Village of Trumansburg

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Climate Action Plan

(Emissions Inventory + Reduction Strategies)

2014

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LIST OF ABBREVIATIONS

ICLEI – Local Governments for Sustainability USA

$MtCO_2e$ – Metric Tons of Carbon Dioxide Equivalent

EXECUTIVE SUMMARY

The Village of Trumansburg, NY's Board and Mayor have approved this Climate Action Plan. Stefan Lutter, a Master of Regional Planning student at Cornell University and Trumansburg native, proposed and conducted the project in conjunction with his degree requirements. Professor Michael Manville served as committee chair on the project, while Professor Marty Petrovic served as minor committee member.

This Climate Action Plan amounts to Trumansburg's first certified effort towards Climate Action and it is composed of two parts. The Emissions Inventory documents the greenhouse gas emissions for which the Village government and residents are responsible, and is followed by reduction strategies to address those emissions. In short, the Plan outlines actions for the Village to take in order to cut financial costs and emissions from 2013, the base year, to 2030, the target year. While the Village has touched on environmental issues in past plans, this project is a bold, isolated effort that will address environmental impact.

The author used self-developed methods to conduct the Emissions Inventory, while the reductions strategies were analyzed in part using ICLEI's (Local Governments for Sustainability) free CACP program. Trumansburg agreed in principal to become a paying member of ICLEI in order to use the emissions inventory tools, but it was determined that this was not a necessary step as alternative methods of inventorying emissions were sufficient. The Emissions Inventory however, does follow ICLEI's commonly used framework of examining government emissions and community emissions on a separate

basis, responding to the degree of control the government has over those emissions.

This report serves as a baseline emissions analysis. First, it helps the Village understand the environmental impact of its own operations, and the behavior of its residents and visitors. Second, it serves as a baseline to measure future emissions against and therefore examine progress against the goals identified in this document.

The Emissions Inventory is based primarily on consumption- electricity use, natural gas use, solid waste generated, and so on. Environmental impacts and greenhouse gas emissions are generated by far more actions than outlined in this Plan, and therefore, it can safely be assumed that this study represents a low estimate of greenhouse gas emissions, rather than an exact figure documenting environmental impact.

Introduction

Climate Action Planning has increased in popularity nationwide over the past few decades, particularly at the local level. This is due in part to real concerns over climate change and sincere efforts to reduce emissions, in part to increase competitiveness for State and Federal grant programs, and in part to increase the general appeal of a municipality as a place to live (many strategies have co-benefits that improve livability, such as enhancing the pedestrian network). Collective action at the local level across the country has played a large role in the growing battle against climate. This is in part due to the difficulties making progress with a controversial topic at the Federal level[1]. The growing local-based climate solutions have high potential to reduce the United States contribution to climate change.

Climate Action Planning differs from more traditional planning in several senses. First, the concepts are science-based, which can present a difficulty in obtaining input from communities. Second, climate change is a highly political subject and even of those who readily admit to anthropogenic climate change, not all have accepted the changes they experience first hand in their location[2]. This differs from planning directed at issues such as traffic or land use, subjects that nearly everyone has experienced. Due to these factors, addressing climate change at a governmental level can be risky for any politician, further complicating progress towards climate planning.

Due to the developing nature of Climate Action Planning, and the lack of experience in the field amongst professional planners, much of the work has involved consultants or other exterior services. One major contributor to Climate Action Planning nationally has been ICLEI. ICLEI produces tools

that can aid in producing an Emissions Inventory or analyzing Emissions Reduction Strategies, but ultimately the tool serves as a broad standard rather than a more specific, place-based solution[3].

Plans can range in length and detail, from a single page announcing broad emissions targets, to a several page document detailing specific strategies[4]. In most cases, these plans are issued as an independent work, but a recent trend has been to amend current Comprehensive Plans adopted by local governments to include portions on climate change and goals. The latter strategy represents a somewhat 'quick fix' solution, potentially directed more at the ultimate goal of grant funding rather than a genuine effort to reduce emissions.

Generally, plans include an emissions target, a timeline, interim targets, a business-as-usual scenario for comparison, and several categorized strategies that will help to achieve the identified target[5]. The best practice for presenting strategies incorporates the cost-effectiveness of those strategies.

Plans cover topics such as transportation, energy use, energy production, and waste management. In general these topics are more measurable and therefore are compatible with an emissions inventory analysis. While some plans do include actions such as enhancing local food production, these are often difficult to measure due to the indirect nature of their emissions and lack of sufficient studies. Because of this, it is difficult to judge whether local food production alone will lower emissions. While these strategies are important and can provide far more benefits than reduced emissions, it should be noted within the document that that there will be difficulty in measuring any effect on emissions resulting from the action.

