =2, high=3)
Buildings and Facilities	LED streetlights	moderate	low-hanging fruit	low (if through utility's program); high (if purchasing streetlights)	short-term	3
Buildings and Facilities	Renewable energy installations	moderate	moderate effort	low (if PPA); high (if owning system)	short-term	2.75
Buildings and Facilities	Renewable energy subscriptions	moderate	low-hanging fruit	low	short-term	2.75
Buildings and Facilities	100% Renewable Energy Commitment	high	low-hanging fruit to moderate effort	medium	short-term to medium-term	2.25
Buildings and Facilities	Green building policy	moderate	low-hanging fruit	low	short-term	3
Transportation	Alternative fuel vehicles	moderate, as more heavy-duty EVs become available	heavy lift (currently), hopefully low-hanging fruit in future	medium to high	long-term	2.75
Transportation	Right-sizing vehicle fleet/fleet efficiency policy	moderate	moderate effort	low	ongoing	3
Transportation	Flexible schedules	low	moderate effort	low	ongoing	2.75
Transportation	Flexible meeting options	low	low-hanging fruit	low	ongoing	2.75
Transportation	Alternative transportation: electric vehicle charging stations	low	low-hanging fruit	medium	short-term	2

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium =2, high=3)
Transportation	Alternative transportation: bicycle infrastructure	low	low-hanging fruit	low	short-term	3
Transportation	Alternative transportation: subsidy for public transit use and/or ride-sharing	low	low-hanging fruit	low	short-term	1
Waste	Environmentally preferred purchasing policy-waste reduction	low	low-hanging fruit	low	ongoing	2.75

Discussion

Buildings and Facilities

The Town of Dryden has already implemented a number of strategies to reduce energy use and emissions from municipal buildings and facilities, including converting lighting in municipal facilities to LEDs, adopting benchmarking of municipal building energy use, installing geothermal at the Town Hall, and installing solar PV on the roofs of the Town Hall and Highway Garage. The town is in the process of replacing the geothermal system at the Town Hall with a more efficient version, converting street lights to LEDs, and considering options for purchasing renewable energy certificates (RECs). In the future, the town can consider implementing other energy efficiency measures at buildings and facilities, installing additional renewable energy projects to offset municipal electric use, and supporting a community solar farm by subscribing municipal accounts that are not already offset by renewable energy on town properties. The town can also consider adopting a green building policy for capital improvement projects to ensure any new town buildings or additions are built to a high efficiency standard.

Transportation
The Town of Dryden has already installed an electric vehicle charging station at Town Hall and has completed a fleet inventory. The town can consider using the fleet inventory to inform a right-sizing effort and/or fleet efficiency policy, establishing alternative work schedules including telecommuting (for applicable employees), continuing to hold town meetings in Zoom or hybrid formats if state requirements allow, installing bike racks, and providing a modest subsidy for public transit use and/or to encourage employee ride-sharing. The town can also consider installing additional electric vehicle charging stations and/or implementing an electric vehicle and fuel-efficient vehicle purchasing policy to mandate converting town vehicles to biodiesel, all electric, or plug-in hybrid, as long as a clean vehicle alternative is no more than 10% more costly when considering Total Cost of Ownership (TCO).

Waste
The town can consider implementing a sustainable purchasing policy that mandates recycled and low-packaging waste products as long as the cost is no more than 10% higher than the standard option.

The strategies outlined above related to reducing emissions from municipal operations can also benefit the town in relation to NYSERDA's Clean Energy Communities and DEC's Climate Smart Communities Certification programs.

Community Reduction Strategies

The table below explains the emissions reduction strategies the town is either currently undertaking or is interested in considering in the future related to reducing emissions from the Dryden community.

Sector	Strategy	Implementation Path	Partners	Notes
Transportation	Significant Transportation Education and Outreach Campaigns	The town can continue to encourage/support EV conversion through assistance with community-wide EV education events and/or aggregation programs	NYSERDA Clean Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins); City of Ithaca; Sustainable Tompkins; TCAT; Way2GoPlug In America (bi-annual "Ride and Drive" events; TC3 as potential co-host/location for events)	EV community campaign is CEC HIA and action grant-eligible if at least 10 purchases through the campaign. It is also a CSC Certification action - PE8 Action: Community Campaigns. Additional points could be earned through both CSC Certification and CEC for additional charging stations installed by the town.

Sector	Strategy	Implementation Path	Partners	Notes
Transportation	EV Charging Station Infrastructure	The town can incentivize the deployment of EV charging stations through adopting streamlined permitting processes for installation on private property including multi-family buildings and public rights-of-way	NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	NYSERDA has published resources on EV Charging Station permitting: https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Siting/EV-Charging-Station-Permitting-Resources
Transportation	EV Charging Station Infrastructure	The town can require the deployment of EV charging stations through requiring new and substantially rehabbed buildings to include EV charging stations and/or to be "EV ready." The town can also install EV charging stations for public use.	NYSERDA Clean Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins)	The town has already installed a level 2 charging station at the town hall and could receive points through CSC Certification PE6 Action: Alternative-fuel Infrastructure. The town can educate residents and businesses about NYSERDA ChargeReady NY and NYSEG Make-Ready program incentives
Transportation	Anti-Idling Regulation	The town can promote adherence to existing ordinance.	The town can work with the local school board to educate parents and bus operators as appropriate	The US EPA has published a Compilation of State, County, and Local Anti-Idling Regulations: https://www.epa.gov/sites/production/files/documents/CompilationofStateIdlingRegulations.pdf
Transportation	Launch an Eco-Driving Campaign Alongside Employers	The town can launch an Eco-Driving Campaign with large employers and institutions like TC3 to encourage shared driving, public transit, or car-free days by celebrating/thanking dedicated riders, etc.	Dryden public schools, TC3; Cornell University (intern support); Cornell Cooperative Extension; TCAT; Way2Go	

Sector	Strategy	Implementation Path	Partners	Notes
Transportation	Establish a Bicycle Advisory Committee and pursue certification as a Bicycle-Friendly Community through The League of American Bicyclists	The town can follow the Building Blocks of a Bicycle Friendly Community (e.g., bicycle education in schools, bike-to-work events, bike month, create a bicycle plan)	Dryden public schools, TC3, Tompkins County; Ithaca-Tompkins County Transportation Council; Bike Walk Tompkins; Cornell University (intern support); Cornell Cooperative Extension; local bike shops; Finger Lakes Cycling Club	City of Ithaca achieved Bronze-level in 2016 (Buffalo, Rochester and NYC also); Safe Routes to Schools
Transportation	Improve bike infrastructure	The town can implement bike infrastructure (e.g., bike lanes, sharrows, bike racks, signage, bike share program) in strategic locations; Town can make trails usable year-round.	Tompkins County planning	i.e. in Varna and Etna, around/adjacent to the Villages of Dryden and Freeville, school routes, Dryden rail trail/other trail systems. This is also a CSC Certification action - PE6 Action: Planning & Infrastructure for Bicycling & Walking.
Transportation	Improve pedestrian infrastructure	The town can implement pedestrian infrastructure (i.e. sidewalks, signage, etc.) in strategic locations and make trails usable year-round.	Tompkins County planning	i.e. in Varna and Etna, around/adjacent to the Villages of Dryden and Freeville, school routes, Dryden rail trail/other trail systems. This is also a CSC Certification action - PE6 Action: Planning & Infrastructure for Bicycling & Walking.
Transportation	Increase transit coverage area/ride sharing	The town can partner with TCAT and Cortland bus systems to increase transit coverage and ridership, including transit stop improvements. Park and ride lots could also be made available/promoted for carpooling.	Tompkins and Cortland Counties; Ithaca-Tompkins County Transportation Council	connecting TCAT and Cortland bus systems? Town briefly launched "Last Mile" transit service to connect users within 1 mile to transit services before COVID, goal to get up and running again. TC3 Cortland Area Transit/Way-to-go other items to consider. There are two CSC Certification actions related to this action - 6.12 Implement Strategies That Increase Public Transit Ridership and Alternative

Sector	Strategy	Implementation Path	Partners	Notes
				Transport Modes, which may be removed or updated after July 2, 2021, and PE3 Action: Incentives for Employee Carpooling & Transit.
Transportation	Compact development	The town can consider revising zoning to encourage compact, mixed-use development, especially for affordable housing projects to be located in clusters close to destination to reduce transportation burden on low and moderate-income residents.	Tompkins County planning	County nodal development strategy report encompasses this idea. There is currently a CSC Certification action related to this - 6.2 Incorporate Smart Growth Principles into Land-use Policies and Regulations, which may be removed or updated after July 2, 2021.
Transportation	Ban on new gas stations	The town can enact a ban on the construction of new gas stations.	Elected Officials to Protect America, Sierra Club, Pace University Law	The City of Petaluma, CA enacted such a ban in March 2021: https://petaluma.granicus.com/MetaViewer.php?view_id=31&clip_id=3218&meta_id=483708.
Residential	Residential building electrification (heat pumps)	The town can partner with HeatSmart Tompkins to educate community members about heat pumps/energy efficiency upgrades. The town can educate community members on available incentives through the utility, EMPOWER, and Assisted Home Performance programs (part of what HeatSmart Tompkins does). The town can consider revising site plan review to include energy/sustainability considerations. The town can also consider revising zoning to include incentive zoning for efficiency/heat pump measures, especially	HeatSmart Tompkins; NYSERDA Clean Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins)	The town Planning Board already encourages new buildings to consider heat pumps. This action could also qualify the Town for the Community Campaigns - Clean Heating and Cooling/Energy Efficiency action as part of the Clean Energy Communities program if enough heat pumps/insulation/air sealing projects are completed (10). The town has already begun working on this community campaign. It is also a CSC Certification action - PE8 Action: Community Campaigns.

Sector	Strategy	Implementation Path	Partners	Notes
		when tied with affordable housing projects.		
Residential	Educate residents about energy efficiency and conservation	The town can partner with HeatSmart Tompkins and others to educate community members about heat pumps/energy efficiency upgrades. The town can educate community members on available incentives through the utility, EMPOWER, and Assisted Home Performance programs (part of what HeatSmart Tompkins does). The town can encourage the local realtor community to include energy performance in the Multiple Listing Service (MLS) Property Inventory. The town can partner with Dryden public schools, TC3, CCE-Tompkins or other partners to organize "Neighborhood Energy Blitz" energy savings and water conservation kit distribution events. Educate residents on water conservation measures including rain barrels, rain gardens and permeable pavement. Encourage builders and landscape professionals to participate in community landscape conservation and water efficient landscaping workshops.	HeatSmart Tompkins; NYSERDA Clean Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins), Ithaca Board of Realtors	This action could also qualify the town for the Community Campaigns - Clean Heating and Cooling/Energy Efficiency action as part of the Clean Energy Communities program if enough heat pumps/insulation/air sealing projects are completed (10). The town has already begun working on this community campaign. It is also a CSC Certification action - PE8 Action: Community Campaigns. Can also utilize Sustainable Tompkins' Climate Fund, "WRAP" from the Tompkins County Office of Aging, the USDA Rural Development sec. 504 program, and with Tompkins County Action.
Residential	Energy efficient new construction	The town can consider adopting future stretch energy codes. Stretch codes	NYSERDA Circuit Rider for NYStretch (Lou Vogel for Southern Tier);	The Town Board has already adopted the NYStretch Code 2020. Both the Town Board

Sector	Strategy	Implementation Path	Partners	Notes
		apply to new construction and substantial rehab projects only. The town can continue to share the Tompkins County Energy Recommendations for New Construction with builders. The town can encourage planting of shade trees for new construction with eastern, southern or western exposure, when feasible. The town can consider requiring EV and solar-readiness in new construction projects. The town can meet with local builders and contractors to discuss barriers and interest in pursuing green build strategies.	NYSERDA Clean Energy Communities Contractor (CCE Tompkins); Tompkins/Cortland Builders and Remodelers Association	and Planning Board currently encourage developers to follow the Tompkins County Energy Recommendations for New Construction, self-score their project and share the results. Adopting the NYStretch Energy Code is also a High Impact Action through CEC and is also eligible for an action grant if adopted before 12/31/21. It is also a CSC Certification action - PE6 Action: NYStretch Energy Code.
Residential	Mandatory energy benchmarking and disclosure	The town can consider requiring residential properties to be assessed for energy performance upon sale or rental and to require such information to be disclosed to buyers/renters. These policies do not require either the seller or buyer to make any improvements to the energy efficiency of the home.	American Council for an Energy Efficient Economy (ACEEE) has a policy toolkit: https://www.aceee.org/toolkit/2020/02/residential-energy-use-disclosure-guide-policymakers	Residential energy rating and disclosure policies can help increase consumer transparency about the costs associated with operating a home, promoting more sound purchasing decisions. Also, by quantifying building energy use, these policies can inform future policy and program efforts to reduce building energy consumption and track progress toward achieving community-wide climate and/or energy targets. To date, dozens of municipalities have implemented residential energy audit and disclosure requirements.
Residential	Energy efficient retrofits	The town can establish an incentive-based zoning program to encourage enhanced energy standards.	NYSERDA; CCE-Tompkins; NYSEG	To limit "price creep" from meeting enhanced energy standards. The town has already discussed creating a subgroup focused on an

Sector	Strategy	Implementation Path	Partners	Notes
				incentive-based zoning program.
Residential	Advocate for state adoption of advanced energy codes	The town can work with its state elected officials and through the NYS Association of Towns and NYSERDA	State elected officials, NYS Association of Towns, NYSERDA	
Residential	Solar energy	The town can continue to support residential solar energy development through education and outreach. This includes continuing to encourage community solar subscriptions for residents that do not have the ability or means to install solar where they live. The town is also considering renewable energy purchase programs such as Community Choice Aggregation with a 100% renewable electricity default mix for residents and/or an opt-out CDG program. Residential customers can also consider purchasing renewable electricity through an ESCO.	NYSERDA; NY-Sun resources; NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	Community solar subscriptions do not require any up-front costs to subscribers and typically come with guaranteed savings which makes it especially attractive. While the town negotiated an exclusive discount with Solar Farms New York, other community solar providers serve the area as well. Tompkins County's Comprehensive Plan also includes goals to prioritize renewable energy, and the town is currently working with Sustainable Tompkins on implementing a CCA. From Open NY June 1, 2021: Total solar in town already includes 48,145 kW, 55,957,215 kWh/yr (projects that received NYSERDA's residential/small commercial and commercial/industrial incentives), which offsets 6,451 MTCO2e of otherwise grid electric use/emissions. Would be good to identify additional acreage/locations suitable for community solar for reference. This could be applicable to multiple CSC Certification actions, including PE8 Action: Community Campaigns and

Sector	Strategy	Implementation Path	Partners	Notes
				PE8 Action: Community Choice Aggregation.
Commercial/ Industrial	Commercial/ industrial building electrification (heat pumps)	The town can partner with HeatSmart Tompkins to educate community members about heat pumps/energy efficiency upgrades. The town can educate the business community on available incentives through the utility (part of what HeatSmart Tompkins does). The town can consider revising site plan review to include energy/sustainability considerations. The town can consider revising zoning to include incentive zoning for efficiency/heat pump measures, especially when tied with multi-family affordable housing projects. The town can also encourage Tompkins County to adopt Open C-PACE to provide a low cost, long-term option to finance clean energy projects in commercially owned buildings.	HeatSmart Tompkins; NYSERDA Clean Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins); NYSEG	The town Planning Board already encourages new buildings to consider heat pumps. This action could also qualify the town for the Community Campaigns - Clean Heating and Cooling/Energy Efficiency action as part of the Clean Energy Communities program if enough heat pumps/insulation/air sealing projects are completed (10). It is also a CSC Certification action - PE8 Action: Community Campaigns.
Commercial/ Industrial	Building energy efficiency retrofits	The town can partner with HeatSmart Tompkins and	HeatSmart Tompkins; NYSERDA Clean	This action could also qualify the town for the

Sector	Strategy	Implementation Path	Partners	Notes
		others to educate community members about heat pumps/energy efficiency upgrades. The town can educate the business community on available incentives through the utility (part of what HeatSmart Tompkins does). The town can also encourage Tompkins County to adopt Open C-PACE and work with Tompkins County Industrial Development Agency and Ithaca-Area Economic Development to market the Open C-PACE program which provides a low-cost, long-term option to finance clean energy projects in commercially owned buildings. The town can work with NYSEG and local partners to organize a friendly "Battle of the Buildings" energy -savings competition for small main street businesses.	Energy Communities Contractor (CCE Tompkins); NYSERDA CEEP Contractor (CCE Tompkins); Tompkins County Business Energy Advisor Program; NYSEG	Community Campaigns - Clean Heating and Cooling/Energy Efficiency action as part of the Clean Energy Communities program if enough heat pumps/insulation/air sealing projects are completed (10). It is also a CSC Certification action - PE8 Action: Community Campaigns. Can also utilize Sustainable Tompkins' Climate Fund, "WRAP" from the Tompkins County Office of Aging, the USDA Rural Development sec. 504 program, and with Tompkins County Action. Also, the County is still operating its Business Energy Advisor Program for Commercial/Industrial projects & renovations.
Commercial/ Industrial	Energy efficient new construction	The town can consider adopting future stretch energy codes. Stretch codes apply to new construction and substantial rehab projects only. The town can continue to share the Tompkins County Energy Recommendations for New Construction with builders and promote the Tompkins County Business Energy Advisors program. The town can consider requiring EV and solar-readiness in new construction projects.	NYSERDA Circuit Rider for NYStretch (Lou Vogel for Southern Tier); NYSERDA Clean Energy Communities Contractor (CCE Tompkins); Tompkins County Business Energy Advisors program	The Town Board has already adopted the NYStretch Code 2020. Both the Town Board and Planning Board currently encourage developers to follow the Tompkins County Energy Recommendations for New Construction, self-score their project and share the results. Adopting the NYStretch Energy Code 2020 is also a High Impact Action through CEC and is also eligible for an action grant if adopted before 12/31/21. NYStretch is also a CSC Certification action -

Sector	Strategy	Implementation Path	Partners	Notes
				PE6 Action: NYStretch Energy Code.
Commercial/ Industrial	Energy efficient retrofits	The town can create an incentive-based zoning program to encourage enhanced energy standards. The town can enact a local law similar to New York City Local Law 97 of 2019 which requires buildings to reduce greenhouse gas emissions by 40% by 2030 and 80% average reduction by 2050.	NYSERDA; CCE-Tompkins; Tompkins County Business Energy Advisor Program; NYSEG; Elected Officials to Protect America; Pace Univ. Law; Stand.earth	Most examples such as LL 97 in NYC apply only to very large buildings (i.e., larger than 25,000 SF): https://codegreensolutions.com/nyc-carbon-emissions-bill-passed-into-law-local-law-97-what-it-means-for-commercial-building-owners/. The town has already discussed creating a subgroup focused on an incentive-based zoning program.
Commercial/ Industrial	Mandatory energy benchmarking and disclosure	The town can enact a law like New York City Local Law No. 84 (adopted 2011) requiring private commercial/industrial properties to be assessed for energy performance upon sale or rental and to require such information to be disclosed to buyers/renters. These policies do not require either the seller or buyer to make any improvements to the energy efficiency of the home.	American Council for an Energy Efficient Economy (ACEEE) has a policy toolkit: https://www.aceee.org/toolkit/2020/02/residential-energy-use-disclosure-guide-policymakers; Ithaca 3030 District	Commercial/industrial energy rating and disclosure policies can help increase consumer transparency about the costs associated with operating a business, promoting more sound purchasing decisions. Also, by quantifying building energy use, these policies can inform future policy and program efforts to reduce building energy consumption and track progress toward achieving community-wide climate and/or energy targets. To date, several municipalities have implemented energy audit and disclosure

Sector	Strategy	Implementation Path	Partners	Notes
				requirements (NYC, Montgomery County, DC, SF, Austin). Most existing laws apply only to large private buildings (i.e., larger than 50,000 SF).
Commercial/ Industrial	Solar energy	The town can support commercial solar energy development through education and outreach and supportive zoning. The town can also consider making battery energy storage an allowed use in certain zones to partner with solar energy development locally. Commercial customers can also consider purchasing renewable electricity through an ESCO.	NYSERDA; NY-Sun resources; NYSERDA Clean Energy Communities Contractor (CCE Tompkins)	Tompkins County's Comprehensive Plan also includes goals to prioritize renewable energy. From Open NY June 1, 2021: Total solar in town already includes 48,145 kW, 55,957,215 kWh/yr (projects that received NYSERDA's residential/small commercial and commercial/industrial incentives), which offsets 6,451 MTCO2e of otherwise grid electric use/emissions. Would be good to identify additional acreage/locations suitable for community solar for reference. This could be applicable to multiple CSC Certification actions, including PE8 Action: Community Campaigns and PE8 Action: Community Choice Aggregation.
Waste	Demolition & Construction Waste	Develop a policy/ordinance requiring specific demolition or deconstruction recycling standards/procedures	City of Ithaca, Tompkins County, Finger Lakes ReUse, Tompkins/Cortland Builders and Remodelers Association	

Sector	Strategy	Implementation Path	Partners	Notes
Waste	Sustainable vendor policy for public events	The town can encourage recycling at public events (including at schools) of cardboard, paper, containers and food/organics. Encourage use of recyclable silverware and food take-out packaging. Ensure provision of proper landfill, recycling and organic bins.	Tompkins County Department of Recycling & Materials Management; Dryden school district; Cornell Cooperative Extension	
Waste	Food waste reduction/ composting	The town can continue to support existing composting programs through the Tompkins County Department of Recycling & Materials Management by providing information and materials to residents on how to get involved. The town can continue to inform the public about the existing compost drop-off site, located at the Highway Department. The town can expand its community garden program to promote use of compost and local food.	Tompkins County Department of Recycling & Materials Management; Dryden school district; Cornell Cooperative Extension	Expand on existing county programs. This could also be applicable to multiple CSC Certification actions, including PE5 Action: Waste Reduction Education Campaign, PE5 Action: Compost Bins for Residents. The town already has received credit for CSC Certification action PE5 Action: Residential Organic Waste Program for the town's food scraps recycling program.
Agriculture	Methane management	The town can help provide information on funding opportunities and resources on manure storage coverage and flare systems and anaerobic digesters to the two CAFOs within the community where installation could benefit both the farm and the environment. The town can encourage Tompkins County to adopt Open C-PACE to help farmers finance anaerobic digester projects.	Cornell Cooperative Extension of Tompkins County; Tompkins County Farm Bureau; Tompkins County Soil and Water Conservation District; NYS Ag & Markets	Anaerobic digesters can help reduce emissions from manure management on large farms. The biogas collected can be used for heat and electricity, and solids can be used for fertilizer or bedding for livestock. Farms can accept food waste from nearby food establishments and/or households to mix with manure to make digesters even more efficient. NYS Dept. of Agriculture and Markets currently

Sector	Strategy	Implementation Path	Partners	Notes
				administers a Climate Resilient Farming grant program.
Agriculture	Carbon farming practices	The town can help connect farmers to resources related to carbon farming practices, including conservation tillage or no-till measures, growing of cover crops during off-seasons, crop rotation, riparian restoration and buffers, vegetative barriers, forage and biomass planting, grassed waterways, hedgerow planting, and others.	Cornell Cooperative Extension of Tompkins County; Tompkins County Farm Bureau; Tompkins County Soil and Water Conservation District; NYS Ag & Markets	Carbon farming practices increase carbon sequestration and storage in soil. Carbon farming practices also benefit farms by restoring soils, enhancing crop production, and reducing erosion and nutrient runoff.
Agriculture	Electrification of farm vehicles and equipment	The town can monitor programs to assist farms with electrification including tools and tractors	Cornell Cooperative Extension of Tompkins County; Tompkins County Farm Bureau; Tompkins County Soil and Water Conservation District; NYS Ag & Markets	The Bonneville Environment Foundation, Sustainable Northwest and Forth have launched a pilot program in Oregon to test electric tractors and educate farmers: https://www.govtech.com/fs/oregon-farms-to-put-electric-tractors-to-work-in-real-world.html. A variety of new models are available or coming to market soon: https://medium.com/codex/electric-tractors-are-here-shall-we-call-them-ets-94baca0d0207.
Cross-cutting	Climate Emergency Declaration / Endorse Global Fossil Fuel Non-Proliferation Treaty	The Town Board can pass a resolution declaring its recognition of a Climate Emergency and commit to actions to address.	The Climate Mobilization: https://www.theclimatemobilization.org/climate-emergency/. Stand.earth SAFE Cities coalition: https://www.stand.earth/page/fossil-fuel-free/what-are-safe-cities.	A map of declarations by local governments in the US with links to legislative language may be found here: https://www.google.com/maps/d/u/0/embed?mid=12XomdI_Muh3WZlk0zp_22o6_-ThMpfNb&ll=42.467140634031%2C-75.21962752322115&z=7. Stand.earth template: https://www.stand.earth/sites

Sector	Strategy	Implementation Path	Partners	Notes
				/stand/files/template_safe_cities_ffnpt_resolution.pdf
Cross-cutting	Tree planting	The town can establish a Tree Committee (or sub-committee of the Conservation Board) to implement tree planting projects in public rights of way, which can reduce traffic speeds and improve pedestrian and bicyclist safety. The town can apply to become a designated Tree City USA through the Arbor Day Foundation. The town can conduct education and outreach to encourage existing homes to plant deciduous shade trees for houses with eastern, western or southern exposures that heat up during the summer while avoiding conflict with installation of solar PV panels.	Freeville Tree Committee, NYS Urban Forestry Council, NYS Dept. of Environmental Conservation, Cornell Cooperative Extension, Arbor Day Foundation	Freeville Tree Committee has secured NYSEG and other grant funding to complete tree planting projects in the past.
Cross-cutting	Revise Climate Action Plan goals regularly and adapt to State and Federal regulations/requirements	The town can consider creating a Climate and Energy Board for the town of Dryden as a subcommittee to the Conservation Commission	Tompkins County, State agencies	The intent of this strategy is to add resources, influence, and permanence to the town's existing Climate Smart Communities task force. This group has been very active in advancing the town through the CEC and CSC Certification programs. This group can continue to help the town stay up-to-date with County and State

Sector	Strategy	Implementation Path	Partners	Notes
				goals and regulations related to clean energy and climate change. The task force can also continue to support education and outreach efforts and help advocate for County and State goals related to clean energy and climate change mitigation/adaptation efforts.
Cross-cutting	Get involved from a policy standpoint	The town can monitor State policy and participate in Public Service Commission proceedings to inform policy decisions related to clean energy.	NYSEG; other municipalities	The town recognizes that there are sometimes roadblocks to implementing certain clean energy actions that may be related to policies affecting utilities or other entities. The town can partner with other municipalities to petition the Public Service Commission in such matters to influence clean energy policy in a way that will be beneficial to the community.
Cross-cutting	Participate in State and Federal programs related to climate change and clean energy	The town can continue to pursue actions through State and Federal programs such as NYSERDA's Clean Energy Communities Leadership Round and DEC's Climate Smart Communities Certification program and any future programs that may become available.	NYSERDA CEC contractor (CCE Tompkins) can assist with both CEC and CSC Certification efforts; NYSERDA; DEC Office of Climate Change	The town is already a Designated Clean Energy Community and is continuing to work through the Leadership Round of the program. The town is also already a Certified Bronze CSC but can pursue Silver level Certification.

The same strategy metrics were considered for each strategy related to reducing emissions from the Dryden community, including impact of implementation, achievability, estimated cost, timeframe of implementation, and priority to the Town. The priority scores were calculated the same as described for municipal strategies.

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium=2, high=3)
Transportation	Significant Transportation Education and Outreach Campaigns	moderate	moderate effort	low	short-term to medium-term	1.75
Transportation	EV Charging Station Infrastructure	moderate	moderate effort	low	short term	2.00
Transportation	EV Charging Station Infrastructure	moderate	heavy lift	low-medium	short-term to medium-term	2.00
Transportation	Anti-Idling Regulation	low	low-hanging fruit (to pass ordinance); heavy lift (to enforce)	low	short-term	2.00
Transportation	Launch an Eco-Driving Campaign Alongside Employers	low	low-hanging fruit	low	short-term to medium-term	2.25
Transportation	Establish a Bicycle Advisory Committee and pursue certification as a Bicycle-Friendly Community through The League of American Bicyclists	moderate	low-hanging fruit	low	short-term	1.75
Transportation	Improve bike infrastructure	moderate	moderate effort	medium	medium-term	1.75
Transportation	Improve pedestrian infrastructure	moderate	moderate effort	medium	medium-term	2.25

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium=2, high=3)
Transportation	Increase transit coverage area/ride sharing	moderate	heavy lift	low	medium-term	2.00
Transportation	Compact development	moderate to high	moderate effort	low	short-term	3.00
Transportation	Ban on new gas stations	low	moderate effort	low	short-term to medium-term	1.50
Residential	Residential building electrification (heat pumps)	high	low-hanging fruit to moderate effort	low	short-term to medium-term	3.00
Residential	Educate residents about energy efficiency and conservation	moderate	low-hanging fruit	low	short-term	2.75
Residential	Energy efficient new construction	moderate	low-hanging fruit	low	short-term	2.50
Residential	Mandatory energy benchmarking and disclosure	moderate	moderate effort	low	short-term to medium-term	2.00
Residential	Energy efficient retrofits	moderate	moderate effort	low	short-term	3.00

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium=2, high=3)
Residential	Advocate for state adoption of advanced energy codes	moderate	low-hanging fruit	low	ongoing	2.25
Residential	Solar energy	high	moderate effort	low	short-term	3.00
Commercial/ Industrial	Commercial/ industrial building electrification (heat pumps)	high	low-hanging fruit to moderate effort	low	short-term to medium-term	3.00
Commercial/ Industrial	Building energy efficiency retrofits	moderate	low-hanging fruit	low	short-term	2.50
Commercial/ Industrial	Energy efficient new construction	moderate	low-hanging fruit	low	short-term	3.00
Commercial/ Industrial	Energy efficient retrofits	moderate	low-hanging fruit	low	short-term	2.33
Commercial/ Industrial	Mandatory energy benchmarking and disclosure	moderate	moderate effort	low	short-term to medium-term	2.50
Commercial/ Industrial	Solar energy	high	moderate effort	low	short-term	3.00
Waste	Demolition & Construction Waste	low	moderate effort	low	medium-term	2.50
Waste	Sustainable vendor policy for public events	low	low-hanging fruit	low	short-term, ongoing	2.50
Waste	Food waste reduction/ composting	low	low-hanging fruit	low	short-term, ongoing	2.50

Sector	Strategy	Strategy Metrics				
		Impact of Implementation (low, moderate, high emissions reductions)	**Achievability** (low-hanging fruit, moderate effort, heavy lift)	**Estimated Cost** (low, medium, high)	**Timeframe** (short-term, medium-term, long-term, ongoing)	**Priority Score** (low=1, medium=2, high=3)
Agriculture	Methane management	moderate	moderate effort	low (for town's participation, high for farm implementation)	ongoing	2.00
Agriculture	Carbon farming practices	moderate	moderate effort	low	ongoing	2.25
Agriculture	Electrification of farm vehicles and equipment	low	low	low	ongoing	1.75
Cross-cutting	Climate Emergency Declaration / Endorse Global Fossil Fuel Non-Proliferation Treaty	low	low-hanging fruit	low	short-term	2.25
Cross-cutting	Tree planting	low	low-hanging fruit	low	short-term	2.25
General considerations	Revise Climate Action Plan goals regularly and adapt to State and Federal regulations/requirements	low	moderate effort	low	ongoing	3.00
General considerations	Get involved from a policy standpoint	low to high, depending on the policy	low-hanging fruit	low	ongoing	2.67
General considerations	Participate in State and Federal programs related to climate change and clean energy	moderate	moderate effort	low to high, depending on program and actions	ongoing	3.00

Discussion

Transportation

To assist in reducing emissions from community-wide transportation, the town has already installed a charging station for public use at Town Hall and can continue and expand efforts to encourage electric vehicle adoption by installing additional charging stations, embarking on education and outreach campaigns related to electric vehicles, adopting streamlined permitting processes for installation on private property including multi-family buildings and public rights-of-way, and requiring new and substantially rehabbed buildings to include EV charging stations and/or to be "EV ready." The town could also consider banning additional gas stations from being constructed in the town. The town can further reduce emissions from vehicles by promoting existing anti-idling regulations, launching an Eco-Driving Campaign, and working with TCAT and the Cortland bus system to improve transit coverage. Finally, the town can encourage walking and bicycling as a means of transportation through establishment of a Bicycle Advisory Committee, improving bicycle and pedestrian infrastructure, and revising zoning to encourage compact, mixed-use development.