Cities with Climate Action Plans do have lower rates of emissions, though there is not substantial data to suggest a causal relationship[6]. Naturally, places that may already be disposed to environmentally beneficial actions are likely to pursue a Climate Action Plan. Others claim that Climate Action Planning can help steer long-term behavioral changes, and that local governments have enough influence to stimulate significant emissions reductions within their geographical boundaries. However, a Plan will still provide the benefit of an emissions inventory analysis, and specific strategies to pursue over a chosen timeline. It also provides the capability to examine and measure progress.

Trumansburg Background

The Village of Trumansburg sits in northern Tompkins County about eleven miles north of Ithaca, the County seat. According to the 2010 Census, Trumansburg has a population of 1,797 persons separated into 816 households. With an area of 1.2 square miles, the Village has a high population density for a small town, at 1,585 people per square mile.

Most residents of the Village work outside the community, particularly in Ithaca, with an average commute time of 23.5 minutes. Just over 33 percent of the population is employed in 'educational service, and health care and social assistance', by far the largest employment sector for Village residents. The median household median is $42,891, which is considerably less than the Tompkins County median of $50,539.

The Village itself features a prominent downtown area with a variety of stores, restaurants, health services, public buildings such as a library and schools, and

more. While businesses are scattered throughout the Village, Main Street is the primary commercial area.

Trumansburg is a community that fosters and embraces progressive ideas, such as the Village's stance on hydraulic fracturing. Past planning efforts have put the Village in good position to pursue projects such as this Climate Action Plan. With a recent Comprehensive Plan in 2008, and a recently renovated Main Street, the Village has shown intent to pursue improvements that benefit residents and visitors alike.

Climate Change

Each year the causes and resulting impacts of climate change are better understood. Each year, in response, more local municipalities take action into their own hands, as a means of working to protect their local, regional, and global climates, and to simultaneously improve life for their residents. The Village of Trumansburg is no exception. Through this project, the Village seeks to better understand their emissions profile and what actions will achieve a successful reduction of emissions.

Climate action at the local level plays a key role in the fight against climate change, while also presenting a host of tangible benefits for those involved. Action Plans focuses on attainable steps that achieve measurable results. Local level climate action is better suited to an area's specific abilities, needs, and concerns. Importantly, these actions often end up having a host of 'side-effect' benefits, from reduced energy bills, to enhanced air quality, to beautified streets.

Reducing emissions to limit climate change can be as much about adaptation as it is prevention. By pursuing emissions reductions and efficiencies, Trumansburg seeks to minimize its contribution to climate change. In doing so, some strategies will also aid the Village and its residents in preparation for a changing climate, rising energy costs, and other challenges. Thus, by investing in some emissions reduction strategies, Trumansburg can both prevent and prepare. Many reduction strategies (such as those that increase energy efficiency, or reduce automobile trips) may become necessities in the future, and by taking early action, costs can be avoided and benefits can be received earlier in the process.

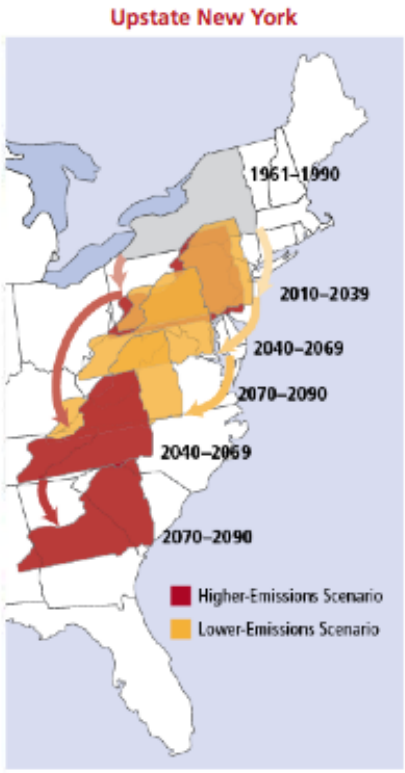

Figure 1: This image displays the changes over time Upstate New York can anticipate, with a conservative estimate likening 2090 New York to present day Virginia.
Source: Climate Choices

Environmental

Upstate New York will not be exempt from the reaches of climate change. Average temperatures have already risen 1.5 degrees in the past several decades, and a recent Intergovernmental Panel on Climate Change report has outlined a further increase of 4.8°C of mean global surface temperatures by 2100[7]. Precipitation patterns are expected to change drastically, with damaging high-rainfall events followed by short-term drought representing a portion of the anticipated rise in severe weather. These changes are among several that could put stress on both the natural and agricultural environments.

Economical

Experts such as the Intergovernmental Panel on Climate Change expect climate change to result in increased costs of necessities including food, water and energy, therefore raising the cost of living. In an area surrounded by both beautiful natural environments and a thriving agriculture industry, changing weather patterns can significantly impact productivity and the overall health of the region. Though climate change deniers often cite warming as a potential opportunity for agriculture through extended growing seasons, various changes such as increased drought and heat may make it more expensive or impossible for current agricultural patterns in the state to persist[8].

Health

Heat waves and high humidity are certainly unpleasant, but as they increase in severity they continue to become dangerous, particularly for the elderly. There

is also concern over spread of vector-borne diseases such as the mosquito-carried West Nile Virus. Increased temperatures can also result in higher costs of conditioning buildings during summer months, negating any savings in heating costs that would result from warmer winters. Disappearance of traditionally cold winters also has implication for the spread of pests and invasive species by expansion of habitat, including the hydrilla plant now infesting Cayuga Lake, the emerald ash borer beetle, and the hemlock killing wooly adelgid insect.

Why Create a Climate Action Plan?

Climate change presents many challenges globally, regionally, and locally. However, it also presents a host of opportunities. Many strategies that help to reduce emissions come hand in hand with other benefits. As the initial effects of a changing climate are already being felt, Trumansburg will improve its preparedness to deal with many of the accompanying challenges described above by pursuing a Climate Action Plan. The plan is not simply prevention, but also adaptation and preparation.

Many state and federal programs consider an emissions inventory and subsequent 'Climate Action Plan' the first step towards resiliency and New York State has been offering financial support in recent years to communities seeking to take action. Trumansburg will be better prepared to pursue such partnerships in the future with a Climate Action Plan in place. Many projects with significant impact will require funding aid, and a Climate Action Plan is crucial in receiving external environmental project financing.

The Village government, residents, businesses, and visitors alike will benefit from Trumansburg's efforts to reduce emissions. Potential 'side-effect' benefits will be examined specifically in the reduction strategies portion of this Plan. Many strategies for emissions reduction are congruent with other characteristics such as community development, livability, and community health.

Many municipalities around the country have realized both the importance of action against climate change and that smaller scale, local effort represents one of the pioneering fronts of action. Trumansburg, by creating this Plan, remains on par with its neighbors- the City and Town of Ithaca, Tompkins County, and others in the region and nationally.

Existing Goals in Trumansburg

While the Village of Trumansburg lacks any specific Climate Action materials prior to this document, environmental concerns were briefly laid out in the most recent Comprehensive Plan (2008). The Comprehensive Plan featured a very brief estimate of Village government energy costs, and concluded that Trumansburg should pursue greater analysis of costs, emissions, and goals in the future. Now, five years later, the Village has taken that step. The Comprehensive Plan outlines environmentally focused goals that the Village hopes to pursue over the 20-year timeline[9]:

- Create and maintain open space to balance land preservation and public use.
- Collaborate with the Town of Ulysses to protect water quality and promote conservation and appreciation of unique natural assets within the area.
- Promote village-wide resource conservation.

- Pursue alternative renewable sources of energy.

This emissions inventory and subsequent Climate Action Plan represent a strong effort from the Village to pursue these relevant goals. The action also follows suit with many nearby municipalities who are embarking on similar projects.

Trumansburg has, however, been included in other Climate Action work. Tompkins County has been actively pursuing Climate Action Planning and has most recently completed a 2008 emissions inventory and subsequent reductions strategies. The study was extensive and the emissions were well documented. At the time, an annual emissions growth rate of .3% was estimated. Using those figures, it is possible to determine a rough estimate of 2012 emissions at the county level[10].

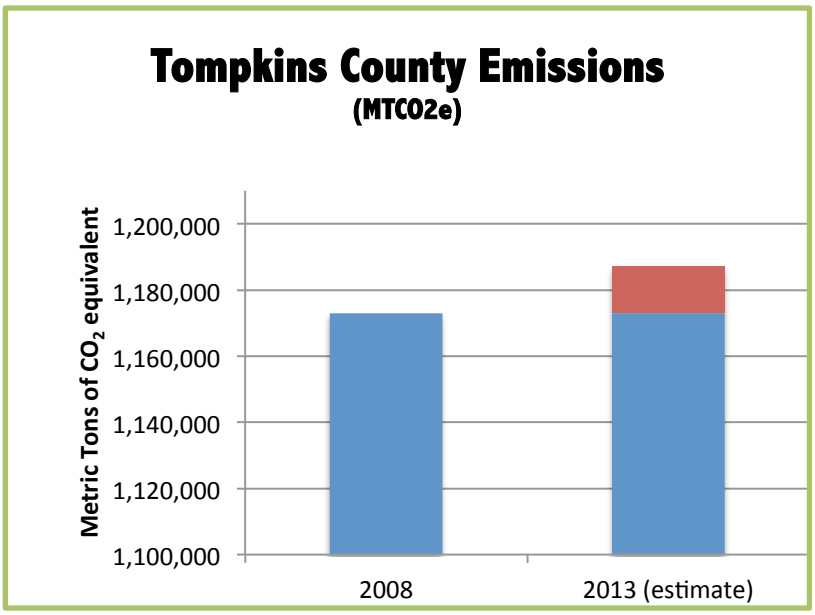

Figure 2: Tompkins County Emissions
Source: Tompkins County Community Greenhouse Gas Emissions Report, 1998-2008