Residential and Commercial/Industrial

To influence emissions from the residential and commercial/industrial sectors, the town Planning Board already encourages heat pumps be installed in new construction, and both the Planning Board and Town Board encourage builders to use the Tompkins County Energy Recommendations for new construction when planning new building projects. The town can continue to promote the Tompkins County Business Energy Advisors program, work with NYSEG and local partners to organize a friendly "Battle of the Buildings" energy-savings competition for small main street businesses, and encourage Tompkins County to adopt Open C-PACE which provides a low-cost, long-term option to finance clean energy projects in commercially owned buildings.

The town can consider revising site plan review to include energy/sustainability considerations and can also consider revising zoning to include incentive zoning for efficiency/heat pump measures and/or enhanced energy standards. The town can partner with Dryden public schools, TC3, CCE-Tompkins or other partners to organize "Neighborhood Energy Blitz" energy savings and water conservation kit distribution events and meet with local builders and contractors to discuss barriers and interest in pursuing green build strategies.

The Town Board recently adopted the NYStretch Energy Code 2020 which will require new buildings to be built to a highly efficient standard through the next code cycle (sometime in 2023), when a new stretch code will likely be available for the town to consider adopting. The town can consider adopting future stretch codes and work with state elected officials and through the NYS Association of Towns and NYSERDA to advocate for adoption of advanced energy codes. The town can consider enacting a local law similar to New York City Local Law 97 of 2019 which requires buildings to reduce greenhouse gas emissions by 40% by 2030 and 80% average reduction by 2050.

The town can encourage the local realtor community to include energy performance in the Multiple Listing Service (MLS) Property Inventory and consider requiring residential properties

to be assessed for energy performance upon sale or rental and to require such information to be disclosed to buyers/renters.

The town is already promoting community solar options as well as clean heating and cooling and energy efficiency to community members. The town can continue to consider renewable energy opportunities that would benefit community members, such as community choice aggregation (CCA) using a 100% default renewable energy mix and/or opt-out community solar option.

Waste
To help reduce emissions from waste generated in the community, the town can continue to inform the public about the existing compost drop-off site, located at the Highway Department, and expand its community garden program to promote use of compost and local food. The town can develop a policy/ordinance requiring specific demolition or deconstruction recycling standards/procedures and encourage recycling at public events (including at schools) of cardboard, paper, containers and food/organics as well as use of recyclable silverware and food take-out packaging.

Agriculture
To assist in reducing emissions from agricultural activities, the town can help provide information on funding opportunities and resources on manure storage coverage and flare systems and anaerobic digesters to the two CAFOs within the community where installation could benefit both the farm and the environment. The town can encourage Tompkins County to adopt Open C-PACE to help farmers finance anaerobic digester projects.The town can help connect farmers to resources related to carbon farming practices, including conservation tillage or no-till measures, growing of cover crops during off-seasons, crop rotation, riparian restoration and buffers, vegetative barriers, forage and biomass planting, grassed waterways, hedgerow planting, and others. Finally, the town can monitor programs to assist farms with electrification including tools and tractors.

Cross-cutting
The town already has a Climate Smart Communities task force, but could consider creating a Climate and Energy Board as a subcommittee to the Conservation Commission resources, influence, and permanence to the existing task force.

The town can establish a Tree Committee (or sub-committee of the Conservation Board) to implement tree planting projects in public rights of way, which can reduce traffic speeds and improve pedestrian and bicyclist safety. The town can apply to become a designated Tree City USA through the Arbor Day Foundation. The town can conduct education and outreach to encourage existing homes to plant deciduous shade trees for houses with eastern, western or southern exposures that heat up during the summer while avoiding conflict with installation of solar PV panels.

The Town Board can pass a resolution declaring its recognition of a Climate Emergency and commit to actions to address. The town can monitor State policy and participate in Public Service Commission proceedings to inform policy decisions related to clean energy, and continue to pursue actions through State and Federal programs such as NYSERDA's Clean

Energy Communities Leadership Round and DEC's Climate Smart Communities Certification program and any future programs that may become available.

The strategies outlined above related to reducing emissions from the Dryden community can also benefit the town in relation to NYSERDA's Clean Energy Communities and DEC's Climate Smart Communities Certification programs. These are actionable items the local government can consider to assist in mitigating greenhouse gas emissions from the Dryden community.

V. Conclusion

This Climate Action Plan provided an opportunity for the Town of Dryden to develop energy efficiency and emission reduction strategies. This planning effort encouraged local participation and brought together representatives from the local government, citizens, and other key stakeholders to evaluate regional strengths and goals. The process provided a chance to gather information on sustainable community and economic development projects, to give community leaders support to advance sustainable projects, and to identify goals for new sustainable programs and initiatives.

Participants in the planning process worked to identify goals and strategies to improve the environment and address climate change through energy management, infrastructure, land use, and transportation. As a blueprint for the future, the Climate Action Plan efficiently summarizes an action-oriented guide containing strategies to ensure that Dryden meets the needs of current and future generations. In addition, the document will now provide state and local officials with the information needed for long-term commitments and investments in economic, social, and environmental resilience.

Our thanks go to the local leaders and community members for a job well-done. Town officials are encouraged to now focus on implementation of these recommendations, to review the progress made on a regular basis, and to re-evaluate emission reduction goals. In this way, Dryden will continue to protect natural resources, reduce emissions, become more resilient to climate change, and serve as a prominent showcase for energy efficiency and environmental stewardship.

Town of Dryden Community GHG Inventory Report

Town of Dryden, New York
Community Greenhouse Gas Inventory: A Comparison of 2013 and 2018

Compiled by the Central New York Regional Planning and Development Board

May 12, 2021

Town of Dryden

93 East Main Street

Dryden, NY 13053

This community GHG inventory was compiled by the Central New York Regional Planning and Development Board (CNY RPDB) in support of the Dryden 2045 Comprehensive Plan Update project. Contributors include:

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I. Introduction

Background

The Climate Smart Communities Program represents a partnership between New York State and local governments to reduce energy use and GHG emissions while working to adapt to a changing climate. The required ten elements of the Climate Smart Communities Pledge are:

1. Build a climate-smart community.
2. Inventory emissions, set goals, and plan for climate action.
3. Decrease energy use.
4. Shift to clean, renewable energy.
5. Use climate-smart materials management.
6. Implement climate-smart land use.
7. Enhance community resilience to climate change.
8. Support a green innovation economy.
9. Inform and inspire the public.
10. Engage in an evolving process of climate action.

The Town of Dryden adopted the ten-element Climate Smart Communities Pledge as a commitment to greenhouse gas (GHG) emission reduction and climate change adaptation, and it became a Bronze Certified Climate Smart Community in September of 2019. The Climate Smart Communities Certification program recognizes communities that have gone beyond the ten pledge elements by completing and documenting mitigation and adaptation actions at the local level. Certified communities, like the Town of Dryden, are the foremost leaders in the state in terms of climate action. Communities can achieve certification at the Bronze, Silver, or Gold level.

As a part of the update of the town comprehensive plan, the town decided to compile a community GHG inventory to complement their existing municipal operations GHG inventory. A GHG emissions inventory is an audit of activities that contribute to the release of emissions and will act as a baseline for a Climate Action Plan. It is important to note that the information provided in this inventory is not meant to be exhaustive, but rather to provide an estimate of community emissions data at two snapshots in time, 2013 and 2018. The comparison of emissions from 2013 to 2018 throughout this report is meant to provide a comparative basis for understanding baseline emissions; not demonstrate any short-term changes in emissions. The inventory information will inform climate action planning efforts in the town moving forward. This inventory will act as a baseline for tracking and understanding trends associated with future GHG mitigation efforts.

For this community GHG inventory, energy use, waste generation, wastewater treatment, and agricultural information was gathered for both the 2013 and 2018 years, and methods of calculation explained in the U.S. Community Operations Protocol[1] were utilized to generate

[1] The U.S. Community Operations Protocol was developed by ICLEI-Local Governments for Sustainability in order to provide "detailed, cutting-edge guidance on completing a GHG emissions inventory at the community scale in the United States — including emissions from businesses, residents, and transportation," according to ICLEI's website.

emissions figures. Data was entered into the ClearPath[2] tool, outputs were aggregated into metric tons of CO_2 equivalent, and emissions were delineated by sector and source.

Climate Change and Greenhouse Gases

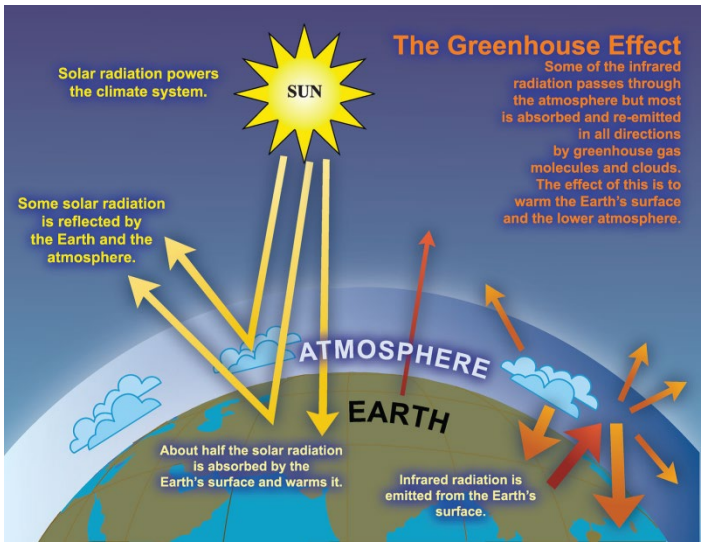


Figure 1: The Greenhouse Effect

Climate change is recognized as a global concern. Scientists have documented changes to the Earth's climate including the rise in global average temperatures, as well as sea levels, during the last century. An international panel of leading climate scientists, the Intergovernmental Panel on Climate Change (IPCC), was formed in 1988 by the World Meteorological Organization and the United Nations Environment Program to provide objective and up-to-date information regarding the changing climate. In its 2014 Fifth Assessment Report, the IPCC states that there is **a greater than 95 percent chance that rising global average temperatures, observed since the mid-20th century, are primarily due to human activities.**[3]

The rising trend of human-generated GHG emissions is a global threat. The increased presence of these gases affects the warming of the planet by contributing to the natural greenhouse effect, which warms the atmosphere and makes the earth habitable for humans and other species (see Figure 1).[4] Mitigation of GHGs is occurring in all sectors as a means of reducing the impacts of this warming trend. However, scientific models predict that some effects of climate change are inevitable no matter how much mitigative action is taken now. Therefore, climate mitigation actions must be paired with adaptation measures in order to continue efforts to curb emissions contributions to global warming, while adapting communities so that they are able to withstand climate change impacts and maintain social, economic, and environmental resilience in the face of uncertainty. Climate adaptation can take shape through infrastructure assessments and emergency planning, as well as through educational efforts to raise public awareness about potential climate change impacts.

New York State outlined projected climate impacts and vulnerabilities during the 2011 ClimAid assessment and 2014 supplement (ClimAid Report).[5] The ClimAid Report projects changes to

[2] ClearPath is a proprietary tool developed by ICLEI-Local Governments for Sustainability to assist local governments with conducting greenhouse gas emissions inventories and with the development of local climate action plans.
[3] IPCC. 2014. Fifth Assessment Report. https://www.ipcc.ch/report/ar5/syr/
[4] IPCC Working Group. https://wg1.ipcc.ch/publications/wg1-ar4/faq/wg1_faq-1.3.html
[5] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Envi

ecosystems (e.g., increased presence of invasive species and shifts in tree composition), while water quality and quantity may also be impacted due to changes in precipitation. Potential beneficial economic impacts were also identified, such as a longer recreation season in the summer, and a longer growing season for the agricultural sector due to rising temperatures. Scientific evidence suggests that the impacts of global climate change will be different in various regions, and will include temperature shifts, more extreme heat events, sea level rise and coastal flooding, more frequent intense precipitation events, and human health risks.

We have already experienced the effects of a changing climate in New York State and abroad, [6] the need for climate action and adaptation is imperative. The goal of building community resilience in order to protect the health and livelihood of residents and natural systems serves as a motivating factor in the assessment of greenhouse gas contributions and effective sustainability planning.

New York State GHG Emissions and Climate Goals

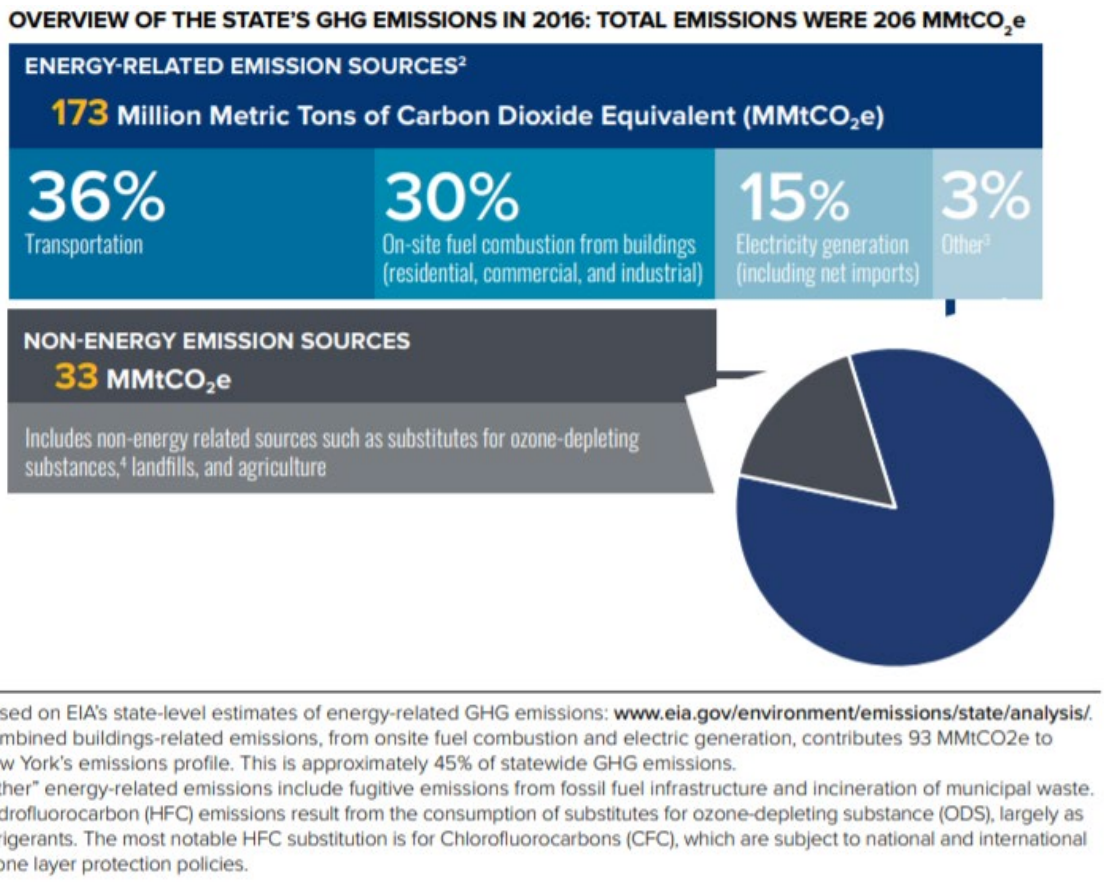
According to the July 2019 *New York State Greenhouse Gas Inventory: 1990-2016* report prepared by the New York State Energy Research and Development Authority (NYSERDA), 2016 state emissions were equal to 206 million metric tons of carbon dioxide equivalent ($MMTCO_2e$), the majority of which came from energy-related sources (173 $MMTCO_2e$) compared to non-energy sources (33 $MMTCO_2e$).[7] Of the energy-related emissions sources, 36% were from transportation, 30% from on-site fuel combustion from buildings, 15% from electricity generation, and 3% from other sources such as fugitive emissions from fossil fuel infrastructure and incineration of municipal waste (see Figure 2).

In July 2019, Governor Cuomo signed the Climate Leadership and Community Protection Act (CLCPA) into law. The CLCPA is New York State's ambitious emissions reduction plan with the goal of making electricity 70% renewable by 2030 and 100% carbon neutral by 2040, reducing GHG emissions 40% below 1990 levels by 2030 and 85% below 1990 levels by 2050, implementing 6,000 MW of solar by 2025, 3,000 MW of energy storage by 2030, and 9,000 MW of offshore wind by 2035 (see Figure 3).

ronmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York

[6] NYSERDA. 2014. Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information. https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York; and National Climate Assessment. 2014. Climate Change Impacts in the United States. https://nca2014.globalchange.gov/.

[7] NYSERDA. Greenhouse Gas Inventory Fact Sheet. https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics.



[1] Based on EIA's state-level estimates of energy-related GHG emissions: **www.eia.gov/environment/emissions/state/analysis/**.
[2] Combined buildings-related emissions, from onsite fuel combustion and electric generation, contributes 93 MMtCO2e to New York's emissions profile. This is approximately 45% of statewide GHG emissions.
[3] "Other" energy-related emissions include fugitive emissions from fossil fuel infrastructure and incineration of municipal waste.
[4] Hydrofluorocarbon (HFC) emissions result from the consumption of substitutes for ozone-depleting substance (ODS), largely as refrigerants. The most notable HFC substitution is for Chlorofluorocarbons (CFC), which are subject to national and international ozone layer protection policies.

Figure 2: Overview of the State's GHG Emissions in 2016

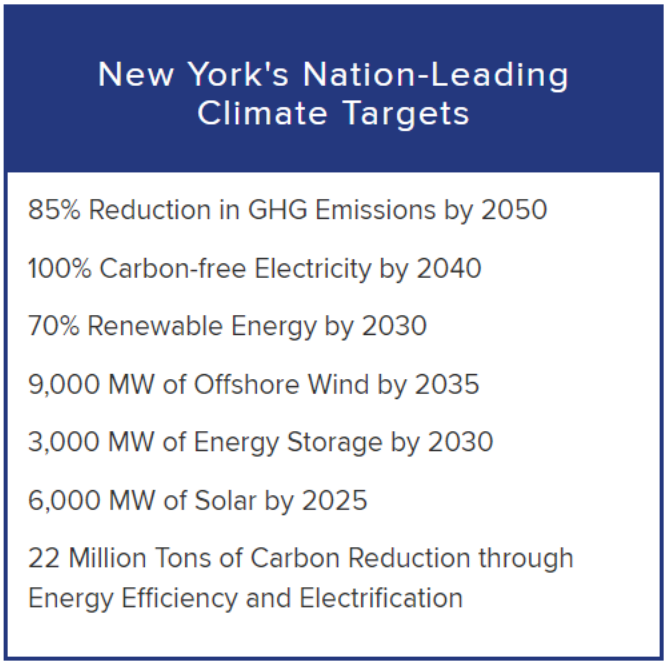


Figure 3: Overview of the CLCPA targets

The Purpose of a Greenhouse Gas Inventory

Many local governments have decided to gain a detailed understanding of how their emissions and their community's emissions are related to climate change and have committed to reducing GHG emissions at the local level. Local governments exercise direct control over their own operations and can lead by example by reducing energy usage in municipal facilities, using alternative fuels for their fleets, and investing in renewable energy sources. Local governments can also influence community-wide activities that contribute to climate change by improving building codes and standards, providing cleaner transportation options, and educating members of the community about their choices as consumers. Each local government is unique with its own set of opportunities, challenges, and solutions, and therefore climate action needs to be tailored to each community at the local level.

Because local governments typically contribute less than ten percent of the total greenhouse gas emissions generated in a given community, it is recommended that local governments develop both local government operations and community-wide greenhouse gas emissions inventories and reduction strategies[8]. Before concerted management and reduction of greenhouse gas emissions can occur within our local governments and communities, local governments must undertake measurement and analysis of all GHG sources. In May 2019, Cornell Cooperative Extension of Tompkins County compiled a local government operations inventory on behalf of the Town of Dryden for the 2013 and 2018 years. This community inventory follows the lead of the government operations inventory by including energy use and emissions data for the community as a whole for the 2013 and 2018 years.

It is important to note that this inventory represents an estimate of emissions for the Town of Dryden community for the 2013 and 2018 years, and that the purpose of this inventory is to gain a general baseline of emissions upon which the town can work from for climate action planning purposes. This inventory includes a number of assumptions and estimations, and the methods used to establish this baseline will not necessarily be the same methods used to measure progress.

There are several major benefits to compiling emissions inventories:

1. **Fiscal benefits:** Developing climate and energy strategies can help reduce energy costs and save taxpayer dollars. Conducting a GHG emissions inventory will explain exactly how energy is being used and identify opportunities to become more efficient.

2. **Climate leadership:** By taking action now to address climate change, local governments and elected officials can be recognized for their leadership on climate and energy issues.

3. **Community benefits:** Measures to reduce GHG emissions and energy consumption typically have many co-benefits. They can improve air quality and public health, stimulate the local economy, create green jobs, and make communities more livable and walkable.

[8] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

4. **Regulatory preparedness:** Taking action now will help your jurisdiction prepare for any future legislative requirements and position your local government for successful compliance.

Town Profile

The Town of Dryden is located in eastern Tompkins County, bordering southwestern Cortland County. The town covers an area of approximately 94.2 square miles and encompasses the Village of Dryden (approximately 1.6 square mile) and the Village of Freeville (approximately 1.1 square miles). The majority of the area is zoned Rural Agricultural or Conservation, with Rural Residential and Neighborhood Residential Districts scattered throughout, and Mixed Use Commercial Districts through the center of the town mostly following Route 13. According to the 2018 American Community Survey, the town has a population of about 12,158 residents outside of the two villages, with 4,969 occupied housing units.

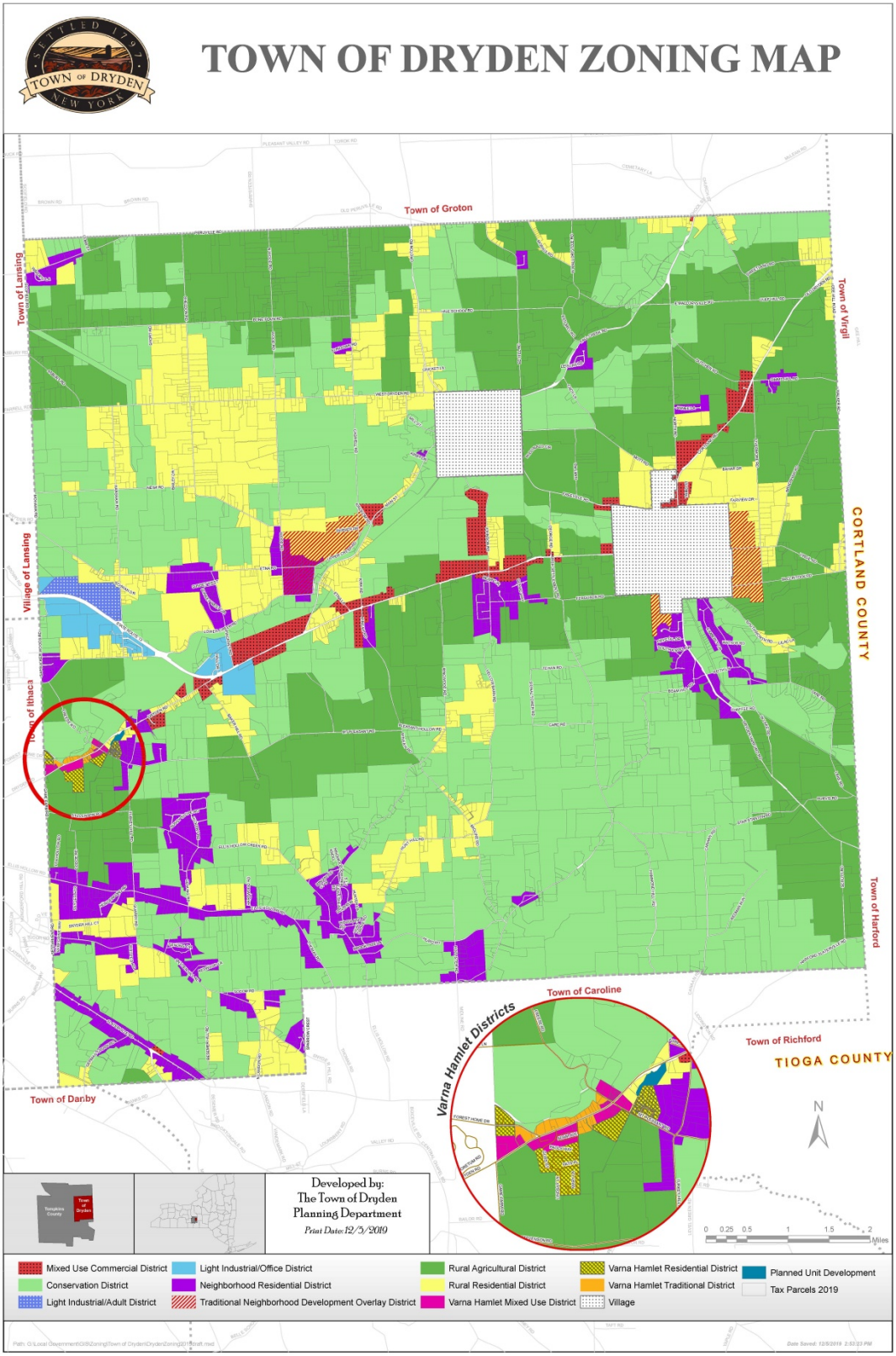


Figure 4: Town of Dryden Zoning Map 2019

II. Data Collection and Analysis

Information related to residential, commercial/industrial, transportation, waste, wastewater, and agriculture were collected for the Dryden community for the 2013 and 2018 years following the U.S. Community Protocol. Specific data collection methods for each sector are explained within each section of this report.

The ICLEI ClearPath tool was utilized to convert the information into emissions data measured in metric tons of carbon dioxide equivalent ($MTCO_2e$). The online tool streamlines the process of converting different sources, units, and varieties of emissions into comparable energy use and emissions figures.

Reporting

The three most prevalent greenhouse gases, and therefore the focus of this analysis, are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The unit used to discuss these gases in aggregate is carbon dioxide equivalent (CO_2e), which is a conversion based on each gas's Global Warming Potential (GWP), or the impact of 1 unit of each gas in the atmosphere compared to 1 unit of CO_2 (see Table 1). This inventory uses the GWP values published by the IPCC's 4th Assessment Report, which is consistent with the GWP values used in the municipal operations inventory so as to allow for direct comparison. A discussion of emissions using the IPCC's 5th Assessment Report is also included later in this report.

Greenhouse Gas (GHG)	Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous Oxide (N_2O)	298

Table 1: Global Warming Potential of Greenhouse Gases

Emissions are reported by sector and source in this inventory. Sectors are included or excluded in the boundaries of GHG inventories based on availability of data, relevance to emissions totals, and scale to which they can be changed. This inventory includes emissions for the residential, commercial/industrial, transportation, waste, wastewater, and agricultural sectors. Commercial and industrial sectors are combined due to availability of data from the Utility Energy Registry (UER), which combines commercial/industrial electricity and natural gas use into what it refers to as the "business" sector. Emissions data is also reported by source, including electricity, natural gas, fuel oil, and propane as sources of emissions within the residential or commercial/industrial sectors, while gasoline, diesel, and ethanol are included as sources of emissions within the transportation sector.

III. Community Emissions Inventory

Overall Results

In 2013, the Town of Dryden's community emissions totaled 131,154 $MTCO_2e$. In 2013, the transportation sector contributed to the largest percentage of emissions, accounting for 64,291 $MTCO_2e$, or 49% of the community's total emissions. Commercial/industrial energy use was the next highest emitting sector, producing 30,566 $MTCO_2e$, or 23% of total community emissions, followed by the residential energy use sector, which produced 25,972 $MTCO_2e$, or 20% of total emissions. The agricultural sector emitted 5,888 $MTCO_2e$, or 4% of emissions, followed by the waste sector which contributed 3,271 $MTCO_2e$, or 3% of emissions. The smallest emitting sector was the wastewater (septic) sector, which produced 1,165 $MTCO_2e$, or 1% of total community emissions.