Tompkins County's inventory and reduction strategies offer limited information specific to the Village of Trumansburg. The emissions inventory is overwhelmingly impacted by commercial and residential sectors in and around the City of Ithaca, making it difficult to decipher anything more than a rough estimate of Trumansburg emissions at the government or community levels.

Many municipalities have begun to implement the strategies outlined in their Climate Action Plans. Ulysses, Ithaca, and Tompkins County have all installed solar panels to generate energy for municipal operations. Efforts that relate to the Village of Trumansburg's goals will be outlined in the Action Plan.

Measuring and Methodology

Sources of Emissions

It is common for Emissions Inventories to divide government emissions into separate 'scopes'. This creates a distinction between direct emissions (commonly referred to as Scope 1) and indirect emissions (Scope 2). Direct emissions are those created by direct burning of fuel; for instance, driving a car or the burning of natural gas. Indirect emissions are that that are created elsewhere, but are *caused* by the consumption of a resource on site; electricity to keep the lights running is one example. In the case of the latter, the use of the electricity itself does not generate emissions, but rather it is the process of generating that electricity, most likely at a power plant, creates emissions.

Site and Primary Emissions

Most emissions inventories, despite going to lengths to differentiate the 'scope' of the emissions being generated, do not account for all emissions that result from resource consumption. In the United States, site analysis is more common. Site analysis will consider the amount of energy consumed on site, and then consider the emissions that result from that amount of energy consumption. Primary analysis includes all emissions from production of electricity. In other words, primary analysis includes all production and transmission losses that occur before the electricity is actually consumed. Therefore, it should be noted that while this inventory does not take into account transmission losses, the actual emissions from electricity might be as much as 6.5% higher than noted[11]. Thus, the emissions numbers are calculated using a conservative method.

Data Sources – Government Emissions

Stefan Lutter collected all data on Village government consumption manually from bills in Village Hall. First, this consisted of examining featured NYSEG Hess, and Integrys bills for heating and electricity for all Village accounts. A full calendar year of bills, ending with the most recent available at time of study, were reviewed, concluding in an evaluation period of May 2012 – April 2013.

In some instances it was apparent that a bill had been misplaced, and thus a monthly average calculated from the remaining bills was used to compose the missing data. Some months were also simply recorded as having no consumption or costs, indicating an account had not been charged. NYSEG

bills consisted of service and delivery charges, while Integrys bills only consisted of delivery charges.

For Village Fleet emissions calculations, the Village Clerk accounts were reviewed. Only seven months were provided, and therefore, an average of these seven were assigned to the remaining five months for the values of both cost and consumption. The fleet receipts included Police, Fire, Department of Public Works, and Emergency Medical Services vehicles.

Data Sources – Community Emissions

Sources for the Community emissions represented a greater variety. Climate Tools, a contractor through New York's Cleaner Greener Communities program, supplied 2012 NYSEG data for gas and electric consumption for the Village of Trumansburg. There were two problems that had to be resolved before the data was usable.

First, the data was divided into five sectors; residential, commercial, industrial (no usage), street lighting, and public authority. The public authority sector featured far more than the Village government however- the Trumansburg schools, Town of Ulysses facilities, and any other public building were counted under this sector. Therefore, the amount of consumption attributable to the Village was subtracted from this total, and the remainder added to the commercial sector.

Second, there was a disparity of 190 accounts in the residential sector between electricity (800) and natural gas (610). The meaning of this was presumed to be that 190 households were obtaining their heat from other methods. To

find out the sources of heat for the missing households, the household heating method figures were obtained from the 2010 census. Of the remaining portion of households not using natural gas for heating purposes, approximately 3% used liquid petroleum gas, 17% used electric heating, 3% used fuel oil, and 1.7% used coal. The average heating per household in Trumansburg, based on the natural gas data from NYSEG, was 960.88 therms, and this was the value given to the homes using propane, heating oil, and coal. The homes using electric heat were already accounted for when considering electricity consumption in the community.

To find out the sources of heat for the missing commercial accounts, the ratio of non-natural gas heating methods for Tompkins County was obtained from the Tompkins County Community Greenhouse Gas Emissions Report, 1998-2008[12]. From that, it was estimated that the unaccounted commercial heating accounts would be using fuel oil.