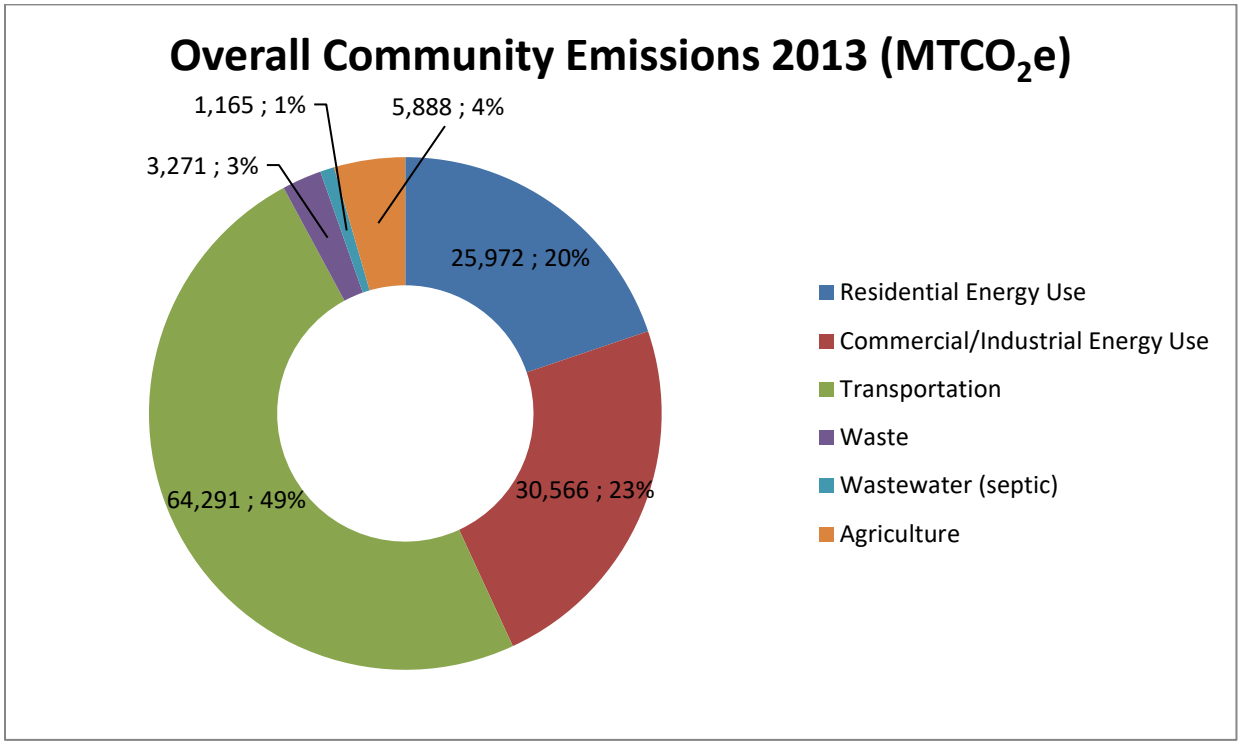


Figure 5: 2013 Community Emissions by Sector

In 2018, the Town of Dryden's community emissions totaled 121,875 $MTCO_2e$. In 2018, the transportation sector contributed to the largest percentage of emissions, accounting for 62,278 $MTCO_2e$, or 51% of the community's total emissions. Commercial/industrial energy use was the next highest emitting sector, producing 29,727 $MTCO_2e$, or 24% of total community emissions, followed by the residential energy use sector, which produced 18,910 $MTCO_2e$, or 16% of total emissions. The agricultural sector emitted 6,458 $MTCO_2e$, or 5% of emissions, followed by the waste sector which contributed 3,836 $MTCO_2e$, or 3% of emissions. The smallest emitting sector was the wastewater (septic) sector, which produced 1,122 $MTCO_2e$, or 1% of total community emissions.

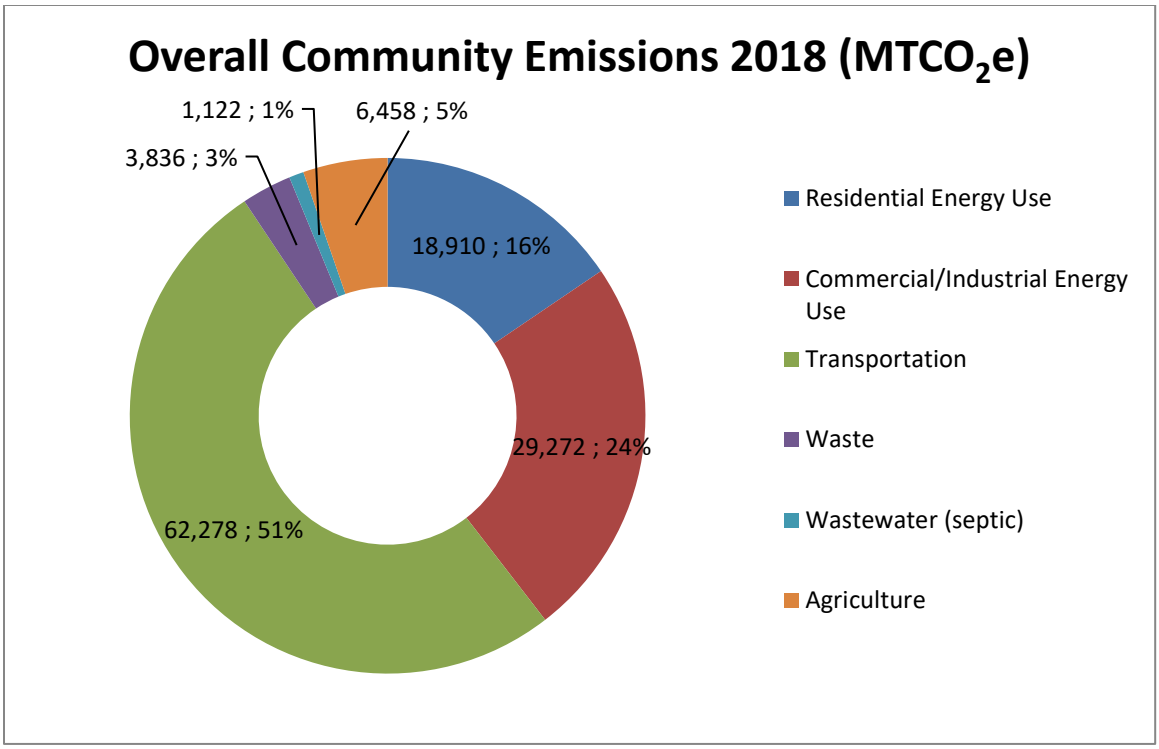


Figure 6: 2018 Community Emissions by Sector

The largest source of community emissions in the Town of Dryden in 2013 was gasoline, accounting for 51,158 $MTCO_2e$, or 39% of all community emissions. Natural gas was also a large emitting source, producing 32,906 $MTCO_2e$ (25%).

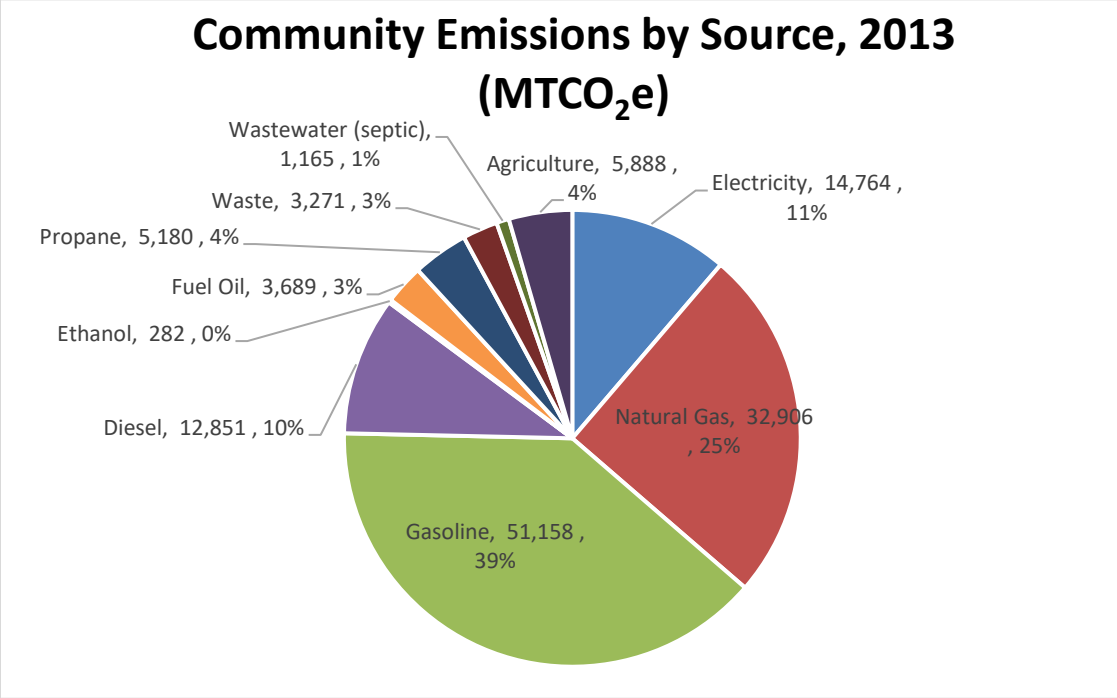


Figure 7: 2013 Community Emissions by Source

The largest source of community emissions in the Town of Dryden in 2018 was gasoline, accounting for 49,488 $MTCO_2e$, or 27% of all community emissions. Natural gas was also a large emitting source, producing 33,010 $MTCO_2e$ (27%).

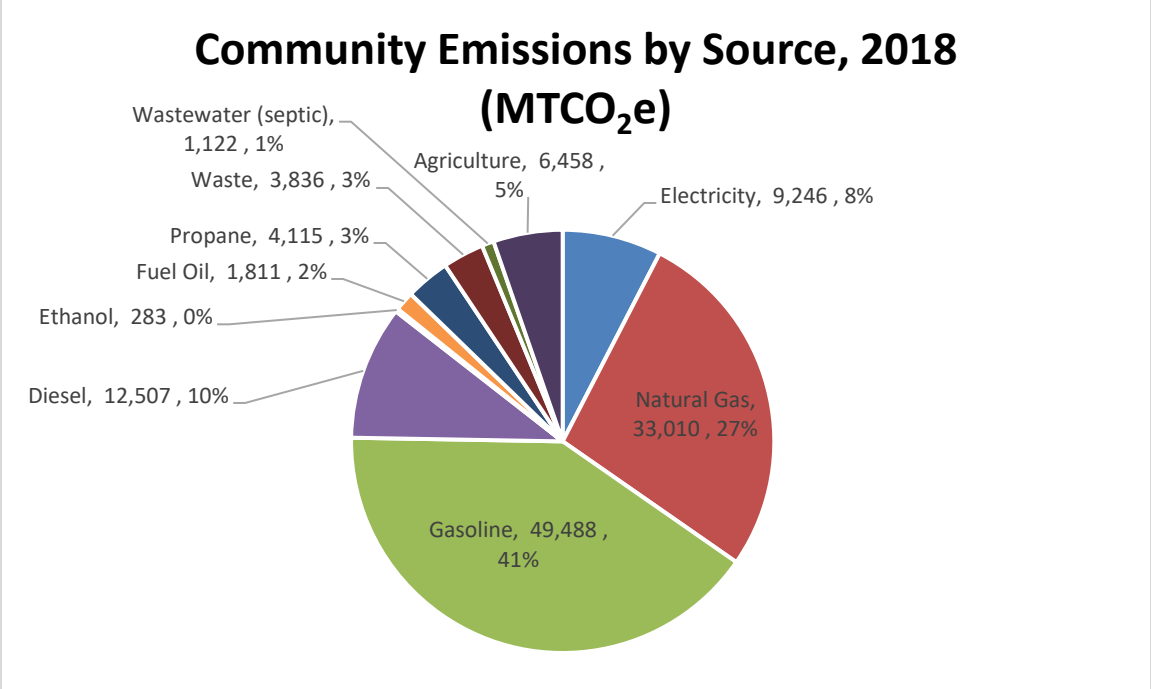


Figure 8: 2018 Community Emissions by Source

Community emissions decreased from 131,154 $MTCO_2e$ in 2013 to 121,875 $MTCO_2e$ in 2018. Transportation was the highest emitting sector in both years, followed by the commercial/industrial energy use sector and residential energy use sector. Emissions decreased in the residential energy use, commercial/industrial energy use, transportation, and wastewater (septic) sectors from 2013 to 2018, while emissions increased in the waste and agricultural sectors, as is illustrated in Figure 9 below.

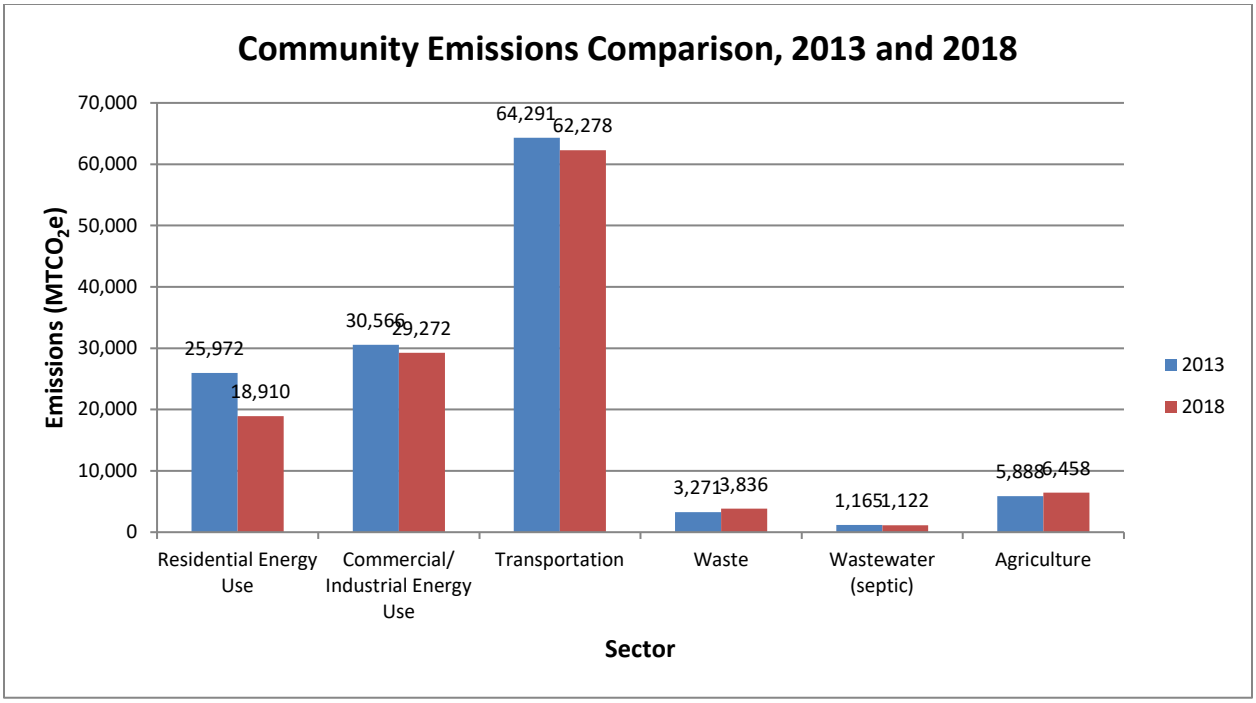


Figure 9: 2013 and 2018 Community Emissions Comparison

Residential Sector

Methods and inputs

Residential electricity and natural gas usage for 2013 was provided by Jim Yienger of Climate Action Associates who gathered this information as a pilot to the Utility Energy Registry (UER), which was developed pursuant to the Order Adopting the Utility Energy Registry, issued by the New York State Public Service Commission on April 20, 2018. The UER is an "online platform designed to offer streamlined public access to aggregated customer load data for electric and natural gas, segmented by customer type and by municipality."[9] 2018 electric and natural gas information were gathered from the NYSEG UER data for Jan-June 2018 and July-Dec 2018, under the residential field.

Residential propane and fuel oil use were compiled using the 2013 and 2018 American Community Survey 5-Year Estimates tables for Selected Housing Characteristics which indicate house heating fuels within the Town of Dryden. This information was compared to New York State data for household heating fuel, also from the 2013 and 2018 American Community Survey 5-Year Estimates tables, and amount/type of fuel consumed within the state (according to the US Energy Information Administration (EIA)'s 2013 and 2018 Residential Energy Consumption Estimates)[10] to calculate estimated heating fuel use within Town of Dryden homes.

[9]NYSERDA. Community Energy Use Data. https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data.
[10]US EIA. State Energy Data System (SEDS): 1960-2017). https://www.eia.gov/state/seds/seds-data-complete.php#Consumption

Residential energy uses were entered into ClearPath using standard emissions factors[11] for natural gas, propane, and fuel oil. The Environmental Protection Agency (EPA)'s Emissions & Generation Resource Integrated Database (eGRID) factors for NPCC Upstate NY from 2012 and 2018 were used for electricity emissions calculations (2013 eGRID figures are not available – see Tables 2 and 3 below).[12]

1. eGRID2012 Subregion Emissions – Greenhouse Gases

eGRID subregion acronym	eGRID subregion name	Carbon dioxide (CO_2)		Methane (CH_4)		Nitrous oxide (N_2O)		Carbon dioxide equivalent (CO_2e)	
		Emissions (tons)	Total output emission rate (lb/MWh)	Emissions (lbs)	Total output emission rate (lb/GWh)	Emissions (lbs)	Total output emission rate (lb/GWh)	Emissions (tons)	Total output emission rate (lb/MWh)
AKGD	ASCC Alaska Grid	3,382,037.0	1,268.73	140,402.7	26.34	40,490.5	7.59	3,389,787.2	1,271.64
AKMS	ASCC Miscellaneous	384,195.8	481.17	29,787.0	18.65	5,666.3	3.55	385,386.8	482.66
AZNM	WECC Southwest	102,534,225.3	1,152.89	3,317,864.6	18.65	2,686,986.1	15.11	102,985,545.7	1,157.96
CAMX	WECC California	67,187,988.1	650.31	6,429,630.8	31.12	1,172,434.9	5.67	67,437,084.4	652.72
ERCT	ERCOT All	205,873,315.5	1,143.04	6,015,952.8	16.70	4,443,235.0	12.33	206,625,056.6	1,147.21
FRCC	FRCC All	118,861,947.3	1,125.35	8,459,346.4	40.05	2,503,826.1	11.85	119,338,507.3	1,129.86
HIMS	HICC Miscellaneous	1,760,031.8	1,200.10	199,673.8	68.08	37,202.0	12.68	1,767,894.6	1,205.46
HIOA	HICC Oahu	5,939,881.8	1,576.38	681,311.9	90.41	162,405.3	21.55	5,972,208.4	1,584.95
MROE	MRO East	21,794,875.8	1,522.57	695,782.7	24.30	731,606.9	25.55	21,915,580.6	1,531.00
MROW	MRO West	145,305,369.2	1,425.15	5,627,262.8	27.60	4,947,215.7	24.26	146,130,871.2	1,433.25
NEWE	NPCC New England	38,377,520.5	637.90	8,764,225.4	72.84	1,288,397.3	10.71	38,669,246.4	642.75
NWPP	WECC Northwest	95,734,309.7	665.75	3,622,959.4	12.60	2,983,818.8	10.38	96,234,699.4	669.23
NYCW	NPCC NYC/Westchester	15,851,201.7	696.70	1,160,747.0	25.51	133,430.3	2.93	15,882,764.1	698.08
NYLI	NPCC Long Island	7,280,232.8	1,201.20	947,931.1	78.20	119,618.7	9.87	7,308,726.9	1,205.90
NYUP	NPCC Upstate NY	16,873,346.4	408.80	1,287,300.2	15.59	315,913.7	3.83	16,935,829.7	410.31
RFCE	RFC East	112,888,707.9	858.56	6,954,055.7	26.44	3,020,840.1	11.49	113,429,807.1	862.68
RFCM	RFC Michigan	68,119,780.7	1,569.23	2,635,889.2	30.36	2,093,696.0	24.12	68,471,962.7	1,577.34
RFCW	RFC West	391,126,291.4	1,379.48	9,701,816.8	17.11	12,286,300.3	21.67	393,132,519.0	1,386.55
RMPA	WECC Rockies	57,993,856.1	1,822.65	1,378,226.1	21.66	1,790,072.3	28.13	58,285,775.9	1,831.82
SPNO	SPP North	59,782,627.7	1,721.65	1,403,934.9	20.22	1,885,096.3	27.14	60,089,349.8	1,730.49
SPSO	SPP South	117,500,299.0	1,538.63	3,627,540.2	23.75	3,050,862.7	19.98	118,011,271.9	1,545.32
SRMV	SERC Mississippi Valley	95,886,176.4	1,052.92	3,816,210.1	20.95	1,931,912.9	10.61	96,225,693.1	1,056.65
SRMW	SERC Midwest	113,709,694.8	1,710.75	2,603,196.3	19.58	3,655,614.1	27.50	114,303,633.0	1,719.68
SRSO	SERC South	146,477,427.2	1,149.05	5,777,614.3	22.66	3,948,687.2	15.49	147,150,138.6	1,154.32
SRTV	SERC Tennessee Valley	153,167,116.4	1,337.15	3,982,959.3	17.39	4,761,521.4	20.78	153,946,973.3	1,343.96
SRVC	SERC Virginia/Carolina	135,132,027.1	932.87	6,937,947.2	23.95	4,229,617.5	14.60	135,860,466.3	937.90
U.S.		**2,298,924,483.4**	**1,136.53**	**96,199,568.7**	**23.78**	**64,226,468.3**	**15.88**	**2,309,886,780.4**	**1,141.95**

Table 2: eGRID2012 Summary Table: Subregion Emissions

[11] The ClearPath tool provides standard emissions factors that were developed by ICLEI and are described in the Local Government Operations Protocol, Appendix G.

[12] US EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

1. Subregion Output Emission Rates (eGRID2018)															
eGRID subregion acronym	eGRID subregion name	Total output emission rates lb/MWh							Non-baseload output emission rates lb/MWh							Grid Gross Loss (%)
		CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2	CO_2	CH_4	N_2O	CO_2e	Annual NO_x	Ozone Season NO_x	SO_2	
AKGD	ASCC Alaska Grid	1,039.6	0.082	0.011	1,045.0	5.5	5.4	1.1	1,262.5	0.110	0.015	1,269.6	6.5	6.4	1.1	5.12%
AKMS	ASCC Miscellaneous	525.1	0.024	0.004	527.0	7.7	7.8	0.7	1,528.3	0.068	0.012	1,533.6	22.8	23.0	2.0	5.12%
AZNM	WECC Southwest	1,022.4	0.077	0.011	1,027.5	0.7	0.7	0.3	1,435.3	0.097	0.014	1,441.8	1.0	0.9	0.3	4.80%
CAMX	WECC California	496.5	0.034	0.004	498.7	0.5	0.4	0.0	929.5	0.047	0.006	932.5	0.8	0.7	0.0	4.80%
ERCT	ERCOT All	931.7	0.066	0.009	936.1	0.5	0.6	0.8	1,261.0	0.083	0.012	1,266.5	0.8	0.8	1.1	4.87%
FRCC	FRCC All	931.8	0.066	0.009	936.1	0.4	0.4	0.3	1,123.9	0.068	0.009	1,128.3	0.4	0.4	0.4	4.88%
HIMS	HICC Miscellaneous	1,110.7	0.118	0.018	1,119.1	7.6	7.6	4.0	1,535.7	0.139	0.022	1,545.8	11.8	11.5	5.0	5.14%
HIOA	HICC Oahu	1,669.9	0.180	0.027	1,682.6	3.5	3.8	8.0	1,682.1	0.159	0.025	1,693.6	4.2	4.2	8.4	5.14%
MROE	MRO East	1,678.0	0.169	0.025	1,689.7	0.9	0.9	0.9	1,634.3	0.149	0.022	1,644.5	0.9	1.0	1.0	4.88%
MROW	MRO West	1,239.8	0.138	0.020	1,249.2	1.0	1.0	1.4	1,764.3	0.192	0.027	1,777.0	1.5	1.4	1.8	4.88%
NEWE	NPCC New England	522.3	0.082	0.011	527.6	0.4	0.4	0.1	931.0	0.086	0.011	936.5	0.5	0.4	0.3	4.88%
NWPP	WECC Northwest	639.0	0.064	0.009	643.4	0.6	0.6	0.4	1,575.1	0.148	0.021	1,585.2	1.4	1.4	0.8	4.80%
NYCW	NPCC NYC/Westchester	596.4	0.022	0.003	597.8	0.3	0.2	0.0	1,067.6	0.022	0.002	1,068.9	0.5	0.5	0.1	4.88%
NYLI	NPCC Long Island	1,184.2	0.139	0.018	1,193.1	0.9	0.8	0.2	1,320.3	0.040	0.005	1,322.8	1.0	0.9	0.4	4.88%
NYUP	NPCC Upstate NY	253.1	0.018	0.002	253.9	0.1	0.1	0.1	931.5	0.043	0.005	934.0	0.5	0.5	0.5	4.88%
RFCE	RFC East	716.0	0.061	0.008	720.0	0.3	0.3	0.5	1,242.6	0.091	0.013	1,248.6	0.7	0.6	0.8	4.88%
RFCM	RFC Michigan	1,312.6	0.129	0.018	1,321.2	0.8	0.8	1.3	1,748.9	0.171	0.024	1,760.3	1.2	1.2	2.1	4.88%
RFCW	RFC West	1,166.1	0.117	0.017	1,174.0	0.8	0.7	0.9	1,828.3	0.179	0.026	1,840.5	1.4	1.1	1.4	4.88%
RMPA	WECC Rockies	1,273.6	0.123	0.018	1,281.9	0.7	0.7	0.4	1,542.6	0.120	0.017	1,550.7	0.8	0.8	0.4	4.80%
SPNO	SPP North	1,163.2	0.124	0.018	1,171.6	0.6	0.7	0.3	1,945.5	0.201	0.029	1,959.2	1.2	1.3	0.7	4.88%
SPSO	SPP South	1,166.6	0.091	0.013	1,172.8	0.8	0.9	1.2	1,603.5	0.118	0.017	1,611.5	1.3	1.3	1.9	4.88%
SRMV	SERC Mississippi Valley	854.6	0.055	0.008	858.4	0.6	0.7	1.0	1,137.6	0.069	0.010	1,142.2	0.9	0.9	1.4	4.88%
SRMW	SERC Midwest	1,664.2	0.185	0.027	1,676.8	1.1	0.8	2.5	1,907.0	0.204	0.030	1,920.9	1.1	0.9	2.7	4.88%
SRSO	SERC South	1,027.9	0.081	0.012	1,033.5	0.5	0.4	0.3	1,413.7	0.107	0.015	1,420.9	0.8	0.7	0.5	4.88%
SRTV	SERC Tennessee Valley	1,031.5	0.097	0.014	1,038.1	0.6	0.5	0.6	1,644.3	0.149	0.021	1,654.4	0.8	0.8	0.9	4.88%
SRVC	SERC Virginia/Carolina	743.3	0.067	0.009	747.5	0.4	0.4	0.3	1,422.6	0.128	0.018	1,430.9	0.9	0.8	0.5	4.88%
U.S.		**947.2**	**0.085**	**0.012**	**952.9**	**0.6**	**0.6**	**0.7**	**1,432.3**	**0.117**	**0.017**	**1,440.1**	**1.0**	**0.9**	**1.0**	**4.87%**

Table 3: eGRID2018 Summary Table: Subregion Emissions

Results

Residential electricity consumption in 2013 was 46,632,206 kWh; residential natural gas consumption was 1,662,554 therms; residential propane consumption was 80,204 million British Thermal Units (MMBtu); and residential fuel oil consumption was 46,674 MMBtu. Residential emissions from electricity in 2013 were 8,679.3 $MTCO_2e$; emissions from residential natural gas were 8,840.6 $MTCO_2e$; emissions from propane were 4,977.6 $MTCO_2e$; and emissions from fuel oil were 3,474.8 $MTCO_2e$. Overall residential emissions in 2013 were 25,972 $MTCO_2e$.

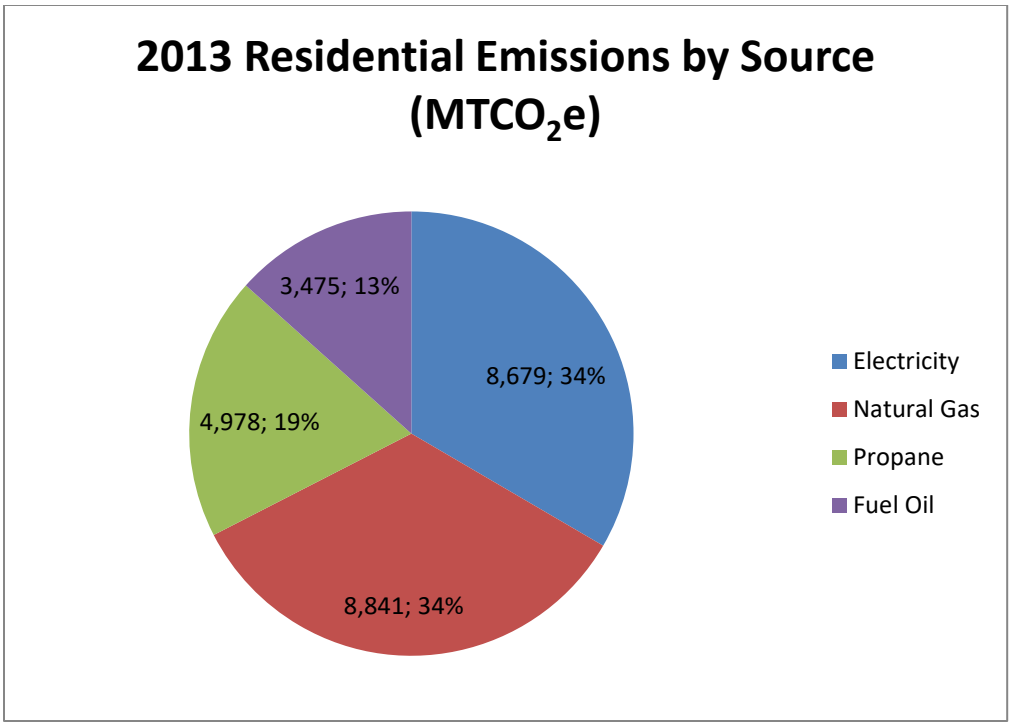


Figure 10: 2013 Residential Emissions by Source

Residential electricity consumption in 2018 was 49,238,767 kWh; residential natural gas consumption was 1,425,918 therms; residential propane consumption was 63,621 MMBtu; and residential fuel oil consumption was 22,872 MMBtu. Residential emissions from electricity in 2018 were 5,676.2 $MTCO_2e$; emissions from residential natural gas were 7,582.3 $MTCO_2e$; emissions from propane were 3,948.5 $MTCO_2e$; and emissions from fuel oil were 1,702.8 $MTCO_2e$. Overall residential emissions in 2018 were 18,910 $MTCO_2e$.