Vehicle miles traveled (VMT) data for the village was obtained through the Ithaca-Tompkins County Transportation Council. The total VMT attributed to the Village was 3,180,540 miles. In other words, people drive approximately that much annually within Village boundaries.

Waste data was retrieved from Recycling and Solid Waste of Tompkins County, but was only available at County level. For an estimate of Trumansburg's contribution, the average amount of waste generated per household was calculated for the entire county, and then multiplied by the population of Trumansburg. The waste value was determined to be about 1,047 tons sent to landfill, annually.

Emissions Calculations + Factors

Emissions were calculated from consumption figures based on EPA factors that represented each unit of consumption's value in MTCO2e. These factors are listed below:

Table 1: CO2 Consumption Equivalents

Fuel	CO2 Factor	Per Unit
Electricity	.0007 MTCO2	Per kWh
Gasoline	.00892 MTCO2	Per gallon
Natural Gas	.00536 MTCO2	Per therm
Diesel	.01018 MTCO2	Per gallon
Propane	.06313 MTCO2	Per MMBTU
Heating Oil	.0732 MTCO2	Per MMBTU
Waste	2.67 MTCO2	Per Ton
Coal	.0929 MTCO2	Per MMBTU

These factors were multiplied by the respective number of units consumed to find the emissions data across all sources, for both the Village Government and Community emissions.

Village of Trumansburg Emissions Inventory

This inventory is divided into two segments. First, government emissions are taken into consideration; which accounts for all Village of Trumansburg emissions, such as the electricity to run Village facilities, or the gas to drive Village police cars. Second, community emissions are taken into consideration, which are all emissions that are created within Village borders for which the Village government itself is not directly responsible. This includes for example, heating fuel used by residents, or emissions from cars driving through town, or a business's electricity consumption.

Government Emissions

Total emissions were determined to be 865.8 $MtCO_2e$. These emissions were divisible into five sectors: Buildings (156 $MtCO_2e$), Wastewater (193 $MtCO_2e$), Fleet (105 $MtCO_2e$), Area and Street Lighting (142 $MtCO_2e$), and Water Delivery Services (269 $MtCO_2e$).

Below, we can see that each sector makes up a significant portion of government emissions. The Water Delivery System, a series of pumps bringing water up several hundred feet of elevation from Cayuga Lake to the Village, contributes an extremely high amount of emissions to government emissions. This, combined with the near equally intensive Wastewater Treatment Plant, combine for over half of the Village emissions.

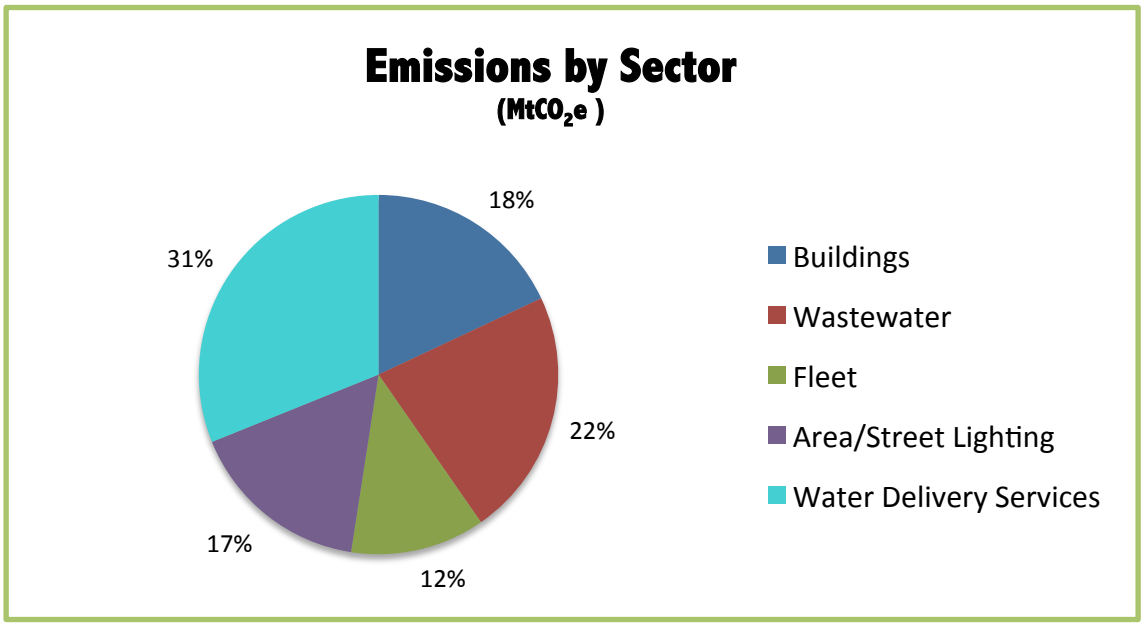

Figure 3: Village Emissions Displayed by Sector.
Wastewater and Water services are responsible for just over half of emissions, as the systems are intense consumers of electricity.