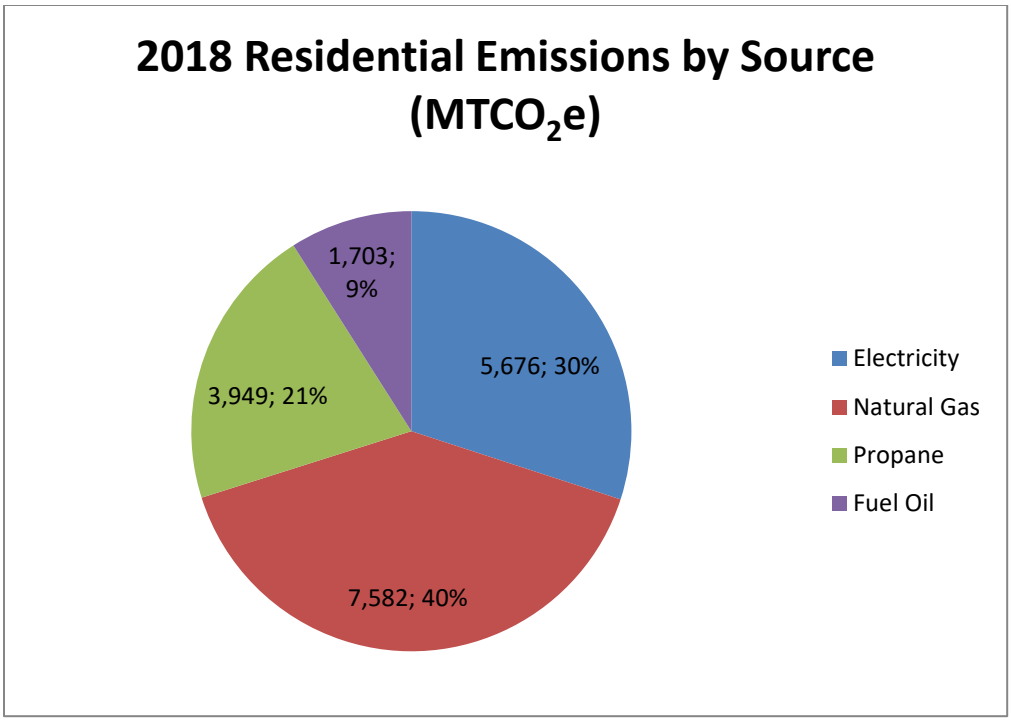


Figure 11: 2018 Residential Emissions by Source

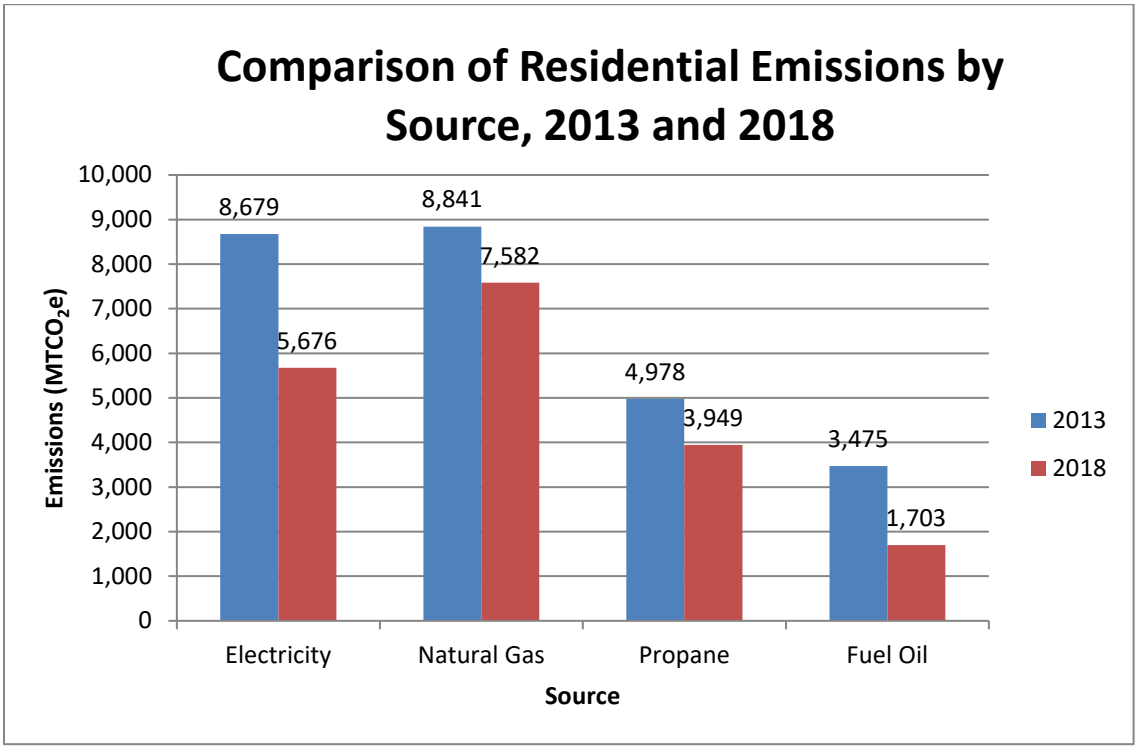


Figure 12: Comparison of Residential Emissions by Source, 2013 and 2018

Discussion

Residential emissions in the Town of Dryden decreased approximately 27% from 2013 to 2018 despite only a 0.2% decrease in occupied housing units and a 1.2% increase in population. All sources of residential emissions saw decreases from 2013 to 2018. As is evident from the eGRID emissions factors noted in Tables 2 and 3 above, emissions from the Upstate NY electric grid decreased significantly during this time period, which would contribute to the decrease in emissions from electricity. In addition, various factors, including weather variations between the two years as explained by heating and cooling degree days, and/or an increase in household energy efficiency or energy-conscious behaviors from 2013 to 2018 could have played a role in the decrease in emissions as well.

Degree days compare the mean outdoor temperature for a location to 65 degrees F, as that is typically the temperature at which households start to use heating fuels and/or air conditioning. A heating degree day (HDD) measures how cold the temperature was on a given day (i.e. 30 degrees F has 35 HDD), whereas a cooling degree day (CDD) measures how warm the mean temperature was on a given day (i.e. 85 degrees F has 20 CDD).

The table below compares 2013 and 2018 HDD and CDD for the Town of Dryden.[13] As the table below indicates, the 2018 heating months were warmer than in 2013, requiring less heating fuel use. However, the 2018 cooling months were warmer, which could indicate higher electric energy use for cooling, where available.

[13] Obtained from https://www.weatherdatadepot.com/ on 3/5/20 using Dryden, NY, balance point of 65 degrees, 2013 base year and 2018 comparison year.

Monthly Degree Day Comparison (Weather Station: NYDY)

	Base Year (2013)			Comparison Year (2018)			Comparison Percentages		
Month	HDD	CDD	TDD	HDD	CDD	TDD	HDD	CDD	TDD
January	1191	0	1191	1327	0	1327	11%		11%
February	1126	0	1126	912	0	912	-19%		-19%
March	1055	0	1055	1096	0	1096	3%		3%
April	609	0	609	780	0	780	28%		28%
May	240	57	297	141	47	188	-41%	-17%	-36%
June	99	90	189	75	64	139	-24%	-28%	-26%
July	19	229	248	8	200	208		-12%	-16%
August	43	88	131	3	190	193		115%	47%
September	247	50	297	124	117	241	-49%	134%	-18%
October	395	12	407	493	17	510	24%		25%
November	883	0	883	922	0	922	4%		4%
December	1138	0	1138	1040	0	1040	-8%		-8%
Annual Total	7045	526	7571	6921	635	7556	-2%	21%	-0%

Oldest available data for this station is Nov 1 2002 12:00:00:000AM

**** January daily data will be available on February 1, when the complete month will be posted.***

A negative percentage means the Comparison Year was more mild than the Base Year. A positive percentage means the Comparison Year was more severe than the Base Year. When the monthly degree days in either the base year or the comparison year are less than 30, a percentage comparison is not calculated. However, the Annual Total comparison percentages include all heating and cooling degree days.

Table 4: Monthly Degree Day Comparison, Town of Dryden 2013 and 2018, 65 degree balance point

Heating fuel use in 2018 was less than in 2013 which corresponds with the lower number of HDD. Since many homes in the Town of Dryden use electricity for heating (13% of homes in 2013 and 21.8% of homes in 2018), it also follows that electric use for heating might decrease from 2013 to 2018 due to the milder winter.

However, since CDD were greater in 2018 than 2013, it would be expected that electric use for cooling would have increased from 2013 to 2018. Electric use did increase by 5.6% from 2013 to 2018 despite a 0.2% decrease in number of occupied households, so this might be attributed to an increase in cooling from 2013 to 2018 as is supported by an increase in CDD. It is notable that despite the increase in residential electric use from 2013 to 2018, emissions from residential electricity still decreased by about 35%. This can be attributed to the decrease in electric grid emissions in Upstate NY during that time period. As Tables 5 and 6 below illustrate, from 2012 to 2018, the Upstate NY electric grid saw a significant decrease in generation from fossil fuels like coal (5.5% to 0.8%) and natural gas (30.4% to 25.9%), and an increase in generation from low-carbon energy sources like nuclear (28.9% to 31.3%), hydro (29.2% to 34.6%), wind (3.6% to 4.7%), and solar (0% to 0.2%). These changes caused emissions from electricity to decrease over the same time period.

5. eGRID2012 Subregion Resource Mix

eGRID subregion acronym	eGRID subregion name	Nameplate capacity (MW)	Net generation (MWh)	Generation Resource Mix (percent)										
				Coal	Oil	Gas	Other fossil	Nuclear	Hydro	Biomass	Wind	Solar	Geo-thermal	Other unknown/ purchased fuel
AKGD	ASCC Alaska Grid	2,007.8	5,331,368.0	12.8477	11.5119	65.3975	0.0000	0.0000	10.2429	0.0000	0.0000	0.0000	0.0000	0.0000
AKMS	ASCC Miscellaneous	754.2	1,596,926.5	0.0000	26.5523	7.6469	0.0000	0.0000	64.4336	0.1606	1.2066	0.0000	0.0000	0.0000
AZNM	WECC Southwest	63,160.5	177,873,710.9	37.3633	0.0501	33.9397	0.0042	17.9531	6.3295	0.3291	0.9724	0.6563	2.3956	0.0067
CAMX	WECC California	95,000.9	206,633,044.0	5.3301	0.8232	58.5863	0.0875	8.9567	12.7375	2.8533	5.0012	0.8732	4.4331	0.3180
ERCT	ERCOT All	115,223.9	360,221,517.3	30.5073	0.9452	49.0477	0.1204	10.6715	0.1091	0.1977	8.2871	0.0328	0.0000	0.0812
FRCC	FRCC All	78,701.1	211,244,527.5	19.4235	0.6443	68.0575	0.6566	8.4594	0.0712	1.7642	0.0000	0.0917	0.0000	0.8317
HIMS	HICC Miscellaneous	974.2	2,933,143.4	1.3576	64.2117	0.0000	7.3575	0.0000	3.9064	3.6304	10.4875	0.1507	8.8982	0.0000
HIOA	HICC Oahu	2,107.4	7,536,125.3	19.8712	74.9241	0.0000	1.8820	0.0000	0.0000	2.3830	0.9371	0.0025	0.0000	0.0000
MROE	MRO East	10,323.2	28,629,056.0	64.3153	0.9998	7.8554	0.1644	15.7738	2.9180	3.7800	4.0806	0.0000	0.0000	0.1126
MROW	MRO West	61,555.1	203,915,893.0	60.8336	0.1281	5.0019	0.1446	10.8341	6.2900	1.2954	15.2138	0.0000	0.0000	0.2584
NEWE	NPCC New England	40,761.9	120,324,524.1	2.9468	0.3392	51.9358	1.6642	30.0154	5.8701	6.0580	1.0680	0.0275	0.0000	0.0748
NWPP	WECC Northwest	80,235.0	287,596,498.3	24.5037	0.3463	10.6587	0.1333	3.2454	52.2177	1.0982	7.0260	0.0040	0.6476	0.1192
NYCW	NPCC NYC/Westchester	14,988.5	45,503,844.6	0.0000	0.1812	61.6948	0.4255	37.2211	0.0032	0.4741	0.0000	0.0000	0.0000	0.0000
NYLI	NPCC Long Island	6,031.2	12,121,635.9	0.0000	2.8882	89.2010	3.5290	0.0000	0.0000	3.9470	0.0000	0.4349	0.0000	0.0000
NYUP	NPCC Upstate NY	28,527.0	82,550,860.0	5.5130	0.1820	30.3999	0.3818	28.8761	29.2443	1.7995	3.6034	0.0000	0.0000	0.0000
RFCE	RFC East	81,434.8	262,972,203.0	23.8506	0.4047	30.7631	0.6749	40.9183	1.1175	1.3829	0.7618	0.1262	0.0000	0.0000
RFCM	RFC Michigan	30,753.9	86,819,386.1	58.5744	0.3601	24.9262	0.7525	11.8643	-0.3321	2.0364	1.8182	0.0000	0.0000	0.0000
RFCW	RFC West	165,405.0	567,064,674.2	58.7362	0.5280	11.0509	0.6630	25.7250	0.6682	0.5006	2.0570	0.0136	0.0000	0.0575
RMPA	WECC Rockies	19,921.2	63,636,839.6	70.3646	0.0411	16.6244	0.0000	0.0000	3.1724	0.0911	9.3627	0.2567	0.0000	0.0870
SPNO	SPP North	23,788.5	69,447,958.9	70.6814	0.0918	9.8012	0.0285	11.9297	0.0981	0.0873	7.2821	0.0000	0.0000	0.0000
SPSO	SPP South	50,658.9	152,734,002.2	48.4033	0.7668	39.4001	0.1997	0.0000	2.0027	1.4982	7.6329	0.0770	0.0000	0.0193
SRMV	SERC Mississippi Valley	52,017.2	182,134,134.3	20.5889	1.2729	53.5965	0.7162	21.1099	0.8429	1.7362	0.0000	0.0000	0.0000	0.1366
SRMW	SERC Midwest	38,922.6	132,935,700.9	75.4034	0.0680	6.8652	0.1280	15.1141	0.2213	0.0972	1.9076	0.0000	0.0000	0.1952
SRSO	SERC South	78,562.6	254,954,509.9	33.8126	0.1918	41.9257	0.0903	19.1033	1.7819	3.0938	0.0000	0.0006	0.0000	0.0000
SRTV	SERC Tennessee Valley	67,967.3	229,094,795.2	53.6644	0.7361	15.5289	0.0097	22.3402	6.9009	0.7985	0.0207	0.0006	0.0000	0.0000
SRVC	SERC Virginia/Carolina	88,528.9	289,711,035.7	34.7513	0.2012	20.2079	0.2173	41.1632	0.8794	2.4344	0.0000	0.0380	0.0000	0.1074
U.S.		**1,309,394.6**	**4,045,517,914.7**	**37.4156**	**0.7034**	**30.2949**	**0.3683**	**19.0169**	**6.7030**	**1.4404**	**3.4476**	**0.1035**	**0.3842**	**0.1221**

2. Subregion Resource Mix (eGRID2018)															
eGRID subregion acronym	eGRID subregion name	Nameplate Capacity (MW)	Net Generation (MWh)	Generation Resource Mix (percent)*											
				Coal	Oil	Gas	Other Fossil	Nuclear	Hydro	Biomass	Wind	Solar	Geo-thermal	Other unknown/ purchased fuel
AKGD	ASCC Alaska Grid	2,417	4,641,060	13.5%	8.3%	61.0%	0.0%	0.0%	13.6%	0.9%	2.6%	0.0%	0.0%	0.0%
AKMS	ASCC Miscellaneous	1,054	1,603,241	0.0%	26.3%	7.2%	0.0%	0.0%	64.4%	0.2%	2.1%	0.0%	0.0%	0.0%
AZNM	WECC Southwest	64,435	165,353,383	26.7%	0.0%	41.1%	0.0%	18.8%	3.4%	0.4%	1.8%	4.4%	3.4%	0.0%
CAMX	WECC California	111,738	200,103,502	4.4%	0.0%	45.2%	0.7%	9.1%	11.0%	2.8%	7.3%	14.9%	4.2%	0.3%
ERCT	ERCOT All	168,673	411,784,692	22.6%	0.0%	48.5%	0.4%	10.0%	0.2%	0.2%	17.0%	0.8%	0.0%	0.1%
FRCC	FRCC All	102,499	233,469,406	11.6%	0.9%	70.6%	0.0%	12.6%	0.1%	2.6%	0.0%	0.9%	0.0%	0.6%
HIMS	HICC Miscellaneous	1,265	2,743,591	0.0%	66.2%	0.0%	0.0%	0.0%	3.5%	1.9%	14.6%	2.9%	4.0%	6.9%
HIOA	HICC Oahu	2,354	7,053,182	18.6%	69.9%	0.0%	0.8%	0.0%	0.0%	6.4%	2.8%	1.5%	0.0%	0.0%
MROE	MRO East	11,489	24,091,646	64.1%	0.5%	22.6%	0.1%	0.0%	5.3%	4.3%	3.1%	0.0%	0.0%	0.1%
MROW	MRO West	81,925	236,704,124	51.8%	0.1%	8.0%	0.0%	10.6%	6.0%	1.1%	21.7%	0.5%	0.0%	0.2%
NEWE	NPCC New England	45,440	105,482,006	1.0%	1.2%	48.9%	0.2%	29.8%	6.7%	7.7%	3.4%	1.1%	0.0%	0.1%
NWPP	WECC Northwest	92,607	294,782,039	21.3%	0.2%	15.7%	0.3%	3.3%	47.7%	1.2%	8.3%	1.3%	0.6%	0.1%
NYCW	NPCC NYC/Westchester	17,331	43,455,637	0.0%	1.4%	60.1%	0.0%	37.6%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%
NYLI	NPCC Long Island	6,322	10,573,426	0.0%	5.5%	84.3%	0.0%	0.0%	0.0%	9.0%	0.0%	1.3%	0.0%	0.0%
NYUP	NPCC Upstate NY	30,838	84,997,204	0.8%	0.6%	25.9%	0.0%	31.3%	34.6%	2.0%	4.7%	0.2%	0.0%	0.0%
RFCE	RFC East	98,984	297,325,701	15.5%	0.5%	39.6%	0.2%	38.9%	2.0%	1.7%	1.0%	0.5%	0.0%	0.0%
RFCM	RFC Michigan	34,643	94,438,353	43.1%	1.3%	32.5%	1.8%	13.6%	0.0%	2.0%	5.7%	0.1%	0.0%	0.0%
RFCW	RFC West	192,653	532,056,236	44.4%	0.3%	21.0%	0.7%	28.3%	0.9%	0.6%	3.6%	0.1%	0.0%	0.0%
RMPA	WECC Rockies	23,700	65,413,620	44.8%	0.0%	25.5%	0.0%	0.0%	12.5%	0.3%	15.3%	1.6%	0.0%	0.1%
SPNO	SPP North	30,309	70,807,115	46.9%	0.2%	11.7%	0.0%	12.9%	0.2%	0.1%	27.9%	0.1%	0.0%	0.0%
SPSO	SPP South	62,596	160,677,686	30.9%	1.7%	40.0%	0.3%	0.0%	2.8%	1.4%	22.4%	0.4%	0.0%	0.1%
SRMV	SERC Mississippi Valley	58,996	177,877,883	16.8%	1.0%	56.5%	1.7%	20.7%	1.3%	1.6%	0.0%	0.1%	0.0%	0.3%
SRMW	SERC Midwest	40,774	128,388,555	70.2%	0.1%	9.4%	0.0%	14.8%	1.0%	0.1%	4.2%	0.0%	0.0%	0.2%
SRSO	SERC South	88,734	262,135,271	26.3%	0.2%	47.3%	0.0%	18.5%	3.0%	3.6%	0.0%	1.0%	0.0%	0.0%
SRTV	SERC Tennessee Valley	72,620	224,259,819	35.5%	0.1%	26.5%	0.0%	27.5%	9.5%	0.8%	0.0%	0.2%	0.0%	0.0%
SRVC	SERC Virginia/Carolina	117,248	328,151,742	19.1%	0.6%	34.6%	0.1%	37.8%	2.3%	2.8%	0.4%	2.2%	0.0%	0.1%
U.S.		**1,561,643**	**4,168,370,118**	**27.5%**	**0.6%**	**35.1%**	**0.3%**	**19.4%**	**6.9%**	**1.6%**	**6.5%**	**1.5%**	**0.4%**	**0.1%**
*percentages may not sum to 100 due to rounding															

Table 6: eGRID2018 Subregion Resource Mix

Additionally, it is possible that residents in the Town of Dryden made energy efficiency improvements and/or behavior changes at their homes between 2013 and 2018 which might have also contributed to the decrease in energy use across residential sources from 2013 to 2018. For example, from 2013 to 2018, residents in the town installed about 310 kW of solar at their homes, generating approximately 364,044 kWh of electricity each year.[14] Additionally between 2013 and 2018, 32 homes in the Town of Dryden completed building shell improvements (i.e. insulation and air sealing) through NYSERDA's Residential Existing Homes Program, making their homes more energy efficient.[15]

Commercial/Industrial Sector

Methods and inputs

Commercial/industrial electricity and natural gas usage for 2013 was provided by Jim Yienger, as described in the above Residential Sector section, including commercial, industrial, street and area lighting, and public authority accounts. 2018 electric and natural gas information were

[14] According to data accessed through Data.NY.Gov regarding solar installations within the Town of Dryden that utilized NYSERDA's residential solar incentive

[15] According to data accessed through Data.NY.Gov regarding 1-4 family homes within the Town of Dryden that worked through NYSERDA's Residential Existing Homes Program for building shell upgrades

gathered from the NYSEG UER data for Jan-June 2018 and July-Dec 2018, under the Business field (which includes non-residential customers similar to the 2013 pilot information).

Commercial/industrial propane and fuel oil use were estimated by assuming the proportion of residential homes using propane and fuel oil within the Town of Dryden is equal to the proportion of commercial square footage within the Town of Dryden using propane and fuel oil.

The proportion of residential homes using propane and fuel oil was determined from the 2013 and 2018 American Community Survey 5-Year Estimates tables for Selected Housing Characteristics, which indicate house heating fuels within the Town of Dryden, compared to total occupied housing units within the town. These ratios were multiplied by the estimated commercial square footage within the Town of Dryden to come up with the estimated commercial/industrial space within the town that uses fuel oil and propane.

Commercial/industrial square footage in the Town of Dryden was estimated using information from Real Property Services (RPS) provided by Tompkins County. The RPS information indicates that there are 125 commercial/industrial facilities in the Town of Dryden, and there is square footage information for 110 of those facilities. The 15 facilities with no square footage listed were estimated using the average square footage of the other 110 facilities. Total commercial/industrial square footage was estimated at 700,000 square feet.

Commercial square footage in the Town of Dryden using fuel oil and propane were then compared to commercial square footage using fuel oil and propane within New York State. Total commercial floor space within New York was calculated using EIA's Commercial Buildings Energy Consumption Survey (CBECS) for 2012 (this was the most recent year with data available – 2018 data is expected to be released in spring/summer 2021),[16] multiplied by the total number of nonfarm workers as per the New York State Department of Labor.[17] Dryden commercial/industrial space using fuel oil and propane were then compared to the statewide proportion of households using fuel oil and propane from the statewide American Community Survey. That ratio was then multiplied by the total fuel use within New York State (from the EIA's State Energy Data System (SEDS) 2013 and 2018 reports)[18] to come up with the total fuel oil and propane use within the Town of Dryden. These calculations are explained in detail within the CNY RPDB's data collection and analysis workbooks for this inventory.

Commercial energy uses were entered into ClearPath using the default emissions factors for natural gas, propane, and fuel oil.[19] Similar to the residential electric analysis, the EPA's eGRID factors from 2012 and 2018 were used for electricity emissions calculations for the commercial/industrial sector (2013 eGRID figures are not available).[20]

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[16] US EIA. Commercial Buildings Energy Consumption Survey (CBECS). https://www.eia.gov/consumption/commercial/data/2012/#b1-b2

[17] US Department of Labor. Major Areas, Current Employment Estimates. http://labor.ny.gov/stats/cesemp.asp

[18] US EIA. State Energy Data System (SEDS): 1960-2018. https://www.eia.gov/state/seds/seds-data-complete.php#Consumption.

[19] The ClearPath tool provides standard emissions factors that were developed by ICLEI and are described in the Local Government Operations Protocol, Appendix G.

[20] US EPA. Emissions & Generation Resource Integrated Database (eGRID). https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

Additionally, information about emissions from the Dominion Energy Borger Station provided by C.T. Male Associates in July and August 2020[21] was used to inform overall commercial/industrial emissions. These emissions would not have been included within UER data, as the station does not use utility-delivered natural gas to power their pumps, but rather natural gas that passes through the station directly via the pipeline.

Results

Not including the Borger Station, commercial/industrial electricity consumption in 2013 was 32,690,070 kWh; commercial/industrial natural gas consumption was 987,728 therms; commercial/industrial propane consumption was 3,261 million British Thermal Units (MMBtu); and commercial/industrial fuel oil consumption was 2,872 MMBtu. Commercial/industrial emissions from electricity in 2013 were 6,084.4 $MTCO_2e$; emissions from commercial/industrial natural gas were 5,252.2 $MTCO_2e$; emissions from propane were 202.4 $MTCO_2e$; and emissions from fuel oil were 213.81 $MTCO_2e$. According to C. T. Male Associates, natural gas used to power the Borger Station's pumping turbines currently contributes to 18,813 $MTCO_2e$, which equates to about 3,537,941 therms of natural gas burned.[22] These current figures were used for 2013 and 2018, as there were no significant changes in plant operations during that time.

[21] This inventory assumes that the emissions data provided by C. T. Male Associates uses the same methodology and global warming potentials as this inventory for calculating emissions, as calculation methodology was not available. This inventory does not include fugitive methane emissions from the Borger Station, as the data provided by C. T. Male Associates only provided a forecast of future fugitive methane emissions after the proposed upgrades are completed but not current or historic fugitive methane emissions. Publicly-available information does not provide fugitive methane emissions either.

[22] Energy use data is not available for the Borger Station; however, emissions information was provided by C. T. Male Associates in short tons. Emissions in short tons were converted to metric tons and added to this inventory – 20,738 short tons emissions currently = 18,813 metric tons; 27,339 short tons projected future emissions = 24,802 metric tons. Publicly-available data does not provide energy usage of the facility either, so energy usage was estimated assuming all process emissions were from burning of natural gas and emissions data was converted into therms of natural gas. This energy use estimate is used to inform other sections of this inventory.

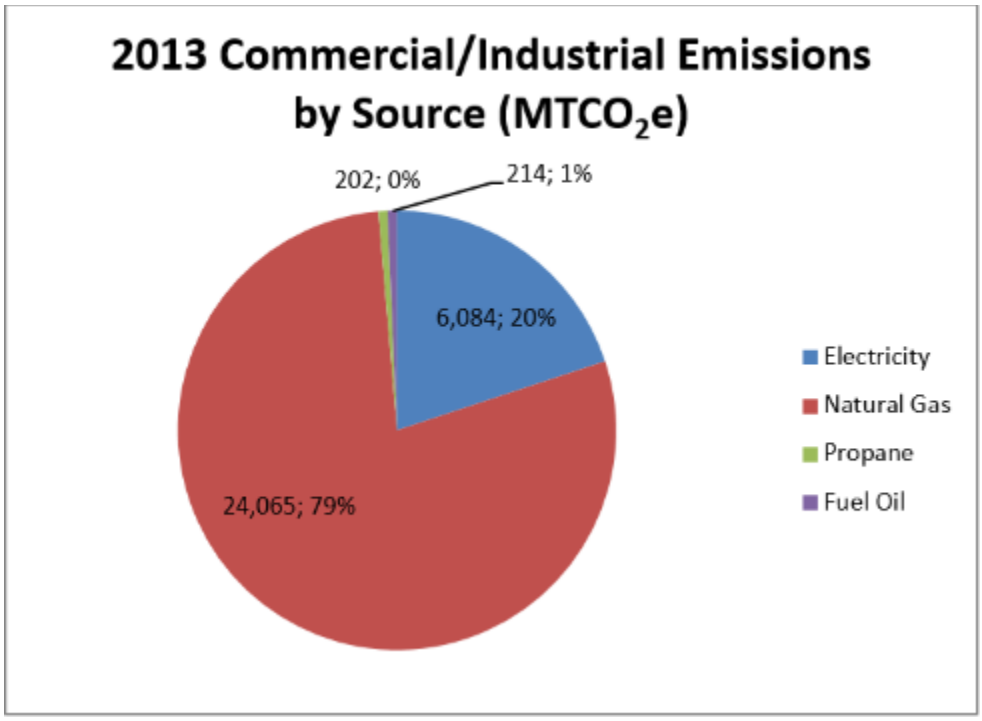

Figure 13: 2013 Commercial/Industrial Emissions by Source

Not including the Borger Station, commercial/industrial electricity consumption in 2018 was 30,964,571 kWh; commercial/industrial natural gas consumption was 1,244,020 therms; commercial/industrial propane consumption was 2,675 MMBtu; and commercial/industrial fuel oil consumption was 1,452 MMBtu. Commercial/industrial emissions from electricity in 2018 were 3,569.6 $MTCO_2e$; emissions from commercial/industrial natural gas were 6,615.1 $MTCO_2e$; emissions from propane were 166.02 $MTCO_2e$; and emissions from fuel oil were 108.1 $MTCO_2e$. According to C. T. Male Associates, natural gas used to power the Borger Station's pumping turbines currently contributes to 18,813 $MTCO_2e$, which equates to about 3,537,941 therms of natural gas burned.

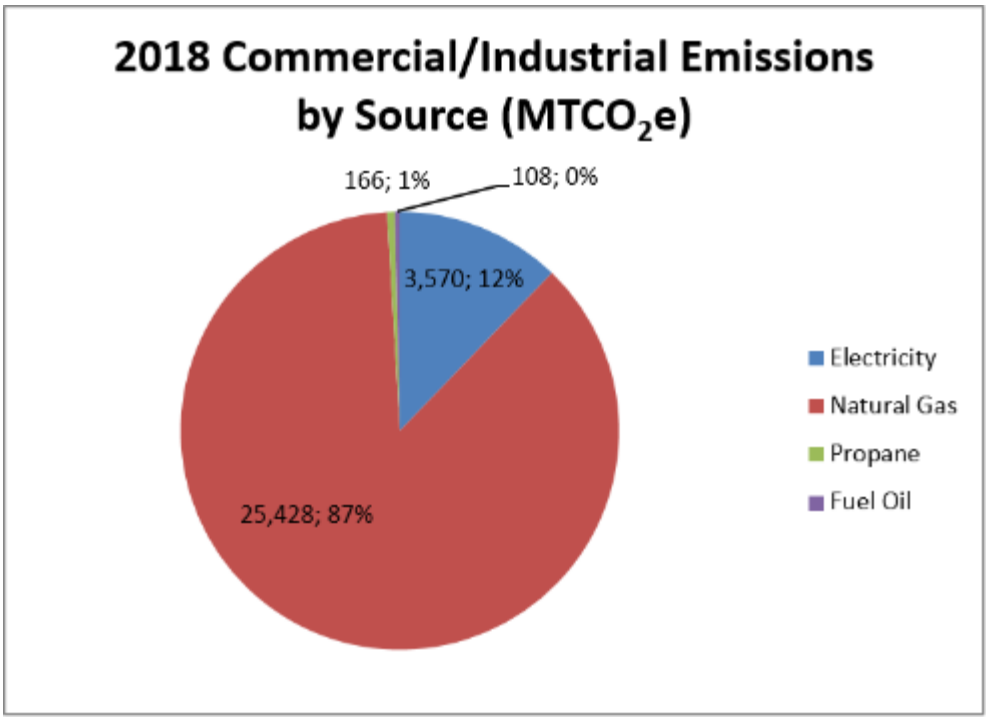

Figure 14: 2018 Commercial/Industrial Emissions by Source

Total commercial/industrial emissions in the Town of Dryden in 2013 were 30,566 $MTCO_2e$, and total commercial/industrial emissions in the Town of Dryden in 2018 were 29,272 $MTCO_2e$, with the breakdown by source explained in Figure 15 below.

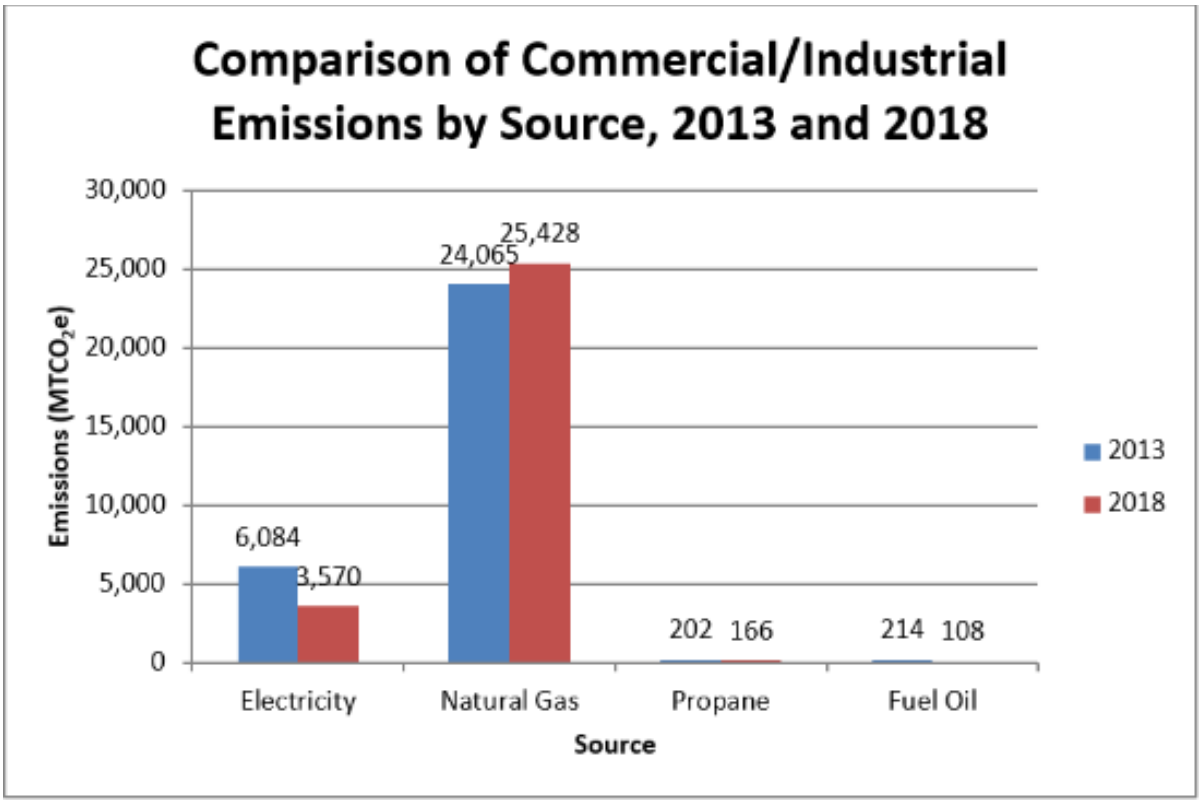

Figure 15: Comparison of Commercial/Industrial Emissions by Source, 2013 and 2018

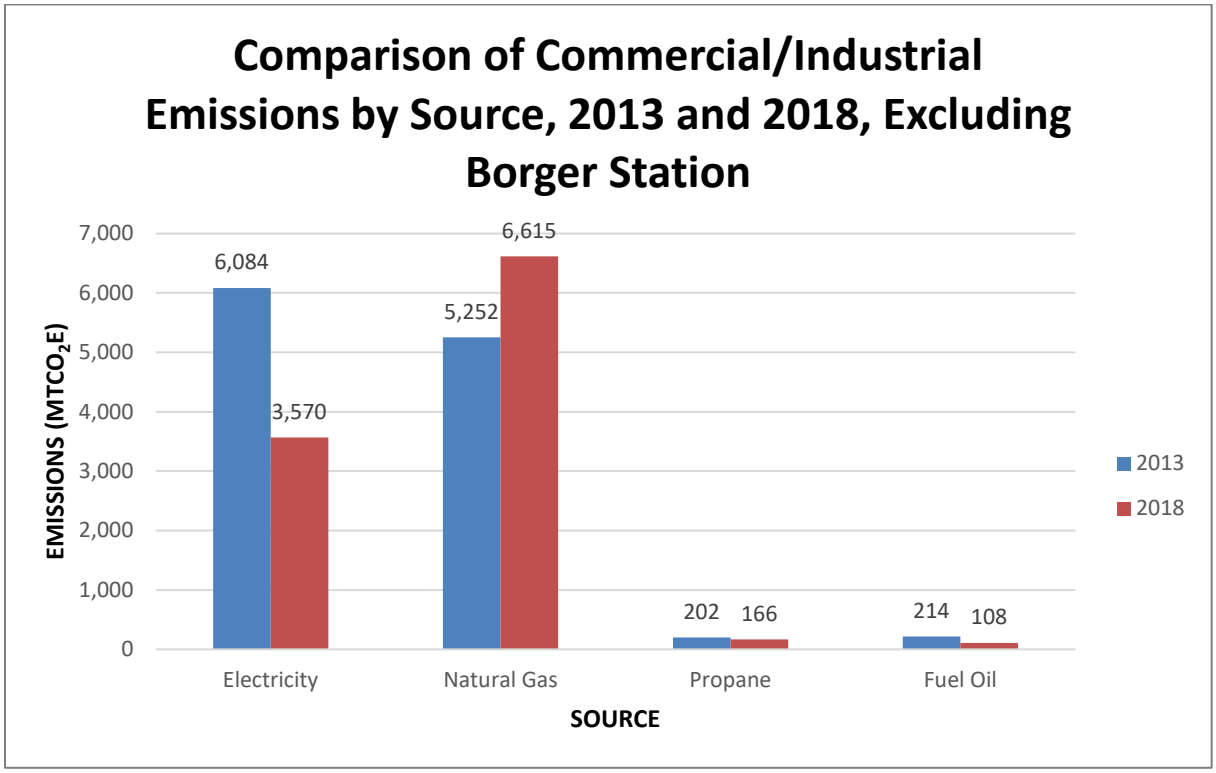

Figure 16: Comparison of Commercial/Industrial Emissions by Source, 2013 and 2018, Excluding Borger Station

Discussion

Overall commercial/industrial emissions in the Town of Dryden decreased from 2013 to 2018 by 4%; although, excluding the Borger Station information, commercial/industrial emissions decreased by 11%. Process emissions from the Borger Station pumps contributed to 62% of commercial/industrial emissions in 2013 and 64% of emissions in 2018.

Emissions from all sources except natural gas decreased from 2013 to 2018. As was noted in the residential section above, emissions from the Upstate NY electric grid decreased significantly during this time period, which contributed to the decrease in emissions from electricity. Also similar to the residential sector, HDD differences might explain some of the decreases in electricity, propane, and fuel oil used for heating from 2013 to 2018. Likewise, it is possible that businesses in the Town of Dryden made energy efficiency improvements and/or behavior changes at their facilities between 2013 and 2018 which might also help explain the decrease in energy use across commercial/industrial electricity, propane, and fuel oil sources from 2013 to 2018.

Overall commercial/industrial natural gas emissions increased by 6% from 2013 to 2018; however, excluding the Borger Station information, commercial/industrial natural gas emissions in the Town of Dryden increased by 26%. Commercial/industrial square footage is estimated as the same for the town from 2013 to 2018 for the purposes of this inventory, but it is possible that businesses actually expanded or new businesses entered the town between 2013 and 2018 which may have increased natural gas fuel usage in this sector.[23]

Transportation Sector

Methods and inputs

Transportation emissions were estimated using estimated annual vehicle miles traveled (AVMT), 2013 and 2018 U.S. National Default emissions factors (updated 2020 – see Tables 7 and 8 below)[24], and estimates for percentage of vehicle types.[25] Transportation emissions were broken down for diesel, gasoline, and ethanol, assuming a standard 10% ethanol blend in gasoline.[26]

AVMT for 2013 was calculated by multiplying available Annual Average Daily Traffic (AADT) counts from 2012 (closest available year's data) and earlier by road lengths within the Town of

[23] Since fuel oil and propane use for commercial/industrial buildings was also estimated based on the percentage of residential homes using those fuels, there is also room for error in these estimations, and it is possible that all or most heating fuel for commercial/industrial properties converted to natural gas for heating by 2018. This could also mean an overstatement of commercial emissions from propane and fuel oil in 2018 if those fuels were replaced by natural gas. Another possible reason natural gas use might have increased could be if any local vehicle fleets converted to compressed natural gas-fueled vehicles that are filled within the town.

[24] As per Eli Yewdall at ICLEI, "The default vehicle factor sets are derived from EIA data for fuel economy, and EPA emissions factors for CH4 and N2O. Because EPA publishes factors by model year, we had to convert those to represent the average mix of new and old vehicles on the road in a particular year; we did this using data from the US National GHG inventory."

[25] As provided in ClearPath: Gasoline passenger vehicles: 60.6% Deisel passenger vehicles: 0.3% Gasoline light trucks: 32.4% Deisel light trucks: 1.3% Gasoline heavy trucks: 0% Deisel heavy trucks: 5.4%

[26] To account for the 10% ethanol in most modern gasoline blends, VMT was entered for gasoline as 90% of the total VMT and for ethanol as 10% of the total VMT.

Dryden and multiplying total daily VMT by 365 days per year, and AVMT for 2018 was calculated by multiplying available AADT counts from 2018 and earlier by road lengths within the Town of Dryden and multiplying total daily VMT by 365 days per year.[27]

AADT counts were primarily only available for main arteries; therefore, additional calculations for AADT were needed to estimate AVMT for local/collector roads, as well as some main arteries that do not have AADTs available. The total length of roads in Dryden with traffic counts is 125 miles, while 107.7 miles of roads do not have AADT counts available.

[27] AADT and road segment length GIS data provided by Tom Mank, Data Analyst at the Ithaca Tompkins County Transportation Council. These traffic counts include all traffic within the town, including pass-through traffic where the origin and destination of trips occur outside of the town's boundaries. These trips will be more difficult to address in climate action planning than the trips that begin and/or end within the town.

* Name	2013 US National Defaults (updated 2020)
Year	2013
Gas Passenger Vehicle Fuel Economy (MPG)	23.41044
Gas Passenger Vehicle g CH4/mi	0.0220
Gas PassengerVehicle g N2O/mi	0.0171
Gas Light Truck Fuel Economy (MPG)	17.15954
Gas Light Truck g CH4/mi	0.0272
Gas Light Truck g N2O/mi	0.0306
Gas Heavy Truck Fuel Economy (MPG)	5.35632
Gas Heavy Truck g CH4/mi	0.1411
Gas Heavy Truck g N2O/mi	0.0787
Gas Transit Bus Fuel Economy (MPG)	17.15954
Gas Transit Bus g CH4/mi	0.0272
Gas Transit Bus g N2O/mi	0.0306
Gas Para Transit Bus Fuel Economy (MPG)	17.15954
Gas Para Transit Bus g CH4/mi	0.0272
Gas Para Transit Bus g N2O/mi	0.0306
Gas Motorcycle Fuel Economy (MPG)	23.41044
Gas Motorcycle g CH4/mi	0.0220
Gas Motorcycle g N2O/mi	0.0171
Electric Vehicle Fuel Economy (MPGe)	
Diesel Passenger Vehicle Fuel Economy (MPG)	23.41044
Diesel Passenger Vehicle g CH4/mi	0.0005
Diesel PassengerVehicle g N2O/mi	0.001
Diesel Light Truck Fuel Economy (MPG)	17.15954
Diesel Light Truck g CH4/mi	0.001
Diesel Light Truck g N2O/mi	0.0015
Diesel Heavy Truck Fuel Economy (MPG)	6.04151
Diesel Heavy Truck g CH4/mi	0.0051
Diesel Heavy Truck g N2O/mi	0.0048
Diesel Transit Bus Fuel Economy (MPG)	17.15954
Diesel Transit Bus g CH4/mi	0.001
Diesel Transit Bus g N2O/mi	0.0015
Diesel Para Transit Bus Fuel Economy (MPG)	17.15954
Diesel Para Transit Bus g CH4/mi	0.001
Diesel Para Transit Bus g N2O/mi	0.0015
Diesel Motorcycle Fuel Economy (MPG)	23.41044
Diesel Motorcycle g CH4/mi	0.0005
Diesel Motorcycle g N2O/mi	0.001

Table 7: 2013 US National Default Transportation Emissions

* Name	2018 US National Defaults (updated 2020)
Year	2018
Gas Passenger Vehicle Fuel Economy (MPG)	24.21489
Gas Passenger Vehicle g CH4/mi	0.0186
Gas PassengerVehicle g N2O/mi	0.0093
Gas Light Truck Fuel Economy (MPG)	17.52427
Gas Light Truck g CH4/mi	0.0201
Gas Light Truck g N2O/mi	0.0167
Gas Heavy Truck Fuel Economy (MPG)	5.361348
Gas Heavy Truck g CH4/mi	0.086
Gas Heavy Truck g N2O/mi	0.0664
Gas Transit Bus Fuel Economy (MPG)	17.52427
Gas Transit Bus g CH4/mi	0.0201
Gas Transit Bus g N2O/mi	0.0167
Gas Para Transit Bus Fuel Economy (MPG)	17.52427
Gas Para Transit Bus g CH4/mi	0.0201
Gas Para Transit Bus g N2O/mi	0.0167
Gas Motorcycle Fuel Economy (MPG)	24.21489
Gas Motorcycle g CH4/mi	0.0186
Gas Motorcycle g N2O/mi	0.0093
Electric Vehicle Fuel Economy (MPGe)	
Diesel Passenger Vehicle Fuel Economy (MPG)	24.21489
Diesel Passenger Vehicle g CH4/mi	0.0005
Diesel PassengerVehicle g N2O/mi	0.001
Diesel Light Truck Fuel Economy (MPG)	17.52427
Diesel Light Truck g CH4/mi	0.001
Diesel Light Truck g N2O/mi	0.0015
Diesel Heavy Truck Fuel Economy (MPG)	6.224736
Diesel Heavy Truck g CH4/mi	0.0051
Diesel Heavy Truck g N2O/mi	0.0048
Diesel Transit Bus Fuel Economy (MPG)	17.52427
Diesel Transit Bus g CH4/mi	0.001
Diesel Transit Bus g N2O/mi	0.0015
Diesel Para Transit Bus Fuel Economy (MPG)	17.52427
Diesel Para Transit Bus g CH4/mi	0.001
Diesel Para Transit Bus g N2O/mi	0.0015
Diesel Motorcycle Fuel Economy (MPG)	24.21489
Diesel Motorcycle g CH4/mi	0.0005
Diesel Motorcycle g N2O/mi	0.001

Table 8: 2018 US National Default Transportation Emissions

According to the *Minimum Maintenance Standards Regulation 239/02*, a set of guidelines produced by the Association of Municipalities of Ontario to help local communities estimate traffic volume, while conducting an AADT count, it is possible to estimate the traffic volume for

dead-ends and cul-de-sacs to avoid resource intensive counts. This is done by multiplying the number of houses on the roadway by a factor of 6 for rural areas.[28]

This method was applied to the Town of Dryden for the roads without AADT counts since most of these roads were local/collector roads. It was determined that there were 4,978 occupied households in the Town of Dryden in 2013 (not inclusive of the two villages) and 4,969 occupied households in the Town of Dryden in 2018, according to the American Community Survey. It was assumed that all homes are on roadways that do not have a count, since most houses are on local/collector roads. By multiplying the number of occupied homes by 6, a combined AADT count of 29,868 was calculated for 2013 and 29,814 was calculated for 2018 for all 107.7 miles of roads without AADT counts available. In order to calculate VMTs, an average AADT value was needed, and derived by dividing the total AADT by the 107.7 miles of uncounted roadway. This gave an average AADT value of 277.4 for both 2013 and 276.9 for 2018, which was applied to all roadways that did not have a count.

Results

AVMT for roads with AADT counts available in 2013 totaled 131,325,828.548, while AVMT for roads with AADT counts available in 2018 totaled 131,646,573.406. AVMT for roads with AADT counts available in 2013 totaled 10,901,820, while AVMT for roads with AADT counts available in 2018 totaled 10,882,110.

NAME	FROM_	TO	2012 or most recent AADT (no 2013 counts available)	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Hanshaw Rd	Rt 13	Etna Rd	6571	0.605	0.605	0.000	0.000	3,975.455	
Rt 13	Warren Rd	Hanshaw Rd	15448	1.131	1.131	0.000	0.000	17,471.688	
Rt 13	Hanshaw Rd	Rt 366	14805	1.294	1.294	0.000	0.000	19,157.670	
Rt 34B	Scofield Rd	Sheldon Rd	4796	2.004	2.004	0.000	0.000	9,611.184	
Rt 34B	Shelton Rd	Wood Rd	4426	1.062	1.062	0.000	0.000	4,700.412	
Rt 34B	Wood Rd	Rt 38	4426	1.740	1.740	0.000	0.000	7,701.240	
Rt 366	Game Farm Rd	Freese Rd	7348	0.752	0.752	0.000	0.000	5,525.696	
Rt 366	Freese Rd	Rt 13	6849	1.691	1.691	0.000	0.000	11,581.659	
Rt 13	Rt 366 Start OLAP	Rt 366 End OLAP	18338	1.242	1.242	0.000	0.000	22,775.796	
Rt 13	Yellow Barn Rd	Springhouse Rd	12354	1.551	1.551	0.000	0.000	19,161.054	
Rt 13	Springhouse Rd	Rt 38	12354	0.807	0.000	0.000	0.807	0.000	
Rt 13	Main St	North Rd	13488	0.884	0.000	0.000	0.884	0.000	
Rt 13	North Rd	County Line	10647	3.217	3.217	0.000	0.000	34,251.399	
Rt 34B	Rt 38	Salt Rd	2656	1.985	1.985	0.000	0.000	5,272.160	

[28] http://www.townshipsofheadclaramaria.ca/download.php?dl=YToyOntzOjI6ImlkIjtzOjI6Ijg1IjtzOjM6ImtleSI7aTo0O30=

NAME	FROM_	TO	2012 or most recent AADT (no 2013 counts available)	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Rt 38	Railroad St	Rt 13	3706	2.484	1.290	0.820	0.374	4,781.734	
W Dryden Rd	Sheldon Rd	Rt 38	2336	1.085	1.007	0.078	0.000	2,351.396	
W Dryden Rd	Asbury Rd	Sheldon Rd	1942	1.351	1.351	0.000	0.000	2,623.642	
Ellis Hollow Rd	Turkey Hill Rd	Thomas Rd	2503	2.023	2.023	0.000	0.000	5,063.569	
Ellis Hollow Creek	Ringwood Rd	Turkey Hill Rd	2087	2.404	2.404	0.000	0.000	5,017.148	
Etna Rd	Hanshaw Rd	Snyder Rd	4138	1.247	1.247	0.000	0.000	5,160.086	
Etna Rd	Upper Creek Rd	Hanshaw Rd	1695	2.382	2.382	0.000	0.000	4,037.490	
Fall Creek Rd	Village Line	Rt 38	4370	0.662	0.000	0.662	0.000	0.000	
Fall Creek Rd	Malloryville Rd	Village Line	4418	1.993	1.993	0.000	0.000	8,805.074	
Fall Creek Rd	Peruville Rd	Malloryville Rd	5446	1.308	1.308	0.000	0.000	7,123.368	
Sheldon Rd	Neimi Rd	Wood Rd	285	1.738	1.738	0.000	0.000	495.330	
North Rd	Fall Creek Rd	Rt 13	1531	2.404	2.383	0.000	0.021	3,648.630	
Sheldon Rd	Peruville Rd	Neimi Rd	597	3.086	3.086	0.000	0.000	1,842.342	
Turkey Hill Rd	Ellis Hollow Crk	Ellis Hollow Rd	1532	0.793	0.793	0.000	0.000	1,214.876	
German Cross Rd	Coddington Rd	Rt 79	280	0.918	0.918	0.000	0.000	257.040	
Ellis Hollow Rd	Thomas Rd	Ellis Hollow Crk	1538	0.414	0.414	0.000	0.000	636.732	
Ellis Hollow Creek	Ellis Hollow Crk	Ringwood Rd	871	0.567	0.567	0.000	0.000	493.857	
Rt 38	Keith La	County Line	3825	2.912	2.912	0.000	0.000	11,138.400	
Mineah Rd	Ringwood Rd	Mt. Pleasant Rd	307	0.522	0.522	0.000	0.000	160.254	
Mt. Pleasant Rd	Mineah Rd	Baker Hill Rd	307	1.911	1.911	0.000	0.000	586.677	
Mt. Pleasant Rd	Baker Hill Rd	Deer Haven Rd	307	1.091	1.091	0.000	0.000	334.937	
Mt. Pleasant Rd	Deer Haven Rd	Turkey Hill Rd	307	0.411	0.411	0.000	0.000	126.177	
Mt. Pleasant Rd	Turkey Hill Rd	Rt 366	1952	0.408	0.408	0.000	0.000	796.416	
Upper Creek Rd	Main St	Etna Rd	1189	0.960	0.960	0.000	0.000	1,141.440	
Lower Creek Rd	Etna Rd	Pinckney Rd	386	1.508	1.508	0.000	0.000	582.088	
Lower Creek Rd	Pinckney Rd	Rt 13	458	0.914	0.914	0.000	0.000	418.612	
Lower Creek Rd	Rt 13	Hanshaw Rd	1090	0.469	0.469	0.000	0.000	511.210	
Freese Rd	Hanshaw Rd	Rt 366	2080	1.129	1.129	0.000	0.000	2,348.320	
Hanshaw Rd	Lower Creek Rd	Rt 13	1507	0.378	0.378	0.000	0.000	569.646	
Hanshaw Rd	Etna Rd	Neimi Rd	1949	1.043	1.043	0.000	0.000	2,032.807	
Hanshaw Rd	Neimi Rd	West Dryden Rd	1002	1.016	1.016	0.000	0.000	1,018.032	
Ellis Hollow Rd	Ellis Holl Crk Rd	Hurd Rd	1206	0.589	0.589	0.000	0.000	710.334	
Snyder Hill Rd	Besemer Hill Rd	Sodom Rd	1452	0.192	0.192	0.000	0.000	278.784	
Snyder Hill Rd	Sodom Rd	N Landon Rd	1452	0.670	0.670	0.000	0.000	972.840	

NAME	FROM_	TO	2012 or most recent AADT (no 2013 counts available)	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Snyder Hill Rd	N Landon Rd	Rt 79	1452	0.654	0.654	0.000	0.000	949.608	
Snyder Hill Rd	Besemer Hill Rd	Quarry Rd	1452	1.042	1.042	0.000	0.000	1,512.984	
Snyder Hill Rd	Quarry Rd	Ithaca T/L	1452	1.113	1.113	0.000	0.000	1,616.076	
Game Farm Rd	Dryden Rd	Ellis Hollow Rd	1337	1.243	1.243	0.000	0.000	1,661.891	
Stevenson Rd	Game Farm Rd	Turkey Hill Rd	807	1.005	1.005	0.000	0.000	811.035	
Turkey Hill Rd	Ellis Hollow Cr	Mt. Pleasant Rd	1807	0.740	0.740	0.000	0.000	1,337.180	
Turkey Hill Rd	Mt. Pleasant Rd	Dryden Rd	517	0.503	0.503	0.000	0.000	260.051	
Genung Rd	Ellis Hollow Rd	Ellis Hollow Cr	337	0.760	0.760	0.000	0.000	256.120	
Yellow Barn Rd	Main St	Ferguson Rd	1017	0.368	0.368	0.000	0.000	374.256	
Ferguson Rd	Yellow Barn Rd	Irish Settlement	1487	0.800	0.800	0.000	0.000	1,189.600	
Ferguson Rd	Irish Settlement	South St	1667	1.155	0.661	0.000	0.494	1,102.651	
Lake Rd	Lake St	W Lake Rd	1372	1.150	0.987	0.000	0.163	1,354.054	
Lake Rd	Purvis Rd	W Lake Rd	226	2.503	2.503	0.000	0.000	565.678	
Pleasant St	Lake Rd	South St	1220	0.367	0.000	0.000	0.367	0.000	
W Lake Rd	Lake Rd	Rt 38	217	1.246	1.246	0.000	0.000	270.382	
Springhouse Rd	Rt 38	Rt 13	2359	0.579	0.000	0.000	0.579	0.000	
George Rd	Rt 38	Rt 13	1861	0.792	0.792	0.000	0.000	1,473.912	
Yellow Barn Rd	Midline Rd	Ferguson Rd	1097	2.889	2.889	0.000	0.000	3,169.233	
Ferguson Rd	Mill St	Rt 38	1552	0.314	0.000	0.000	0.314	0.000	
Midline Rd	Irish settlement	Ringwood Rd	399	2.286	2.286	0.000	0.000	912.114	
Mill St	Ferguson Rd	W Main St	390	0.540	0.000	0.000	0.540	0.000	
Rt 392	North St	Village Line	1302	0.627	0.000	0.000	0.627	0.000	
Rt 392	Village Line	County Line	1302	1.465	1.465	0.000	0.000	1,907.430	
Red Mill Rd	Hile School Rd	Fall Creek Rd	174	0.813	0.813	0.000	0.000	141.462	
Rt 366	Rt 13	Caswell Rd	3748	1.701	1.701	0.000	0.000	6,375.348	
Rt 366	Caswell Rd	Rt 38	5764	1.808	1.211	0.597	0.000	6,977.904	
Rt 38	Freeville V/L N	Rt 34B	3636	2.119	2.086	0.033	0.000	7,583.542	
Rt 79	Ithaca Town Line	Caroline T/ L	9902	2.081	2.081	0.000	0.000	20,606.062	
Ellis Hollow Rd	Game Farm Rd	Turkey Hill Rd	3597	1.052	1.052	0.000	0.000	3,784.044	
Caswell Rd	West Dryden Rd	Rt 34B	458	2.049	2.049	0.000	0.000	938.442	
Rt 13	Rt 366	Yellow Barn Rd	12860	2.377	2.377	0.000	0.000	30,568.220	
Hanshaw Rd	Sapsucker Woods	Lower Creek Rd	2356	1.126	1.126	0.000	0.000	2,652.856	
Ringwood Rd	Ellis Hollow Crk	Midline Rd	690	2.133	2.133	0.000	0.000	1,471.770	
Ringwood Rd	Midline Rd	Rt 13	630	2.299	2.299	0.000	0.000	1,448.370	
Irish Settlement	Midline Rd	Star Stanton Rd	783	1.828	1.828	0.000	0.000	1,431.324	

NAME	FROM_	TO	2012 or most recent AADT (no 2013 counts available)	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Irish Settlement	Star Stanton Rd	Rt 13	843	3.393	3.393	0.000	0.000	2,860.299	
West Dryden Rd	Sheldon Rd	Caswell Rd	2594	1.995	1.995	0.000	0.000	5,175.030	
Neimi Rd	Hanshaw Rd	Sheldon Rd	285	0.964	0.964	0.000	0.000	274.740	
Rt 38	Brooklyn Rd	Freeville V/L	3341	1.101	0.000	1.101	0.000	0.000	
Mill St	Main St	West Dryden Rd	557	0.820	0.667	0.153	0.000	371.379	
Herman Rd	Rt 38	Fall Creek Rd	710	0.485	0.000	0.485	0.000	0.000	
Cady La	Mott Rd	Peruville Rd	118	0.904	0.904	0.000	0.000	106.672	
Lewis St	W Main St	Rt 38	978	0.530	0.000	0.000	0.530	0.000	
McClintock Rd	Lake St	Rt 392	378	1.664	1.291	0.000	0.373	488.146	
Etna La	Lower Creek Rd	Rt 13	451	0.602	0.602	0.000	0.000	271.502	
Pinckney Rd	Rt 13	Lower Creek Rd	937	0.485	0.485	0.000	0.000	454.445	
Quarry Rd	Snyder Hill Rd	Ellis Hollow Rd	849	0.639	0.639	0.000	0.000	542.511	
E Malloryville Rd	Fall Creek Rd	Cortland Rd	482	1.965	1.965	0.000	0.000	947.130	
Rt 38	Rt 13	Keith La	3825	1.593	0.837	0.000	0.756	3,202.739	
Sapsucker Woods Rd	Hanshaw Rd	Rt 13	762	0.948	0.948	0.000	0.000	722.376	
Ed Hill Rd	Fall Creek Rd	Rt 34B	0	2.309	2.309	0.000	0.000	0.000	
Wood Rd N	West Dryden Rd	Rt 34B	0	2.055	2.055	0.000	0.000	0.000	
Wood Rd	Sheldon Rd	West Dryden Rd	0	1.550	1.550	0.000	0.000	0.000	
Johnson Rd	Rt 13	Rt 366	910	1.849	1.331	0.518	0.000	1,211.522	
Hurd Rd	Ellis Hollow Rd	Irish Settlement	0	1.954	1.954	0.000	0.000	0.000	
								359,796.791	**Total daily VMT**
								365	days per year
								131,325,828.548	**Total annual VMT**

Table 9: 2013 Town of Dryden Traffic Data for Road Segments with Available AADT

# occupied housing units:	4,978
Total AADT for roads not accounted for above:	29,868
Days per year:	365
Average AADT for roads not accounted for above:	277.4
Total Annual VMT for manually calculated roads:	**10,901,820**

Table 10: 2013 Town of Dryden Traffic Data for Road Segments without Available AADT