Buildings, such as Village Hall and the Fire Department, contribute nearly a quarter of emissions, much of which is attributable to the Fire Department. One might expect the fleet to attribute fewer emissions for such a small government, but Trumansburg provides regional Fire and EMS support, in addition to the Police and DPW.

Buildings, street lighting, and facilities such as the water system and Wastewater Treatment Plant contribute to electricity consumption, while natural gas use is attributable to heating. The fleet is responsible for both gas and diesel use. Shown below are the emissions by fuel source.

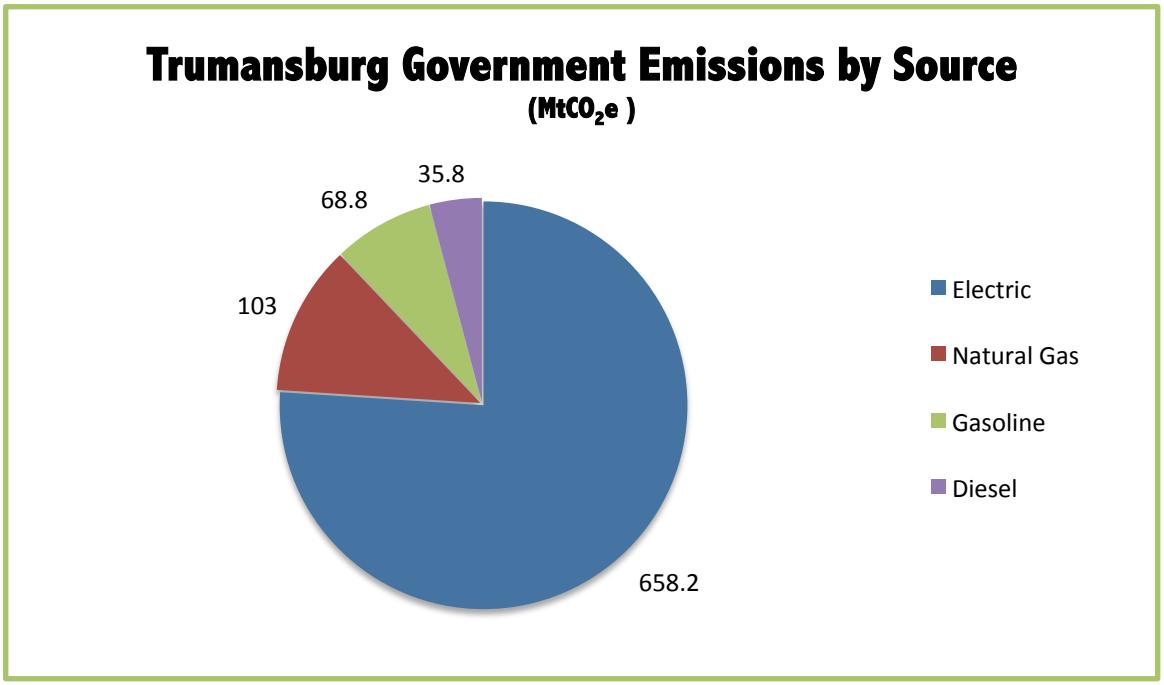

Figure 4: Trumansburg Government Emissions by Source.
Electricity use is overwhelmingly responsible for government emissions, contributing 647 $MtCO_2e$, just over 75% of total emissions. This is largely due to the Water and Wastewater systems.

The most significant source of emissions was electricity, representing 658.2 $MtCO_2$. When examined further, we find that 29.3 percent of the total electricity use is attributed to the Lake Street Waste Water Treatment Plant. Furthermore, two significant water pumps servicing the Village accounted for approximately 40.5 percent of Village electricity use. In total, these three sources amount for the majority (69.8 percent) of government electricity use.

With Village emissions spread across sectors, there is plenty of opportunity for reductions. Each sector presents individual opportunities for efficiency and reductions, and there is no overwhelming source of emissions that may

be unfeasible to address. The situation presents the Village with an array of possible target areas and actions, allowing multiple pathways to emissions reduction.

The cost of the aforementioned energy is not free, either. Trumansburg is paying approximately $139,275 annually for electricity, natural gas, gasoline, and diesel. These high costs are an excellent target for reducing operating costs for the Village. Electricity is far and away the highest portion of expenditure (Figure 5), costing $94,416 for a calendar year.

Table 2: The Cost of Emissions

Source	Amount	Cost (annual)	CO2 per unit	Emissions
Electricity	940,238 Kwh	$94,416	.0007 MTCO2e	658.2 $MtCO_2e$
Natural Gas	19,194 therms	$9,189	.00536 MTCO2e	103 $MtCO_2e$
Gasoline	7,715 gallons	$23,640	.00892 MTCO2e	68.8 $MtCO_2e$
Diesel	3,516 gallons	$12,029	.01018 MTCO2e	35.8 $MtCO_2e$

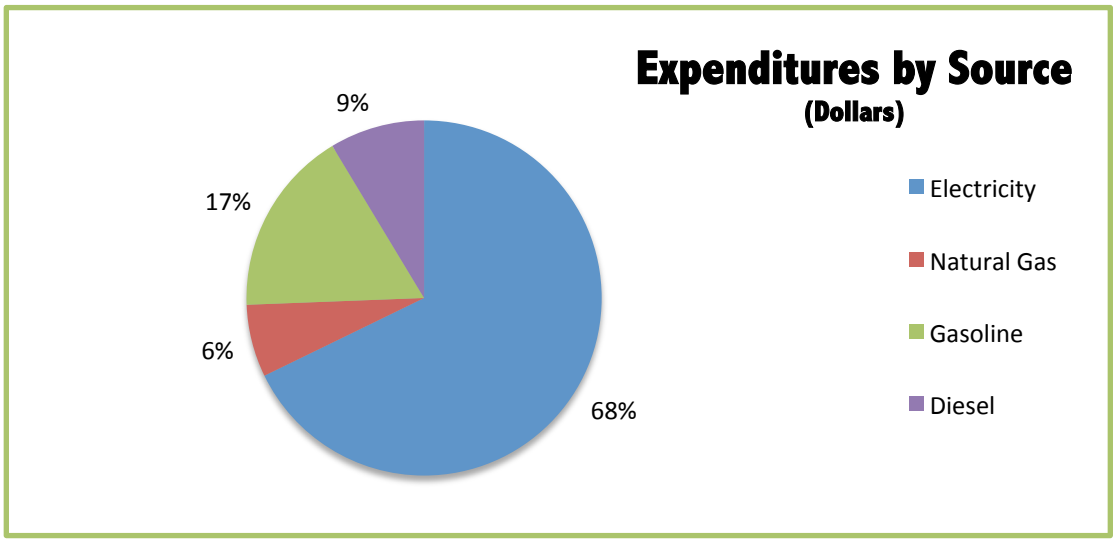

Figure 5: Expenditures by Source (Dollars)
Electricity also accounts for the largest share of Village energy expenditures, totaling $94,416 annually.

Trumansburg Community Emissions

Community emissions are those attributable to the greater Village of Trumansburg and its residents, businesses, and visitors. As the village government has much less control over these emissions (they can provide information, incentives, encouragement, and pursue planning initiatives, but cannot tell residents what they can and cannot do) it is useful to document separately. It includes all electric and natural gas consumption in the residential and commercial sectors, all vehicle miles traveled within Village limits, and all waste (municipal solid waste being sent to landfill) generated within the community. The total emissions for the Trumansburg community were found to be 16,090 $MtCO_2e$.