NAME	FROM_	TO	LastAADT 2	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Hanshaw Rd	Rt 13	Etna Rd	1972	0.605	0.605	0.000	0.000	1,193.060	
Rt 13	Warren Rd	Hanshaw Rd	15464	1.131	1.131	0.000	0.000	17,489.784	
Rt 13	Hanshaw Rd	Rt 366	13929	1.294	1.294	0.000	0.000	18,024.126	
Rt 34B	Scofield Rd	Sheldon Rd	4796	2.004	2.004	0.000	0.000	9,611.184	
Rt 34B	Shelton Rd	Wood Rd	4492	1.062	1.062	0.000	0.000	4,770.504	
Rt 34B	Wood Rd	Rt 38	4426	1.740	1.740	0.000	0.000	7,701.240	
Rt 366	Game Farm Rd	Freese Rd	7011	0.752	0.752	0.000	0.000	5,272.272	
Rt 366	Freese Rd	Rt 13	6849	1.691	1.691	0.000	0.000	11,581.659	
Rt 13	Rt 366 Start OLAP	Rt 366 End OLAP	18391	1.242	1.242	0.000	0.000	22,841.622	
Rt 13	Yellow Barn Rd	Springhouse Rd	11633	1.551	1.551	0.000	0.000	18,042.783	
Rt 13	Springhouse Rd	Rt 38	12354	0.807	0.000	0.000	0.807	0.000	
Rt 13	Main St	North Rd	11834	0.884	0.000	0.000	0.884	0.000	
Rt 13	North Rd	County Line	10132	3.217	3.217	0.000	0.000	32,594.644	
Rt 34B	Rt 38	Salt Rd	2882	1.985	1.985	0.000	0.000	5,720.770	
Rt 38	Railroad St	Rt 13	3706	2.484	1.290	0.820	0.374	4,781.734	
W Dryden Rd	Sheldon Rd	Rt 38	2675	1.085	1.007	0.078	0.000	2,692.631	
W Dryden Rd	Asbury Rd	Sheldon Rd	2480	1.351	1.351	0.000	0.000	3,350.480	
Ellis Hollow Rd	Turkey Hill Rd	Thomas Rd	2622	2.023	2.023	0.000	0.000	5,304.306	
Ellis Hollow Creek	Ringwood Rd	Turkey Hill Rd	2087	2.404	2.404	0.000	0.000	5,017.148	
Etna Rd	Hanshaw Rd	Snyder Rd	4138	1.247	1.247	0.000	0.000	5,160.086	
Etna Rd	Upper Creek Rd	Hanshaw Rd	1607	2.382	2.382	0.000	0.000	3,827.874	
Fall Creek Rd	Village Line	Rt 38	5509	0.662	0.000	0.662	0.000	0.000	
Fall Creek Rd	Malloryville Rd	Village Line	5107	1.993	1.993	0.000	0.000	10,178.251	
Fall Creek Rd	Peruville Rd	Malloryville Rd	6379	1.308	1.308	0.000	0.000	8,343.732	
Sheldon Rd	Neimi Rd	Wood Rd	285	1.738	1.738	0.000	0.000	495.330	
North Rd	Fall Creek Rd	Rt 13	1531	2.404	2.383	0.000	0.021	3,648.630	
Sheldon Rd	Peruville Rd	Neimi Rd	597	3.086	3.086	0.000	0.000	1,842.342	
Turkey Hill Rd	Ellis Hollow Crk	Ellis Hollow Rd	1578	0.793	0.793	0.000	0.000	1,251.354	
German Cross Rd	Coddington Rd	Rt 79	280	0.918	0.918	0.000	0.000	257.040	
Ellis Hollow Rd	Thomas Rd	Ellis Hollow Crk	1462	0.414	0.414	0.000	0.000	605.268	
Ellis Hollow Creek	Ellis Hollow Crk	Ringwood Rd	871	0.567	0.567	0.000	0.000	493.857	
Rt 38	Keith La	County Line	3896	2.912	2.912	0.000	0.000	11,345.152	
Mineah Rd	Ringwood Rd	Mt. Pleasant Rd	307	0.522	0.522	0.000	0.000	160.254	
Mt. Pleasant Rd	Mineah Rd	Baker Hill Rd	307	1.911	1.911	0.000	0.000	586.677	

NAME	FROM_	TO	LastAADT 2	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Mt. Pleasant Rd	Baker Hill Rd	Deer Haven Rd	307	1.091	1.091	0.000	0.000	334.937	
Mt. Pleasant Rd	Deer Haven Rd	Turkey Hill Rd	307	0.411	0.411	0.000	0.000	126.177	
Mt. Pleasant Rd	Turkey Hill Rd	Rt 366	1952	0.408	0.408	0.000	0.000	796.416	
Upper Creek Rd	Main St	Etna Rd	455	0.960	0.960	0.000	0.000	436.800	
Lower Creek Rd	Etna Rd	Pinckney Rd	1441	1.508	1.508	0.000	0.000	2,173.028	
Lower Creek Rd	Pinckney Rd	Rt 13	441	0.914	0.914	0.000	0.000	403.074	
Lower Creek Rd	Rt 13	Hanshaw Rd	1090	0.469	0.469	0.000	0.000	511.210	
Freese Rd	Hanshaw Rd	Rt 366	2080	1.129	1.129	0.000	0.000	2,348.320	
Hanshaw Rd	Lower Creek Rd	Rt 13	1507	0.378	0.378	0.000	0.000	569.646	
Hanshaw Rd	Etna Rd	Neimi Rd	1949	1.043	1.043	0.000	0.000	2,032.807	
Hanshaw Rd	Neimi Rd	West Dryden Rd	1002	1.016	1.016	0.000	0.000	1,018.032	
Ellis Hollow Rd	Ellis Holl Crk Rd	Hurd Rd	1206	0.589	0.589	0.000	0.000	710.334	
Snyder Hill Rd	Besemer Hill Rd	Sodom Rd	1452	0.192	0.192	0.000	0.000	278.784	
Snyder Hill Rd	Sodom Rd	N Landon Rd	1452	0.670	0.670	0.000	0.000	972.840	
Snyder Hill Rd	N Landon Rd	Rt 79	1452	0.654	0.654	0.000	0.000	949.608	
Snyder Hill Rd	Besemer Hill Rd	Quarry Rd	1452	1.042	1.042	0.000	0.000	1,512.984	
Snyder Hill Rd	Quarry Rd	Ithaca T/L	1452	1.113	1.113	0.000	0.000	1,616.076	
Game Farm Rd	Dryden Rd	Ellis Hollow Rd	2081	1.243	1.243	0.000	0.000	2,586.683	
Stevenson Rd	Game Farm Rd	Turkey Hill Rd	807	1.005	1.005	0.000	0.000	811.035	
Turkey Hill Rd	Ellis Hollow Cr	Mt. Pleasant Rd	1807	0.740	0.740	0.000	0.000	1,337.180	
Turkey Hill Rd	Mt. Pleasant Rd	Dryden Rd	517	0.503	0.503	0.000	0.000	260.051	
Genung Rd	Ellis Hollow Rd	Ellis Hollow Cr	337	0.760	0.760	0.000	0.000	256.120	
Yellow Barn Rd	Main St	Ferguson Rd	1017	0.368	0.368	0.000	0.000	374.256	
Ferguson Rd	Yellow Barn Rd	Irish Settlement	1487	0.800	0.800	0.000	0.000	1,189.600	
Ferguson Rd	Irish Settlement	South St	1667	1.155	0.661	0.000	0.494	1,102.651	
Lake Rd	Lake St	W Lake Rd	1372	1.150	0.987	0.000	0.163	1,354.054	
Lake Rd	Purvis Rd	W Lake Rd	127	2.503	2.503	0.000	0.000	317.881	
Pleasant St	Lake Rd	South St	1220	0.367	0.000	0.000	0.367	0.000	
W Lake Rd	Lake Rd	Rt 38	217	1.246	1.246	0.000	0.000	270.382	
Springhouse Rd	Rt 38	Rt 13	1413	0.579	0.000	0.000	0.579	0.000	
George Rd	Rt 38	Rt 13	1861	0.792	0.792	0.000	0.000	1,473.912	
Yellow Barn Rd	Midline Rd	Ferguson Rd	1017	2.889	2.889	0.000	0.000	2,938.113	
Ferguson Rd	Mill St	Rt 38	1607	0.314	0.000	0.000	0.314	0.000	
Midline Rd	Irish settlement	Ringwood Rd	399	2.286	2.286	0.000	0.000	912.114	
Mill St	Ferguson Rd	W Main St	390	0.540	0.000	0.000	0.540	0.000	
Rt 392	North St	Village Line	1302	0.627	0.000	0.000	0.627	0.000	
Rt 392	Village Line	County Line	1302	1.465	1.465	0.000	0.000	1,907.430	
Red Mill Rd	Hile School Rd	Fall Creek Rd	232	0.813	0.813	0.000	0.000	188.616	
Rt 366	Rt 13	Caswell Rd	3686	1.701	1.701	0.000	0.000	6,269.886	

NAME	FROM_	TO	LastAADT 2	Miles Total	Miles in Town	Miles in V Freeville	Miles in V Dryden	2018 DVMT	
Rt 366	Caswell Rd	Rt 38	5764	1.808	1.211	0.597	0.000	6,977.904	
Rt 38	Freeville V/L N	Rt 34B	3636	2.119	2.086	0.033	0.000	7,583.542	
Rt 79	Ithaca Town Line	Caroline T/ L	9101	2.081	2.081	0.000	0.000	18,939.181	
Ellis Hollow Rd	Game Farm Rd	Turkey Hill Rd	3597	1.052	1.052	0.000	0.000	3,784.044	
Caswell Rd	West Dryden Rd	Rt 34B	458	2.049	2.049	0.000	0.000	938.442	
Rt 13	Rt 366	Yellow Barn Rd	12860	2.377	2.377	0.000	0.000	30,568.220	
Hanshaw Rd	Sapsucker Woods	Lower Creek Rd	2355	1.126	1.126	0.000	0.000	2,651.730	
Ringwood Rd	Ellis Hollow Crk	Midline Rd	690	2.133	2.133	0.000	0.000	1,471.770	
Ringwood Rd	Midline Rd	Rt 13	748	2.299	2.299	0.000	0.000	1,719.652	
Irish Settlement	Midline Rd	Star Stanton Rd	783	1.828	1.828	0.000	0.000	1,431.324	
Irish Settlement	Star Stanton Rd	Rt 13	843	3.393	3.393	0.000	0.000	2,860.299	
West Dryden Rd	Sheldon Rd	Caswell Rd	2294	1.995	1.995	0.000	0.000	4,576.530	
Neimi Rd	Hanshaw Rd	Sheldon Rd	285	0.964	0.964	0.000	0.000	274.740	
Rt 38	Brooklyn Rd	Freeville V/L	3081	1.101	0.000	1.101	0.000	0.000	
Mill St	Main St	West Dryden Rd	320	0.820	0.667	0.153	0.000	213.359	
Herman Rd	Rt 38	Fall Creek Rd	756	0.485	0.000	0.485	0.000	0.000	
Cady La	Mott Rd	Peruville Rd	118	0.904	0.904	0.000	0.000	106.672	
Lewis St	W Main St	Rt 38	804	0.530	0.000	0.000	0.530	0.000	
McClintock Rd	Lake St	Rt 392	378	1.664	1.291	0.000	0.373	488.146	
Etna La	Lower Creek Rd	Rt 13	245	0.602	0.602	0.000	0.000	147.490	
Pinckney Rd	Rt 13	Lower Creek Rd	874	0.485	0.485	0.000	0.000	423.890	
Quarry Rd	Snyder Hill Rd	Ellis Hollow Rd	849	0.639	0.639	0.000	0.000	542.511	
E Malloryville Rd	Fall Creek Rd	Cortland Rd	482	1.965	1.965	0.000	0.000	947.130	
Rt 38	Rt 13	Keith La	3825	1.593	0.837	0.000	0.756	3,202.739	
Sapsucker Woods Rd	Hanshaw Rd	Rt 13	762	0.948	0.948	0.000	0.000	722.376	
Ed Hill Rd	Fall Creek Rd	Rt 34B	700	2.309	2.309	0.000	0.000	1,616.300	
Wood Rd N	West Dryden Rd	Rt 34B	600	2.055	2.055	0.000	0.000	1,233.000	
Wood Rd	Sheldon Rd	West Dryden Rd	600	1.550	1.550	0.000	0.000	930.000	
Johnson Rd	Rt 13	Rt 366	910	1.849	1.331	0.518	0.000	1,211.522	
Hurd Rd	Ellis Hollow Rd	Irish Settlement	300	1.954	1.954	0.000	0.000	586.200	
								360,675.544	**Total daily VMT**
								365	days per year
								131,646,573.406	**Total annual VMT**

Table 11: 2018 Town of Dryden Traffic Data for Road Segments with Available AADT

# occupied housing units:	4,969
Total AADT for roads not accounted for above:	29,814
Days per year:	365
Average AADT for roads not accounted for above:	276.9
Total Annual VMT for manually calculated roads:	**10,882,110**

Table 12: 2018 Town of Dryden Traffic Data for Road Segments without Available AADT

Emissions from transportation in the Town of Dryden in 2013 totaled 64,291 $MTCO_2e$, with 51,158 $MTCO_2e$ from gasoline, 12,851 $MTCO_2e$ from diesel, and 282 $MTCO_2e$ from ethanol.

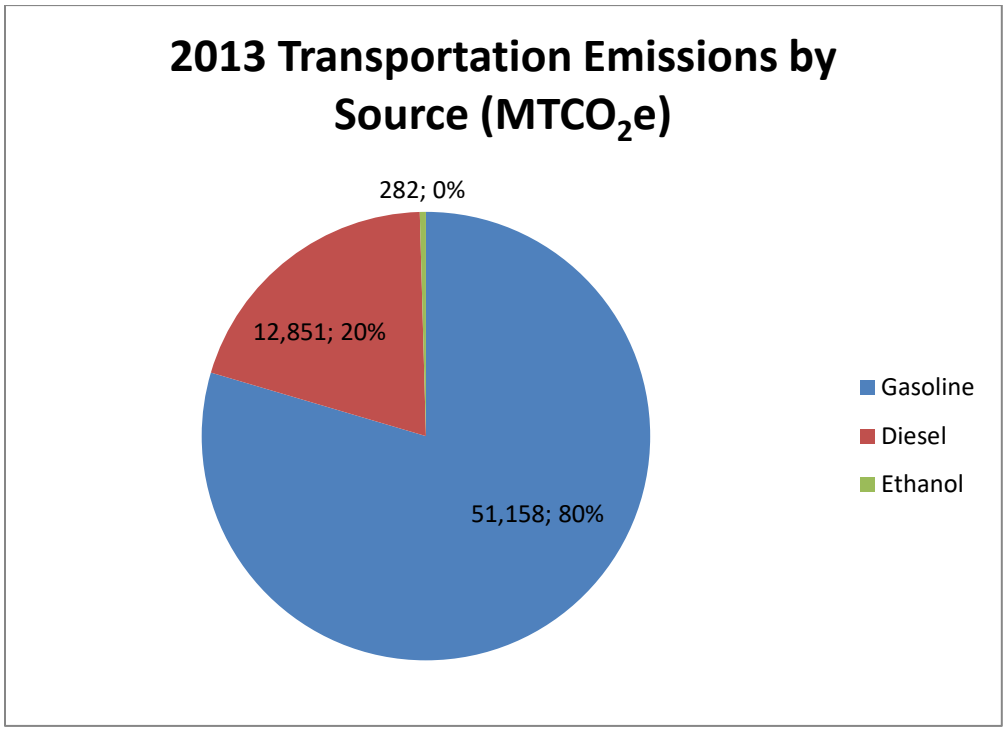

Figure 17: 2013 Transportation Emissions by Source

Emissions from transportation in the Town of Dryden in 2018 totaled 62,278 $MTCO_2e$, with 49,488 $MTCO_2e$ from gasoline, 12,507 $MTCO_2e$ from diesel, and 283 $MTCO_2e$ from ethanol.

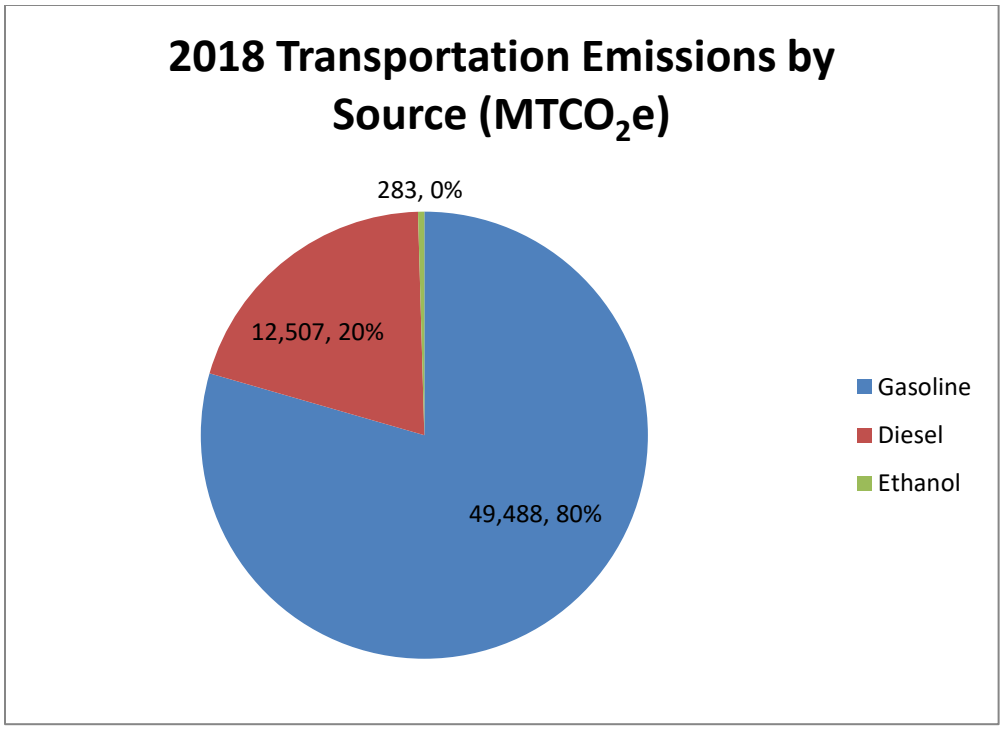

Figure 18: 2018 Transportation Emissions by Source

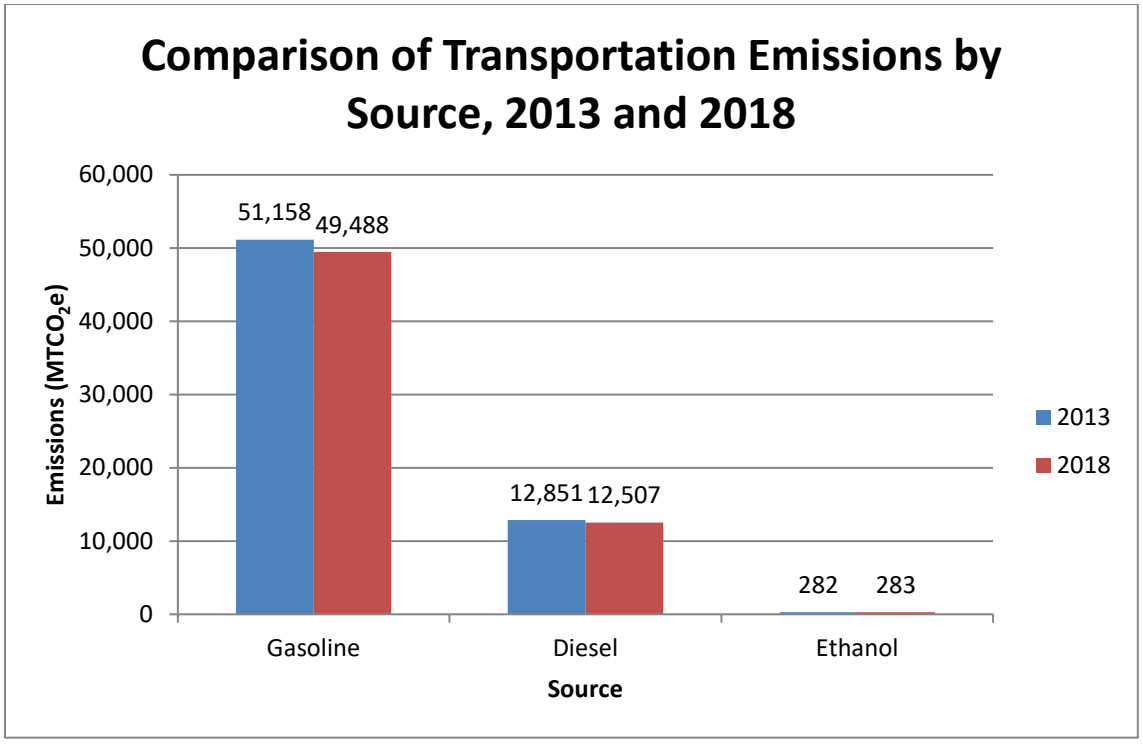

Figure 19: Comparison of Transportation Emissions by Source, 2013 and 2018

Discussion

Transportation emissions in the Town of Dryden decreased by 3.1% from 2013 to 2018, although estimated VMT increased by 0.21%. This decrease in emissions despite relatively constant VMT can likely be attributed to an increase in average vehicle miles per gallon for all vehicle types from 2013 to 2018.

There is some error involved in using this method to estimate AVMT for roads without AADT counts. For instance, the method is meant to be applied to dead end streets and cul-de-sacs, but this study applied it to all roads in Dryden without AADT counts available. In addition, there may have been some double counting if homes in Dryden are located on roads that have AADT counts available. However, this VMT calculation is supposed to serve as a best estimate reference for the town, not as an exact figure. Although this method involves some error, it is the best estimation of traffic volume given the availability of data.

It should also be noted that these methods for accounting for transportation emissions do not take electric vehicles into consideration. As electric vehicle use becomes more prevalent, on road transportation emissions will decrease even if VMT is kept constant. As of October 2, 2020, there are 795 registered electric vehicles in Tompkins County, including 522 plug-in hybrid electric vehicles and 273 battery electric vehicles, according to NYSERDA's Electric Vehicle Registration Map.[29] According to the 2018 American Community Survey 5-year tables for physical housing characteristics for occupied housing in Tompkins County, there are approximately 57,750 residential vehicles in the county, so electric vehicles represent about 1.4% of passenger vehicles within the county.

Waste Sector

Methods and inputs

Waste emissions from the Town of Dryden were calculated using total tons of waste from Tompkins County disposed of at landfills and scaling down to the town based on population. All disposal landfills are located outside the Town of Dryden and all have methane collection. Total waste figures are from Tompkins County's Solid Waste Division's 2013 and 2018 Annual Planning Unit Recycling Reports that are submitted to the NYS Department of Environmental Conservation.[30]

[29] Available at https://www.nyserda.ny.gov/All-Programs/Programs/ChargeNY/Support-Electric/Map-of-EV-Registrations, accessed October 27, 2020.

[30] Obtained from Nathonn Bates, Waste Reduction & Recycling Specialist at the Tompkins County Department of Recycling & Materials Management

Waste Stream (2013)	Landfill(s)	Methane collection?	County Population (2013)	Town of Dryden Population (2013)	Total tons of waste landfilled from Tompkins County (not including recycling waste)	Tons of waste disposed per person	Tons of waste disposed from Town of Dryden
MSW	Seneca Meadows, Ontario County	Yes	102,270	12,016	46,506.00	0.45	5,464.13
C&D Debris	Seneca Meadows, Ontario County	Yes	102,270	12,016	10,228.00	0.10	1,201.72
Non-Hazardous Industrial Waste	Seneca Meadows, Ontario County, Chemung County	Yes	102,270	12,016	4,697.45	0.05	551.92

Table 13: 2013 Community Waste Composition

Waste Stream (2018)	Landfill(s)	Methane collection?	County Population (2018)	Town of Dryden Population (2018)	Total tons of waste landfilled from Tompkins County (not including recycling waste)	Tons of waste disposed per person	Tons of waste disposed from Town of Dryden
MSW	Ontario County	Yes	102,962	12,158	17,154.87	0.17	2,025.69
MSW	Seneca Meadows	Yes	102,962	12,158	9,339.62	0.09	1,102.84
MSW	Hyland Landfill	Yes	102,962	12,158	1,703.75	0.02	201.18
MSW	Chemung County	Yes	102,962	12,158	5,590.18	0.05	660.10
MSW	Stueben County	Yes	102,962	12,158	20,389.23	0.20	2,407.61
C&D Debris	Hakes Landfill	Yes	102,962	12,158	2,716.39	0.03	320.76
Biosolids	Ontario County	Yes	102,962	12,158	4,960.67	0.05	585.77
Biosolids	Chemung County	Yes	102,962	12,158	1,902.40	0.02	224.64
Biosolids	Seneca Meadows	Yes	102,962	12,158	1,048.67	0.01	123.83

Table 14: 2018 Community Waste Composition

Based on guidance from Eli Yewdall, Senior Program Officer at ICLEI, waste data for C&D waste and biosolids (sludge/manure) was then put into ClearPath using the "Waste Generation - California" calculator, keeping the 75% landfill gas and the 10% oxidation percentage defaults. Waste data for mixed Municipal Solid Waste (MSW) was entered into ClearPath using the "Waste Generation (2019)" calculator, assuming a typical methane collection scenario and moderate moisture content. Finally, Non-Hazardous Industrial Waste was not included in this inventory, as industrial waste includes items that do not typically break down to produce

methane in a landfill.[31] The "Waste Generation – California" calculator does not use a factor set, but has waste composition entered into the calculator itself, whereas a 100% mixed MSW factor set was used with the "Waste Generation (2019)" calculator.

Results

Waste emissions in 2013 totaled 3,271 $MTCO_2e$, with 3,187 $MTCO_2e$ from mixed MSW and 84 $MTCO_2e$ from C&D Debris.

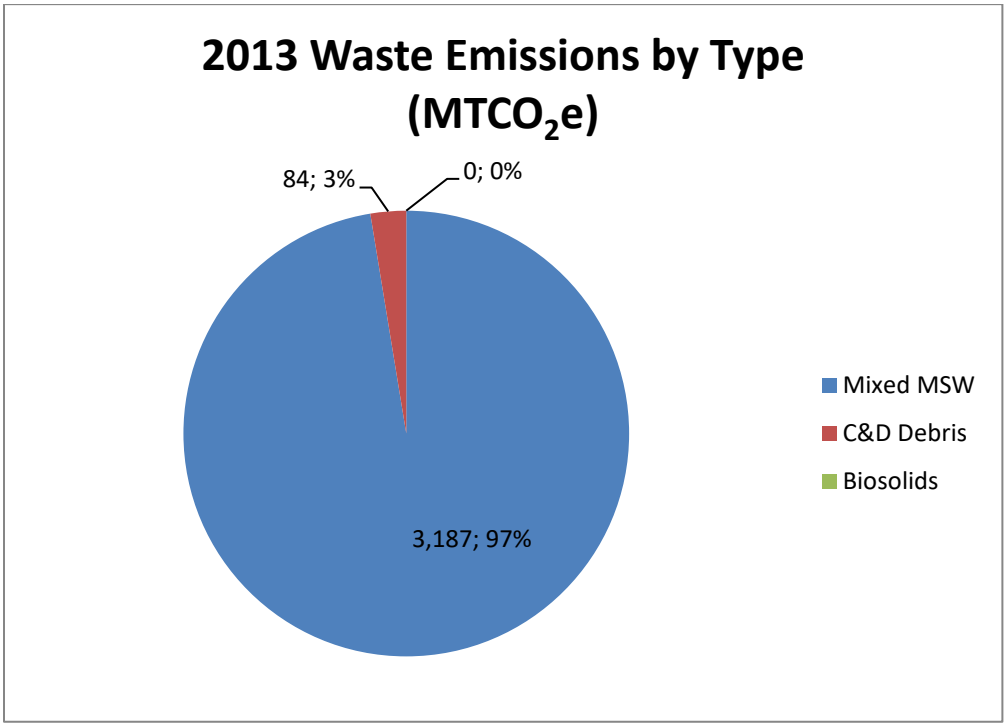

Figure 20: 2013 Waste Emissions by Type

Waste emissions in 2018 totaled 3,836 $MTCO_2e$, with 3,731 $MTCO_2e$ from mixed MSW, 23 $MTCO_2e$ from C&D Debris, and 82 $MTCO_2e$ from Biosolids.

[31] As instructed by Eli Yewdall

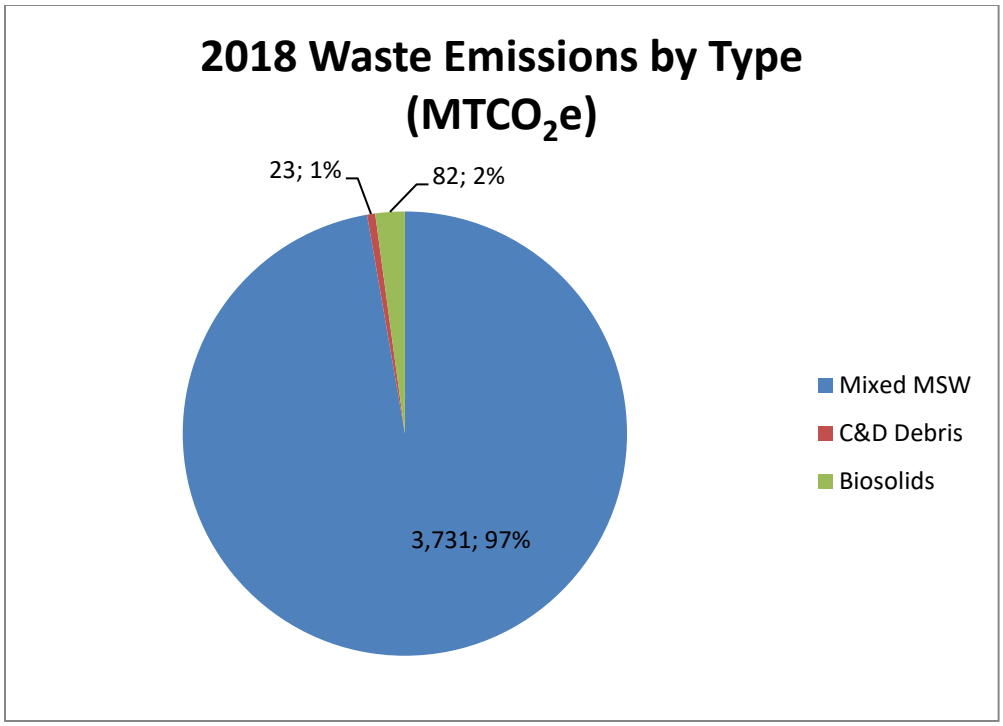

Figure 21: 2018 Waste Emissions by Type

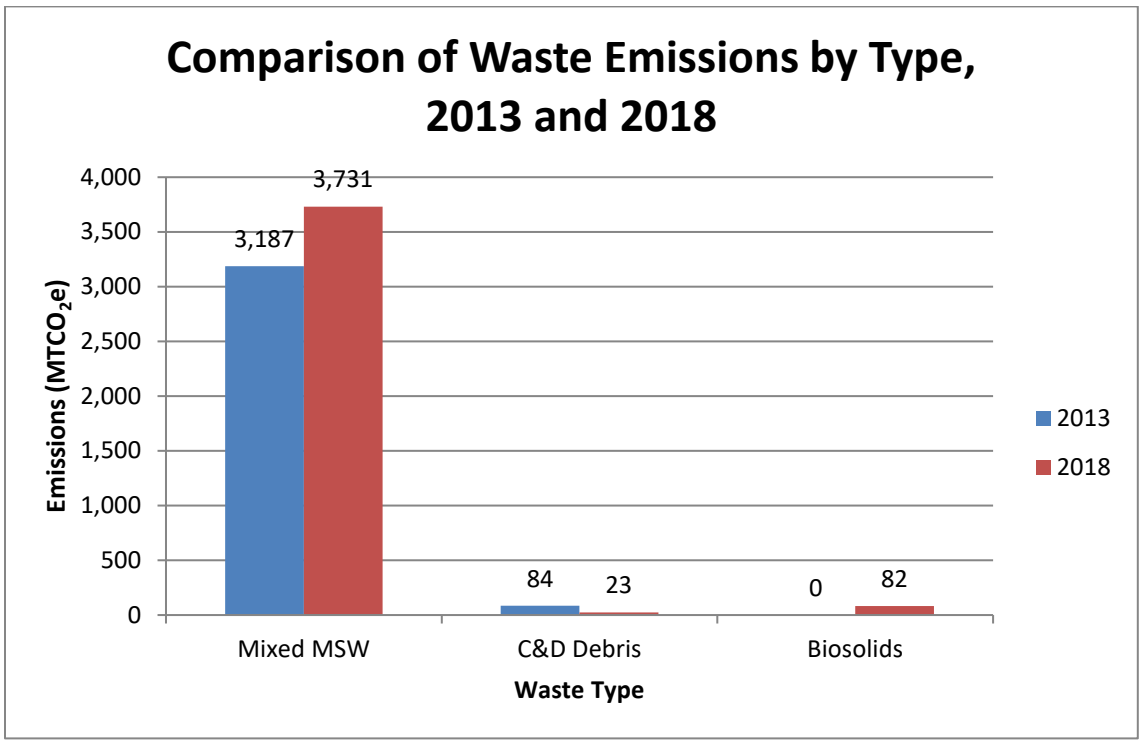

Figure 22: Comparison of Waste Emissions by Type, 2013 and 2018

Discussion

Waste emissions in the Town of Dryden increased by 17.3% from 2013 to 2018, with a 14.8% increase in total waste disposed from the community during that time period (not including non-

hazardous industrial waste to match waste types included in emissions data), despite only a 1.2% increase in population during that time period.[32]

Whatever the reason may be for the increase in waste and waste emissions during this time period, Tompkins County is working hard to divert waste that ends up in landfills, including through their robust recycling program and composting program. For example, in 2013, the Tompkins County Recycling and Solid Waste Center received and processed 15,323 tons of recyclables and 1,807 tons of food scraps for composting, and in 2018 the Tompkins County Recycling and Solid Waste Center received and processed 14,355 tons of recyclables and 1,960 tons of food scraps for composting.[33] The Tompkins County Recycling and Solid Waste Center also supported a Waste Reduction program in 2018 with an emphasis on food waste prevention and donation. This program reached about 306,000 individuals and is estimated to have diverted 4,120 tons of food scraps and 6,340 tons of yard waste through home composting.[34] Initiatives such as these are important for continued efforts to decrease waste sent to landfill, as landfilled waste breaks down to create methane.

Wastewater Sector

Methods and inputs

According to the Town of Dryden Water and Sewer District Consolidation Study report from March 2017, "The majority of the town's 274 customer accounts are connected to the Ithaca Area Wastewater Treatment Facility located in the City of Ithaca. Customers in the Sapsucker Woods Sewer District are afforded sewage treatment services under contract with the Village of Cayuga Heights. Town customers of the Cortland Road Sewer District receive sewage treatment service from the Village of Dryden." The Ithaca Area Wastewater Treatment Facility is partially owned by the Town of Dryden but is outside town boundaries. The Village of Dryden and Village of Cayuga Heights wastewater treatment facilities are also outside the town boundaries. Emissions from treated wastewater from the Town of Dryden should therefore be included in the inventories for the communities within which the treatment facilities are located, and are not included in this inventory. Therefore, only septic system emissions are included in the Town of Dryden's community inventory.

Fugitive emissions from septic systems within the Town of Dryden were calculated using the Population Based method in ClearPath. The population served by septic systems within the town was estimated by subtracting the number of accounts connected to the sewer in 2013 and 2018 (information provided by Ray Burger, Director of Planning for the Town of Dryden) from the total number of households within the Town of Dryden, and then multiplying the number of households served by septic systems by the average household size of owner-occupied units

[32] Since methods to estimate waste emissions within the town are scaled down from county-wide data, there is some room for error. It is possible that waste increased in another municipality within Tompkins County, thus inflating estimated waste stream from each municipality using this method of estimation. It could also be possible that there was an increase in commercial/industrial activities within the county and/or the Town of Dryden that caused a subsequent increase in waste as well.

[33] Recycling and Materials Management of Tompkins County, 2013 and 2018 Annual Reports.

[34] Recycling and Materials Management of Tompkins County, 2018 Annual Report. https://recycletompkins.org/wp-content/uploads/2019/06/2018-TCRMM-Annual-Report.pdf

within the town (from the American Community Survey 2013 and 2018 5-year tables for Selected Housing Characteristics).

Households connected to sewer (2013):	750
Total households (2013):	4,978
Households using septic (2013):	4,228
Average household size of owner-occupied unit in town:	2.54
Population using septic in (2013):	10,739

Table 15: 2013 Estimation for Town of Dryden Population using Septic Systems

Households connected to sewer (2018):	800
Total households (2018):	4,969
Households using septic (2018):	4,169
Average household size of owner-occupied unit in town:	2.48
Population using septic in (2018):	10,339

Table 16: 2018 Estimation for Town of Dryden Population using Septic Systems

Results

Fugitive emissions from septic systems in the Town of Dryden totaled 1,165 $MTCO_2e$ in 2013 and 1,122 $MTCO_2e$ in 2018.

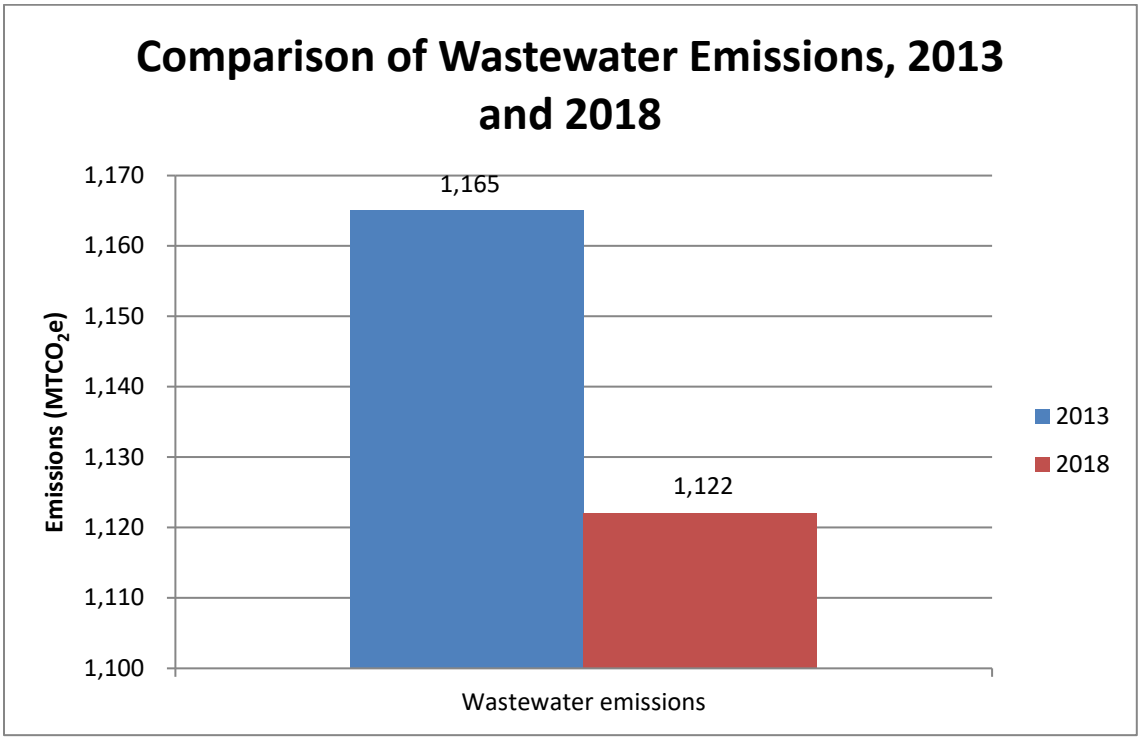

Figure 23: Comparison of Wastewater Emissions, 2013 and 2018

Discussion

Wastewater emissions from the Town of Dryden decreased by 3.7% from 2013 to 2018, which reflects the estimated 3.7% decrease in population utilizing septic systems in 2018 compared to 2013.

Agriculture Sector

Methods and inputs

Agricultural emissions from enteric fermentation were estimated using ICLEI's Community Protocol, Appendix G: Agricultural and Livestock Emission Activities and Sources. Tompkins County data from the 2012 and 2017 Agricultural Census was pared down to town-level data by comparing the ratio of town land in agriculture to county land in agriculture and multiplying that figure by livestock counts. Estimated livestock counts for the town were then multiplied by each animal type's emissions factor (kg CH_4/head/year as provided by ICLEI), then by 1/1000 to convert kg to metric tons. Metric tons of CH_4 from all animal sources was then input into ClearPath to calculate metric tons of carbon dioxide equivalent produced by enteric fermentation from all animal types within the Town of Dryden.

2013	Land in Agriculture (acres)	Data Source
Tompkins County	90,774	2012 Agricultural Census
Town of Dryden	14,836	2018 Town Agriculture and Farmland Protection Plan

Ratio of agricultural land in town: **16.34%**

Table 17: County and Town land in Agriculture, 2013

2018	Land in Agriculture (acres)	Data Source
Tompkins County	91,277	2017 Agricultural Census
Town of Dryden	14,836	2018 Town Agriculture and Farmland Protection Plan

Ratio of agricultural land in town: **16.25%**

Table 18: County and Town land in Agriculture, 2018

Livestock Population, 2013	County	Town (estimated)
beef cows	1,133	185
dairy cows	9,085	1,485
hogs and pigs	750	123
sheep and lambs	1,904	311
goats	520	85
horses and ponies	2,430	397

Table 19: County and Town Livestock Population, 2013

Livestock Population, 2018	County	Town (estimated)
beef cows	1,236	201
dairy cows	10,272	1,670
hogs and pigs	249	40
sheep and lambs	1,242	202
goats	323	52
horses and ponies	1,275	207

Table 20: County and Town Livestock Population, 2018

	Emissions Factor (kg CH4/hear/year)	CH4=Animal Population x EF x (1/1000)
beef cows	94	17.41
dairy cows	140	207.88
hogs and pigs	2	0.18
sheep and lambs	8	2.49
goats	5	0.42
horses and ponies	18	7.15
	Total MT CH_4 in Town of Dryden, 2013:	**235.53**

Table 21: Methane Associated with Livestock Enteric Fermentation in Town of Dryden, 2013

	Emissions Factor (kg CH4/hear/year)	CH4=Animal Population x EF x (1/1000)
beef cows	94	18.88
dairy cows	140	233.74
hogs and pigs	2	0.06
sheep and lambs	8	1.61
goats	5	0.26
horses and ponies	18	3.73
	Total MT CH_4 in Town of Dryden, 2018:	**258.30**

Table 22: Methane Associated with Livestock Enteric Fermentation in Town of Dryden, 2018

Results

The estimated emissions from agricultural enteric fermentation in the Town of Dryden totaled 5,888 $MTCO_2e$ in 2013 and 6,458 $MTCO_2e$ in 2018.

Discussion

There is some margin of error in the calculations for emissions from agricultural enteric fermentation in the Town of Dryden because town-specific livestock counts were not available. Since livestock figures were estimated for the town based off of county data, counts could be off, resulting in either more or less emissions from this sector than reality.

While there are other sources of emissions from agriculture besides enteric fermentation, including from manure management and fertilizer application, data on these sources is largely unavailable and methodologies are limited. Excluding other sources of agricultural emissions in this inventory is also consistent with methodology used in the Tompkins County Greenhouse Gas Inventory.

IV. Community Emissions Forecast

Methods and inputs

A community emissions forecast is included here to provide a sense of what emissions might look like in 2030 and 2045 under a business-as-usual scenario. The forecast was compiled using ClearPath guidance. Compound Average Growth Rates were used to forecast emissions in all sectors, using the inputs noted below.

To forecast emissions from the residential and commercial/industrial sectors, State energy use trends as described in the 2015 New York State Energy Plan and mandates of the Climate Leadership and Community Protection Act (i.e. electricity from 70% renewable sources by 2030 and 100% zero emission electricity by 2040) were used. Information regarding the Dominion Energy Borger Station process emissions from the Borger Replacement Project provided by C.T. Male Associates were also used to inform forecasted commercial/industrial emissions.

To forecast emissions from the transportation sector, State energy use trends as described in the 2015 New York State Energy Plan and Federal rules on vehicle fuel mileage standards were used.[35]

To forecast emissions from the waste sector, population growth rates for the Town of Dryden from the American Community Survey from 2010 vs. 2018 were used, assuming population would continue to grow at a similar rate through 2045 and waste production would increase proportionally to population growth.

To forecast emissions from the wastewater sector, population use rates based on the estimated population using septic systems in 2013 vs. 2018 were used and assumed to continue at that rate of use until 2045.

To forecast emissions from agriculture, county dairy cow counts from the 1992 and 2017 Agricultural Census “Cattle and Calves - Inventory and Sales” tables were used, assuming dairy

[35] This forecast uses the March 2020 Safer Affordable Fuel Efficient (SAFE) Vehicles Rule, which projects combined passenger and light duty vehicle fuel efficiency to be 40.4 mpg by 2026, according to https://www.c2es.org/content/regulating-transportation-sector-carbon-emissions/ accessed 5/12/20.

cow populations in the Town of Dryden would continue to grow at a similar rate through 2045. Dairy cow counts were used because they represent approximately 90% of emissions from agricultural enteric fermentation in the Town of Dryden and have a higher emissions factor than the other livestock types.

Results

Assuming a business-as-usual scenario, emissions in the Town of Dryden in 2030 are expected to decrease from 121,875 $MTCO_2e$ in 2018 to 109,888 $MTCO_2e$ in 2030 (a decrease of about 9.8%), and further decrease to 95,450 $MTCO_2e$ in 2045 (a decrease of about 21.7%). Each sector's forecast is explained further below.

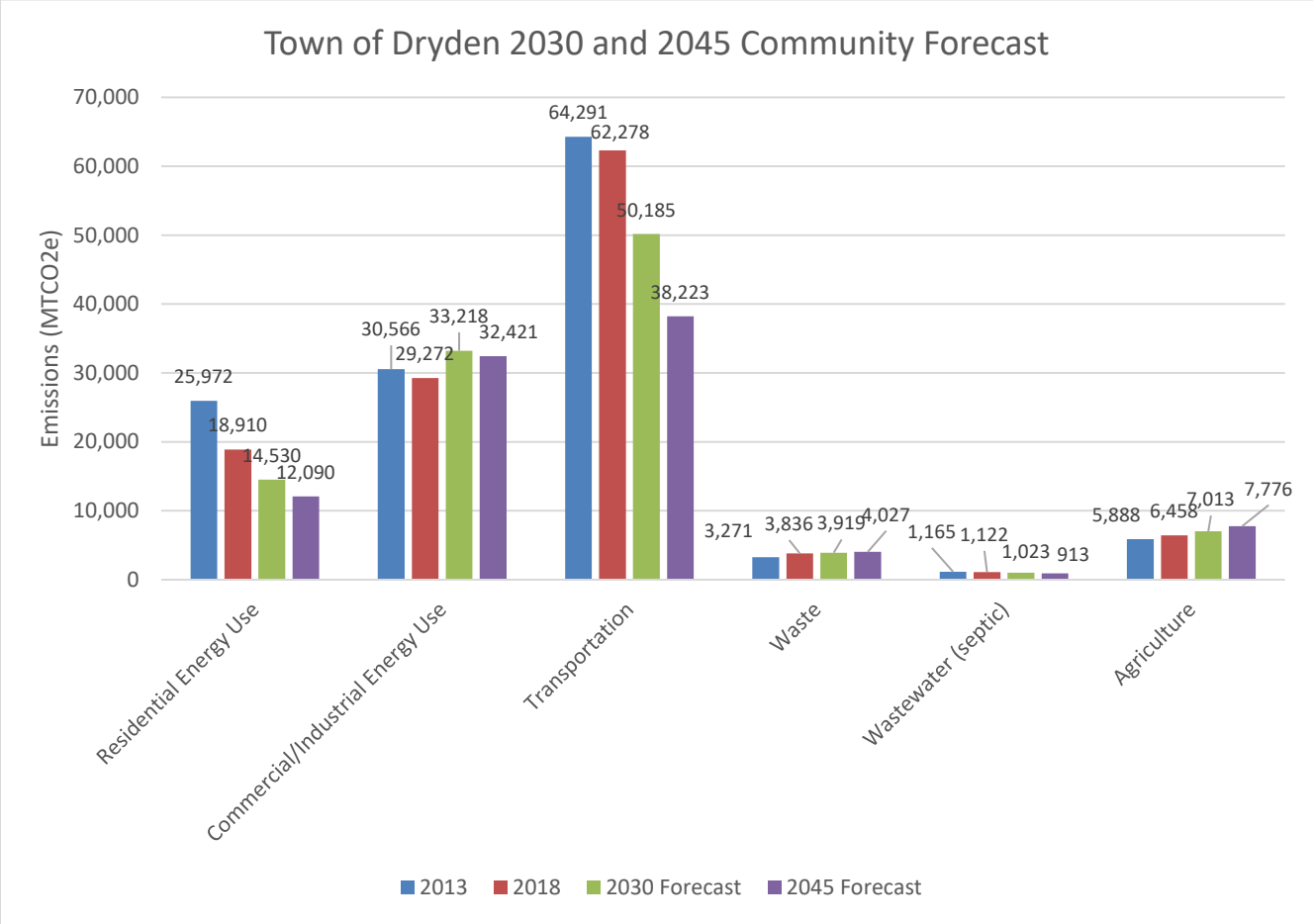

Figure 24: Town of Dryden 2030 and 2045 Community Emissions Forecast

Notably, excluding the Borger Station process emissions, emissions from the rest of the Town of Dryden are forecasted to decrease from 103,062 $MTCO_2e$ in 2018 to 85,086 $MTCO_2e$ in 2030 and 70,648 $MTCO_2e$ in 2045, a decrease of about 17.4% and 31.5%, respectively.

Discussion

Emissions from the residential sector are expected to decrease from 18,910 $MTCO_2e$ in 2018 to 14,530 $MTCO_2e$ by 2030 and to 12,090 $MTCO_2e$ by 2045.

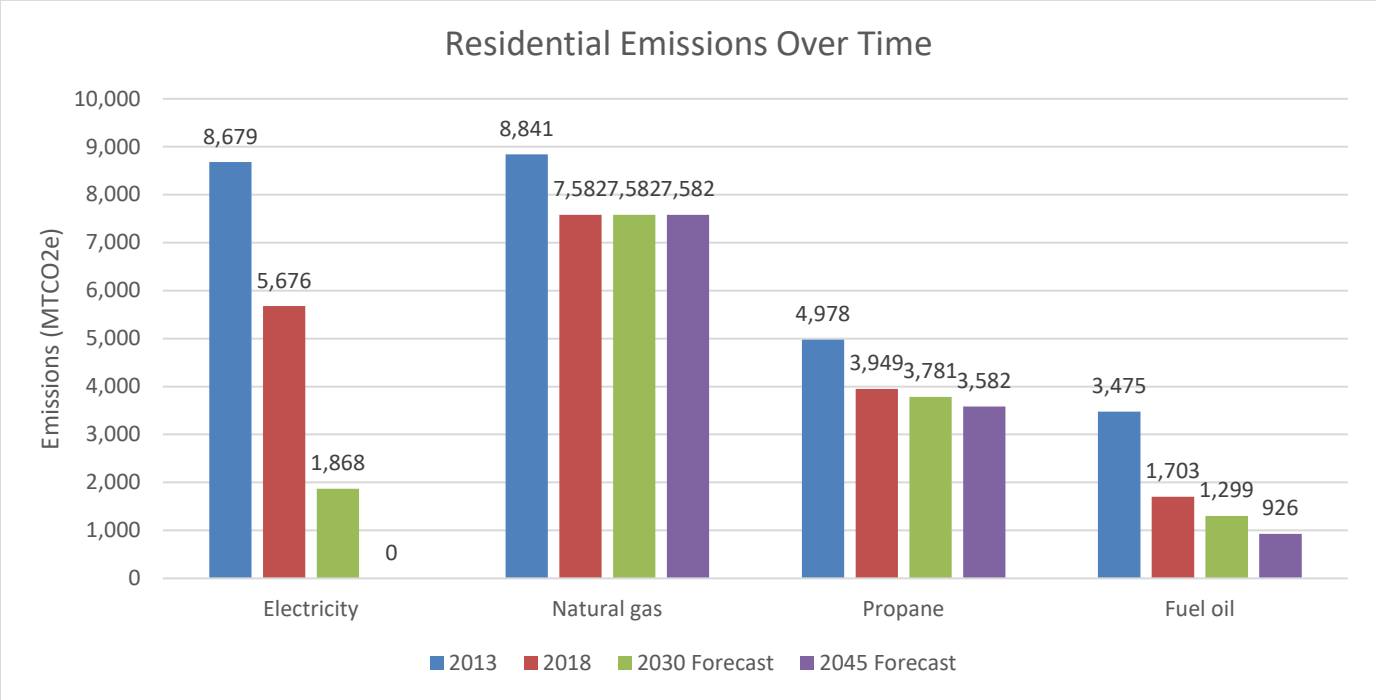

Figure 25: Residential Emissions in the Town of Dryden over time

Since the Climate Leadership and Community Protection Act requires the state to achieve 70% renewable electricity by 2030 and 100% carbon neutral electricity by 2040, emissions from residential electricity use are expected to drop to 0 by 2045. Residential propane and fuel oil use are projected to decrease as well, with natural gas use staying about the same, according to the 2015 New York State Energy Plan.

Emissions from the commercial/industrial sector are expected to increase overall, from 29,272 $MTCO_2e$ in 2018 to 33,218 $MTCO_2e$ by 2030 and to 32,421 $MTCO_2e$ by 2045.

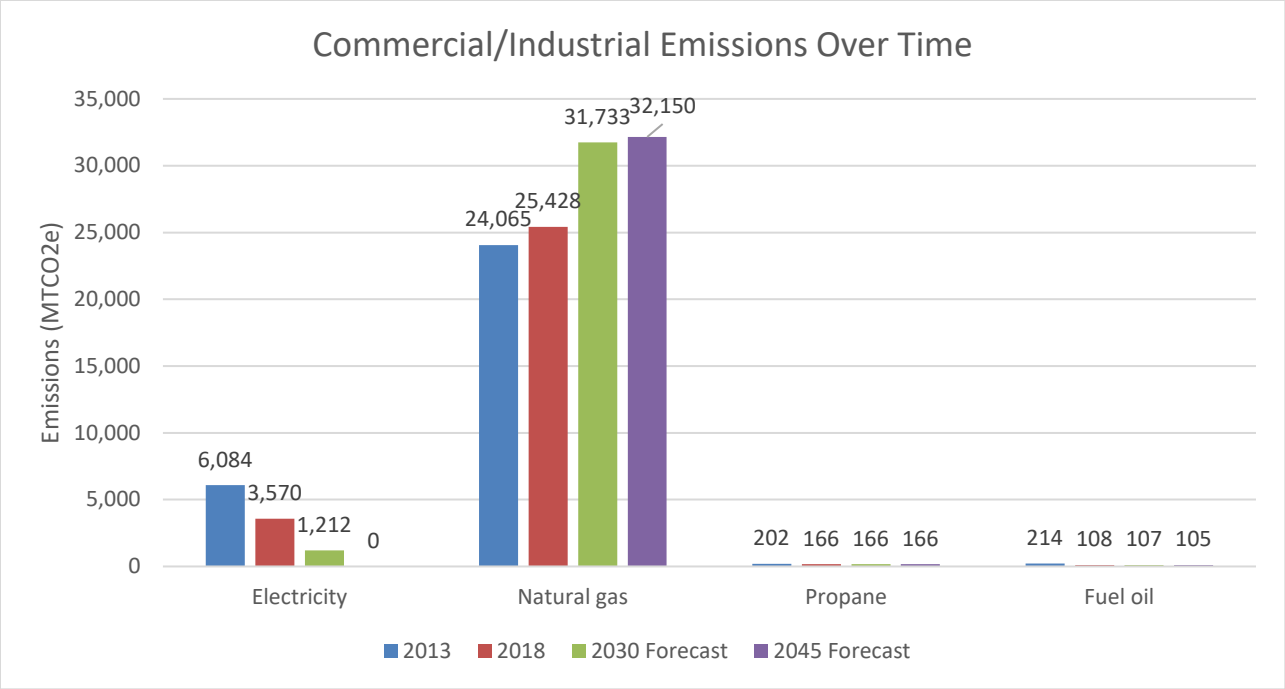

Figure 26: Commercial/Industrial Emissions in the Town of Dryden over time

However, excluding the Borger Station information, emissions from the commercial/industrial sector are expected to decrease overall, from 10,459 $MTCO_2e$ in 2018 to 8,416 by 2030 and to 7,619 $MTCO_2e$ by 2045.

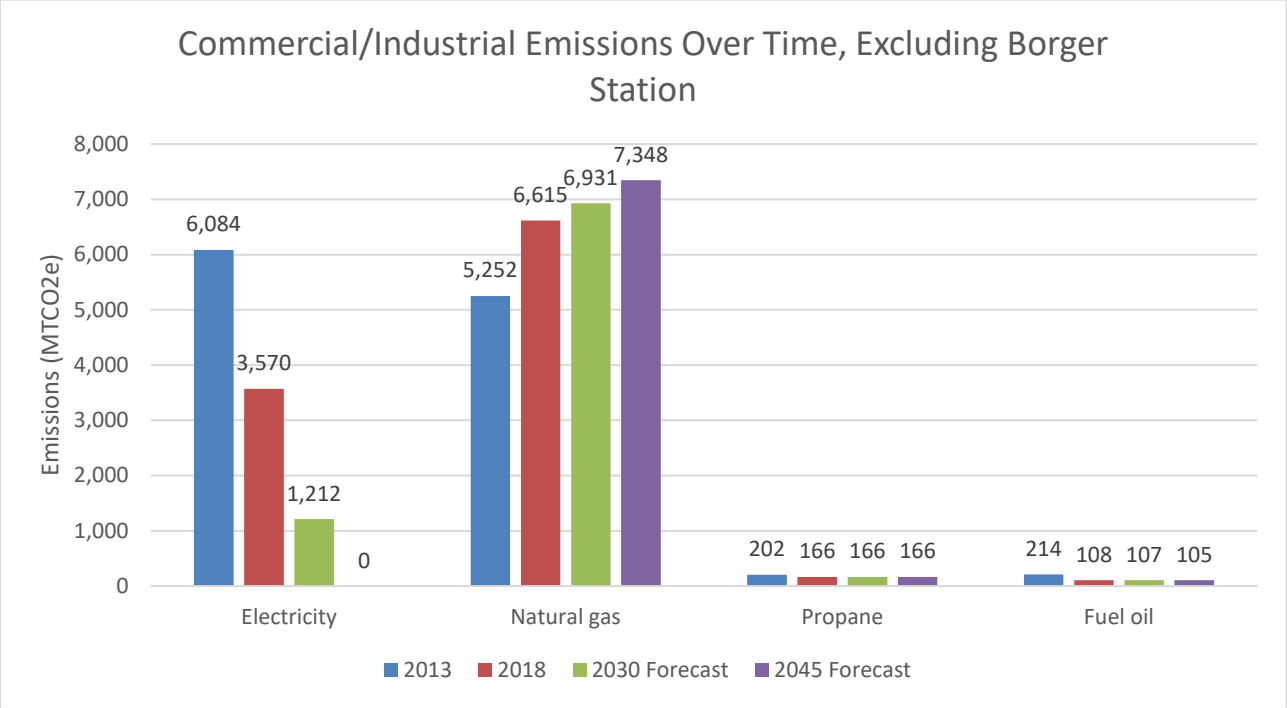

Figure 27: Commercial/Industrial Emissions in the Town of Dryden over time, excluding Borger Station

Since the Climate Leadership and Community Protection Act requires the state to achieve 70% renewable electricity by 2030 and 100% carbon neutral electricity by 2040, emissions from commercial/industrial electricity use are expected to drop to 0 by 2045. Commercial/industrial fuel oil use is projected to decrease as well, with propane use staying about the same and natural gas use increasing over time, according to the 2015 New York State Energy Plan.

According to C.T. Male Associates,[36] the proposed Borger Replacement Project will increase process emissions from the facility from 18,813 $MTCO_2e$ to 24,802 $MTCO_2e$ annually, as the replacement engines are expected to use more fuel than current engines, "*which in turn results in significant reductions of criteria air pollutants,"* according to information provided to the town.

Emissions from the transportation sector are expected to decrease overall as well, from 62,278 $MTCO_2e$ in 2018 to 50,185 $MTCO_2e$ by 2030 and to 38,223 $MTCO_2e$ by 2045.

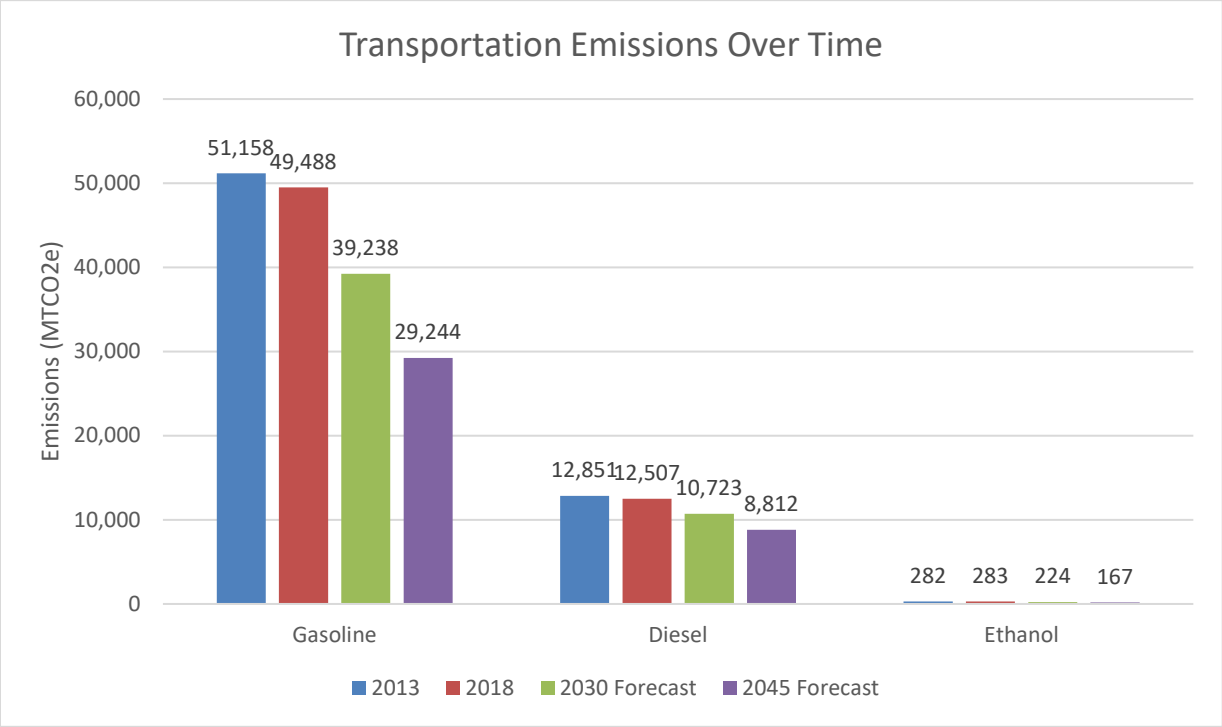

Figure 28: Transportation Emissions in the Town of Dryden over time

According to the 2015 New York State Energy Plan, gasoline and ethanol use and vehicle miles traveled are expected to decrease over time, with diesel use and vehicle miles traveled increasing. However, the carbon intensity of the vehicle miles traveled for all fuel types is expected to decrease as federal transportation policies require vehicle fuel mileage standards to improve over time, so emissions from all fuel sources are expected to decrease.

[36] Emissions information was provided by C. T. Male Associates in short tons. Emissions in short tons were converted to metric tons and added to this inventory – 20,738 short tons emissions currently = 18,813 metric tons; 27,339 short tons projected future emissions = 24,802 metric tons.

Emissions from the waste sector are expected to increase, from 3,836 $MTCO_2e$ in 2018 to 3,919 by 2030 and to 4,027 $MTCO_2e$ by 2045. This forecast is directly related to estimated population growth rate in the town.

Emissions from the wastewater sector are expected to decrease, from 1,122 $MTCO_2e$ in 2018 to 1,023 $MTCO_2e$ by 2030 and to 913 $MTCO_2e$ by 2045. This forecast assumes the town will see a similar decrease of septic systems use as was seen from 2013 to 2018.

Emissions from agricultural enteric fermentation in the Town of Dryden are expected to increase from 6,458 $MTCO_2e$ in 2018 to 7,013 $MTCO_2e$ by 2030 and to 7,776 $MTCO_2e$ by 2045. This forecast assumes emissions from agricultural enteric fermentation will continue to increase at a similar rate as the increase in county dairy cow population from 1992 to 2017.

V. Municipal Operations Emissions Forecast

Methods and inputs

A municipal operations emissions forecast is included here to provide a sense of what emissions might look like in 2030 and 2045 for municipal operations under a business-as-usual scenario. The forecast was compiled using ICLEI's protocol for forecasting and entering data into the ClearPath tool online. Data from the municipal inventory compiled by CCE Tompkins in 2019 was used as a baseline for this forecast. Compound Average Growth Rates were used to forecast emissions in all sectors using the inputs noted below.

To forecast emissions from the municipal buildings and facilities sector, population growth rates as well as mandates of the Climate Leadership and Community Protection Act (i.e. electricity from 70% renewable sources by 2030 and 100% zero emission electricity by 2040) were used. It is assumed that as population of the town increases, energy used by municipal operations at facilities increases in a proportional manner.

To forecast emissions from the municipal vehicle fleet, population growth rates as well as Federal rules on vehicle fuel mileage standards were used.[37] It is assumed that as population of the town increases, energy used by the municipal vehicle fleet increases in a proportional manner.

To forecast emissions from municipal employees' commutes, population growth rates as well as Federal rules on vehicle fuel mileage standards were used. It is assumed that as population of the town increases, municipal employees increase, and therefore energy used by municipal employees during their commute increases in a proportional manner.

Results

Assuming a business-as-usual scenario, emissions in the Town of Dryden in 2030 and 2045 from all municipal sectors are expected to decrease, with total emissions decreasing from 822

[37] This forecast uses the March 2020 Safer Affordable Fuel Efficient (SAFE) Vehicles Rule, which projects combined passenger and light duty vehicle fuel efficiency to be 40.4 mpg by 2026, according to https://www.c2es.org/content/regulating-transportation-sector-carbon-emissions/ accessed 5/12/20.

$MTCO_2e$ in 2018 to 692 $MTCO_2e$ in 2030 and to 572 $MTCO_2e$ in 2045, a decrease of about 16% and 30%, respectively. Each sector's forecast is explained further below.

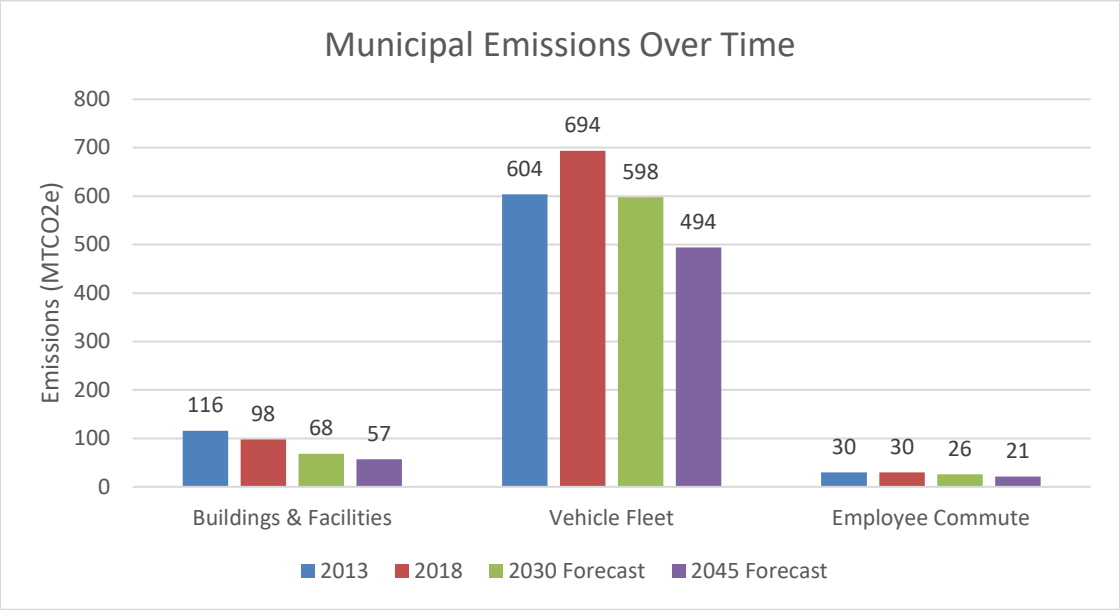

Figure 29: Municipal Operations Emissions in the Town of Dryden over time

Discussion

Municipal natural gas use is expected to increase slightly in accordance with the town population growth trend, but since the Climate Leadership and Community Protection Act requires the state to achieve 70% renewable electricity by 2030 and 100% carbon neutral electricity by 2040, emissions from municipal operations electricity use are expected to drop to 0 by 2045. Overall emissions from municipal buildings and facilities are therefore expected to decrease from 116 $MTCO_2e$ in 2018 to 68 $MTCO_2e$ by 2030 and to 57 $MTCO_2e$ by 2045.

Emissions from the municipal vehicle fleet and municipal employee commutes are expected to decrease as well, because despite an estimated increase in vehicle miles traveled for both sectors in accordance with the town's population growth trend, the carbon intensity of the vehicle miles traveled is expected to decrease as federal transportation policies require vehicle fuel mileage standards to improve over time.

VI. Methane Leakage

Methods and inputs

As natural gas is extracted and distributed, methane is released in leaks throughout the supply chain. While the science is not yet settled on the exact percentage of leakage, recent studies estimate methane leakage rates between 1.4% and 3.6%.[38] The information provided above does

[38] EPA estimates 1.4% leakage rate, Alvarez et. al. estimates 2.3% leakage rate, Brandt et. al. estimates between 1.25 and 1.75 times the EPA assessment figure (1.75% to 2.45%), Zavala-Araiza et. al. estimates a 1.5% leakage rate, and Robert Howarth (paper currently under review) estimates a 3.6% leakage rate.

not take methane leakage rates into account, but information is provided below explaining possible additional emissions from methane leakage during natural gas production/distribution that could be attributed to the Town of Dryden community through electric use and on-site burning of natural gas.

A methane leakage calculator tool developed by Robert Howarth (Ph. D. Cornell) and Terrance Carroll (Cornell Cooperative Extension of Tompkins County) was utilized for this section of the inventory to calculate estimated emissions from methane leakage due to energy used in the Town of Dryden in 2013 and 2018, using a 2% leakage rate. Leakage attributed to electricity and natural gas use were both included in the calculator since natural gas makes up a significant portion of electricity generation for Upstate NY and on-site natural gas combustion is commonly used for heating and/or cooking.

Results

Burning natural gas creates units of heat, commonly measured in therms. One therm of natural gas results in .0053175 $MTCO_2e$ emissions (including CO_2, CH_4, and N_2O emissions). The production of that therm and the lifecycle to get it the location it was eventually burned, assuming a 2% methane leakage rate, results in an additional .0009865 $MTCO_2e$ emissions from methane that is directly released into the atmosphere through leaks. Accounting for the lifecycle of that entire therm of natural gas (production, transmission, usage) therefore results in an 18.55% increase in overall emissions versus an accounting that simply looks at burning the therm for heat.

Based on residential electricity and natural gas use for the Town of Dryden, methane leakage is estimated to have accounted for additional residential emissions of 2,558 $MTCO_2e$ in 2013 and an additional 2,338 $MTCO_2e$ in 2018. Based on commercial/industrial electricity and natural gas use for the Town of Dryden, methane leakage is estimated to have accounted for additional commercial/industrial emissions of 5,042 $MTCO_2e$ in 2013 and an additional 5,303 $MTCO_2e$ in 2018.

Overall, methane leakage is estimated to have accounted for an additional 7,601 $MTCO_2e$ for the Town of Dryden in 2013 and an additional 7,641 $MTCO_2e$ for the Town of Dryden in 2018, increasing overall town emissions by 5.8% and 6.3%, respectively.

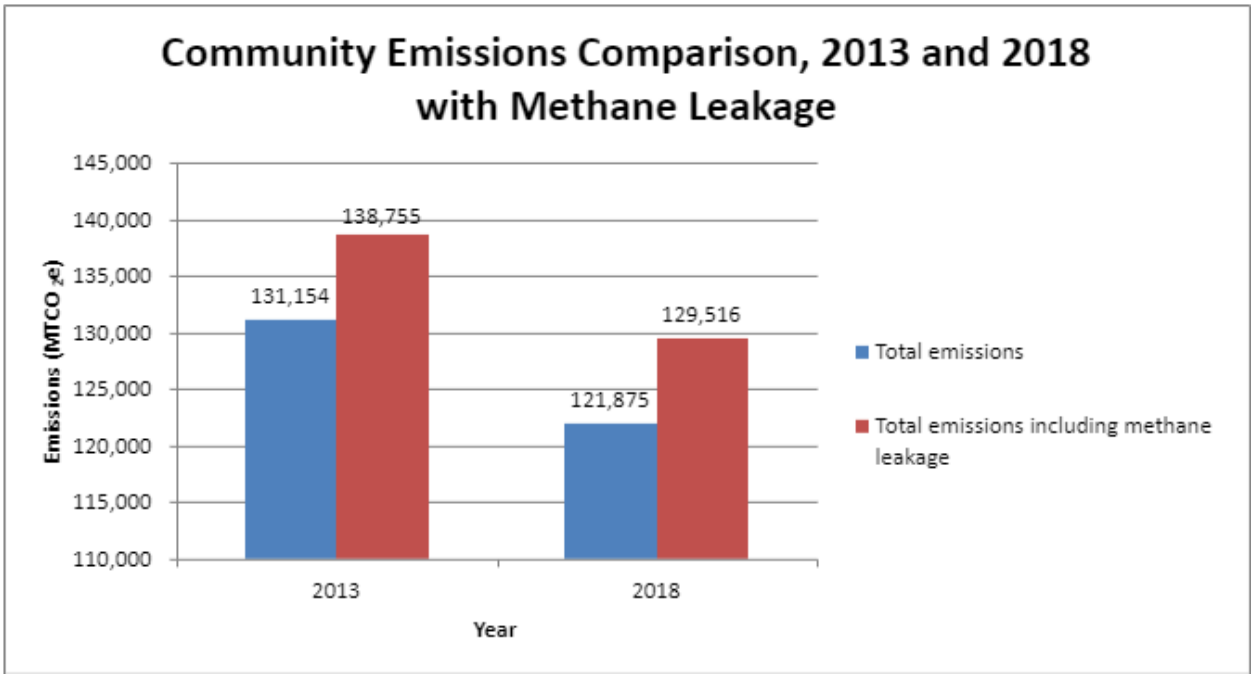

Figure 30: Community Emissions Comparison, 2013 and 2018 with Methane Leakage

Discussion

While there is not yet consensus on precise methane leakage rates, the information included in this inventory provides an estimate of how including methane leakage through the natural gas supply chain might affect overall emissions from the Town of Dryden. As illustrated, accounting for methane leakage does contribute to a noticeable increase in overall emissions, and therefore it is important to take these additional emissions into account in future emissions inventories and climate action planning efforts, especially as the scientific community learns more about precise leakage rates.

It should be noted that burning 1 MMBtu of natural gas produces less emissions than burning 1 MMBtu of fuel oil or coal even when including emissions from leaked methane at a 2% leakage rate.

VII. GWP: IPCC 4th Assessment vs 5th Assessment

The information above utilizes the IPCC's 4th assessment report figures for global warming potential (GWP) to be consistent with the municipal operations inventory calculations, as explained previously. The IPCC 4th assessment report assumes a GWP of 25 for methane over a 100-year period, meaning that the impact of 1 unit of methane in the atmosphere creates 25 times more warming potential than 1 unit of CO_2 over a 100-year time period. However, methane typically remains in the atmosphere for closer to 12 years as opposed to CO_2 which can remain in the atmosphere for over 100 years, meaning that methane's impact while it remains in the

atmosphere is much stronger than that of CO_2. Therefore, the IPCC 5th assessment report includes both a 100 year and 20-year GWP for methane of 28 and 84, respectively.[39]

Also, the IPCC 5th assessment report's 20-year GWP for nitrous oxide is 264 as compared to 298 from the IPCC 4th assessment report, 100-year GWP.

This section of the report includes a discussion of what emissions look like for the Town of Dryden community assuming the IPCC 5th assessment report's 20-year GWP factors for methane and nitrous oxide instead of the 4th assessment report's 100-year GWP factors.

Figure 31 below compares total community emissions for the Town of Dryden assuming the IPCC 4th assessment GWP, the IPCC 4th assessment GWP with methane leakage, the IPCC 5th assessment 20-year GWP, and the IPCC 5th assessment 20-year GWP with methane leakage. Figures 32 and 33 do the same but broken out by sector for 2013 and 2018.

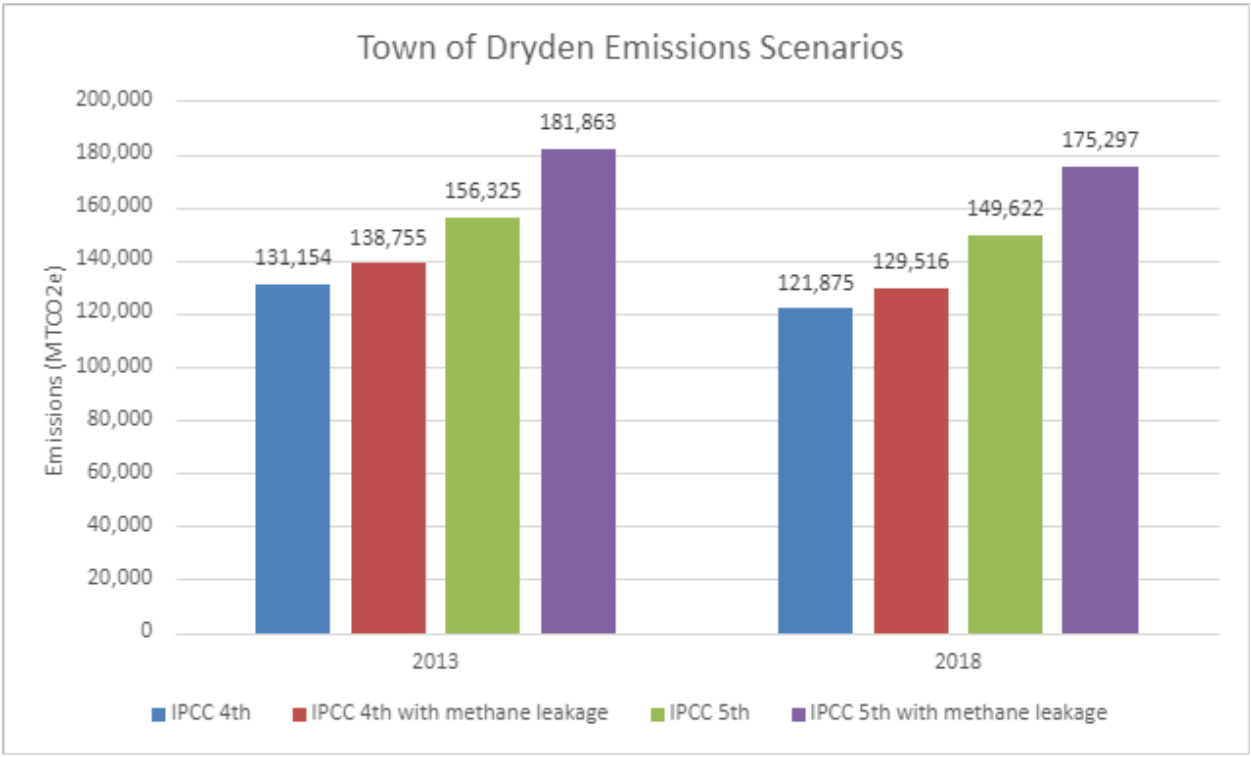

Figure 31: Town of Dryden Emissions Scenarios

[39] IPCC. Climate Change 2014 Synthesis Report. https://ar5-syr.ipcc.ch/ipcc/ipcc/resources/pdf/IPCC_SynthesisReport.pdf

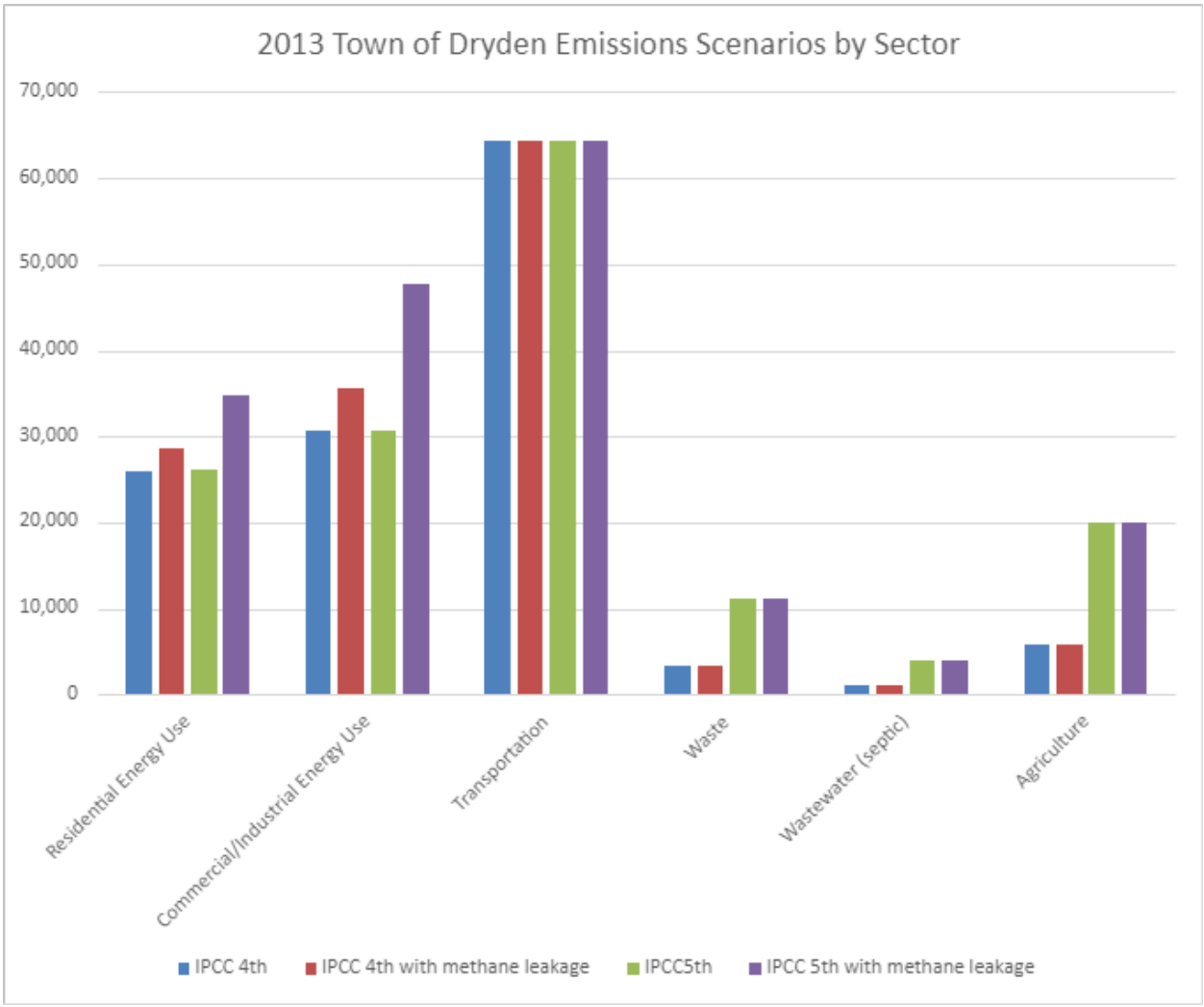

Figure 32: 2013 Town of Dryden Emissions Scenarios by Sector

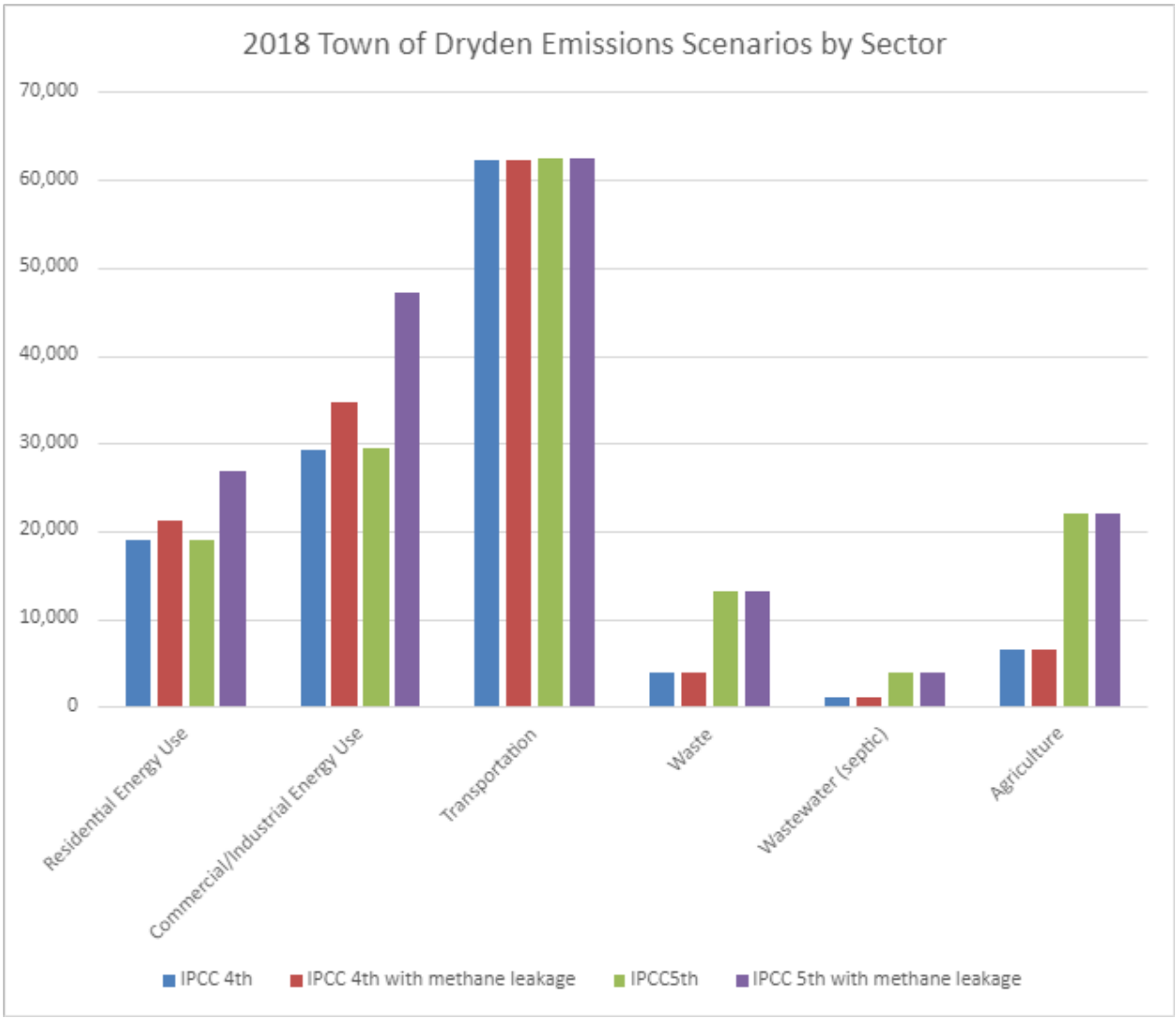

Figure 33: 2018 Town of Dryden Emissions Scenarios by Sector

As illustrated, there is a significant difference in emissions between the various scenarios, so it is important to consider the methodology used in creating this and future inventory updates, as well as when comparing data from this inventory to inventories from other communities.

VIII. Conclusion

The greenhouse gas inventory is the first milestone in climate action planning, to be followed by developing a reduction goal and then creation of a climate action plan.

The results of this study indicate that the largest percentage of community emissions came from the transportation sector for both 2013 and 2018. Transportation emissions should be targeted in the town's future Climate Action Plan so that energy use from this sector can be reduced, therefore lowering both energy costs and GHG emissions.

As a Certified Climate Smart Community, the Town of Dryden has partnered with state and local agencies to combat climate change and pledge to reduce greenhouse gas emissions. Conducting a baseline emissions inventory is an important step in climate action planning, mitigation, and adaptation. This community inventory will provide a benchmark for planning purposes with the goal of setting an emissions reduction target and developing a Climate Action Plan.

IX. Bibliography

Alvarez, R. A., et. al. (2018). Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain. *Science, 361*(6398), 186-188. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6223263/pdf/nihms-1506519.pdf.

Brandt, A. R., et. al. (2014). Methane Leaks from North American Natural Gas Systems. *Science, 343*(6172), 733-735. Retrieved from https://www.researchgate.net/publication/260211785_Methane_Leaks_from_North_American_Natural_Gas_Systems.

Center for Climate and Energy Solutions. (2020). *Federal Vehicle Standards.* Retrieved from https://www.c2es.org/content/regulating-transportation-sector-carbon-emissions/.

Howarth, R. W. (2020). *Methane Emissions from Fossil Fuels: Exploring A New Greenhouse-Gas Footprint Framework Mandated for the State of New York.* Submitted manuscript under review.

ICLEI. (2020). *ClearPath.* Retrieved from https://clearpath.icleiusa.org/.

IPCC. (2014). *Fifth Assessment Report.* Retrieved from https://www.ipcc.ch/report/ar5/syr/.

IPCC Working Group I. (2007). *The Physical Science Basis.* Retrieved from https://wg1.ipcc.ch/publications/wg1-ar4/faq/wg1_faq-1.3.html.

Level of Service Policy for Municipal Highways in the United Townships of Head, Clara & Maria. (2008). Retrieved from http://www.townshipsofheadclaramaria.ca/download.php?dl=YToyOntzOjI6ImlkIjtzOjI6Ijg1IjtzOjM6ImtleSI7aTo0O30=.

Mank, T. (2020, December-January). Emails.

NYSERDA. (2014). *Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information.* Retrieved from https://www.nyserda.ny.gov/About/Publications/Research%20and%20Development%20Technical%20Reports/Environmental%20Research%20and%20Development%20Technical%20Reports/Response%20to%20Climate%20Change%20in%20New%20York.

NYSERDA. (2019). *New York Greenhouse Gas Inventory Fact Sheet.* Retrieved from https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Energy-Statistics.

NYSERDA. (2020). *Community Energy Use Data.* Retrieved from https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data.

Recycling and Materials Management of Tompkins County. (2013 and 2018). *Annual Report.*

Tompkins County Solid Waste Management Division. (2013 and 2018). *Annual Planning Unit Recycling Report.*

US EIA. (2019). *State Energy Data System (SEDS): 1960-2017.* Retrieved from https://www.eia.gov/state/seds/seds-data-complete.php#Consumption.

US EIA. (2016). *Commercial Buildings Energy Consumption Survey (CBECS).* Retrieved from https://www.eia.gov/consumption/commercial/data/2012/#b1-b2.

US EPA. (2020). *Emissions & Generation Resource Integrated Database (eGRID)*. Retrieved from https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid.

Weatherdatadepot. (2020). Retrieved from https://www.weatherdatadepot.com/.

Zavala-Araiza, D., et. al. (2015). Reconciling divergent estimates of oil and gas methane emissions. *Proceedings of the National Academy of Sciences of the United States of America, 112*(51), 15597-15602. Retrieved from https://www.pnas.org/content/112/51/15597.