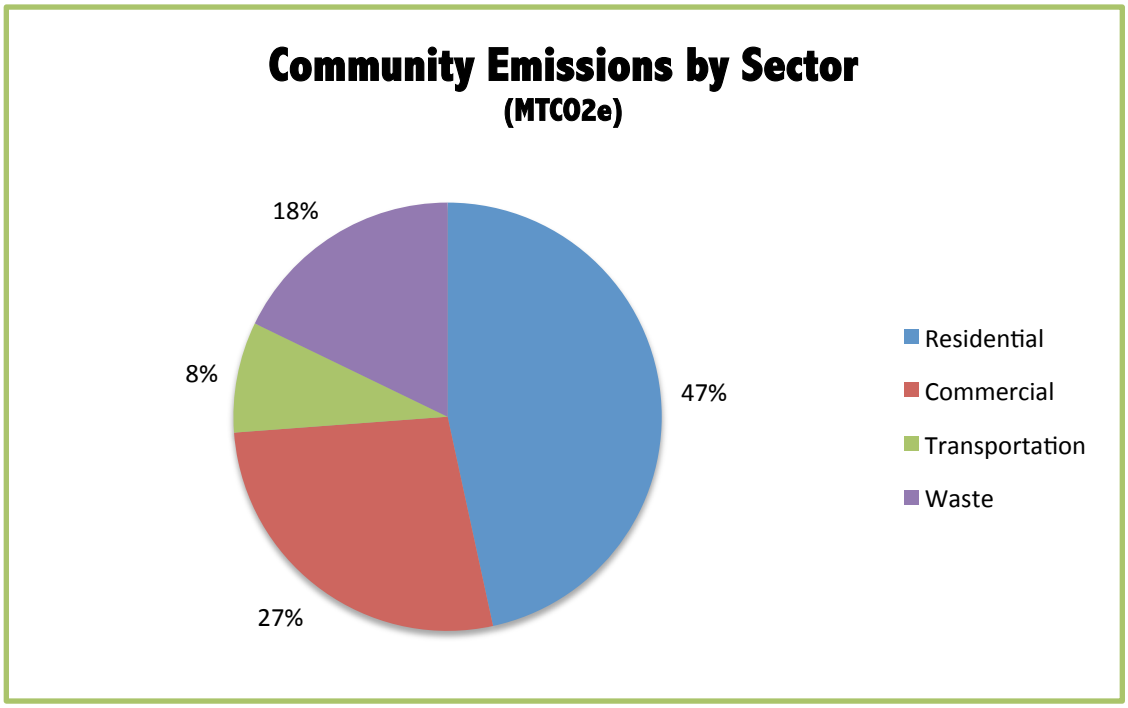

Figure 6: Village of Trumansburg Community Emissions by Sector.
The residential sector (just over 800 housing units) makes up nearly half of total community emissions.

The residential sector (natural gas and electric consumption in households) was the highest source of community emissions, 7,497 $MtCO_2e$. The commercial sector (natural gas and electricity consumption in businesses, schools, etc) represented over a quarter of total emissions with 4,380 $MtCO_2e$. Waste and Transportation sectors followed with 2,868 and 1,345 $MtCO_2e$ respectively.

The Village of Trumansburg features just over 800 households, a mix of retail, eateries, grocery stores, health services, and other businesses. All subscribe to NYSEG for electric services, and most subscribe to natural gas heating services, and thus contribute to the total consumption of those resources village-wide. While most of Trumansburg enjoys the efficiency of natural gas heating, some homes and businesses still rely on heating oil and propane, which contribute higher emissions than natural gas for an equal amount of heating (Figure 7).

The Village is bisected by State Route 96, a key transportation link many people who live in or near Trumansburg use to commute to Ithaca. So, while Trumansburg residents can walk to downtown amenities such as stores and restaurants, 66.5 percent drive to work[13], and countless more trips are driven to amenities outside the Village. The Village is estimated to generate about 3,180,540 vehicle miles traveled annually.

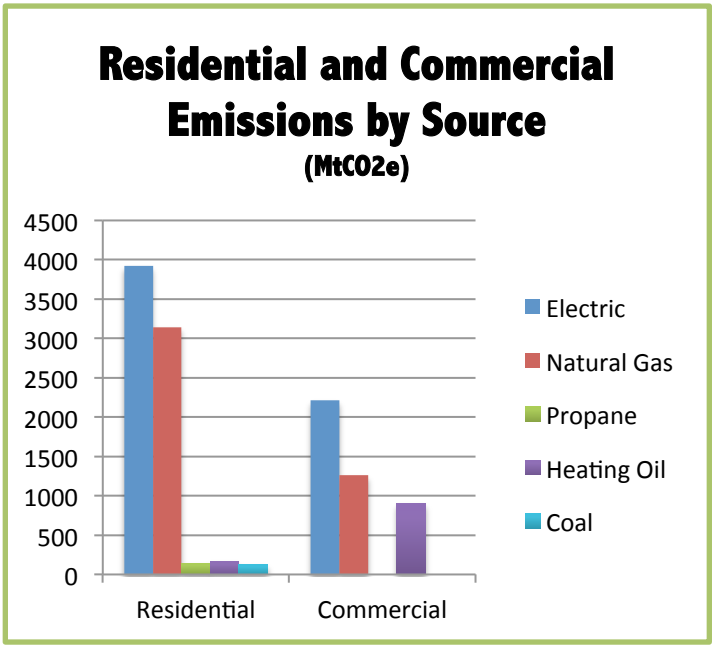

Figure 7: Residential and Commercial Emissions by Source (MtCO2e)
Electricity and natural gas contribute the majority of emissions in both the residential and commercial sectors.

Comparison and Context

In order to put Trumansburg's emissions in context, other emissions inventories were taken into consideration. Because most were not using 2013 as a base year, adjustments to the emissions totals were made using the predicted rate of change outlined in the respective inventories. The resulting estimates of current level emissions were then calculated into a per capita value. This process was done for both government and community emissions, the result being one figure that represents the amount of emissions a municipal government is responsible for emitting per resident in their jurisdiction, and another representing the per person community emissions.

The comparison with other communities serves as a means of evaluating Trumansburg's current emissions amongst its peers. The Village's performance in relation to nearby municipalities will play some part in

deciding goals for reductions. Below are the per capita analyses of surrounding municipalities who have carried out emissions inventories.

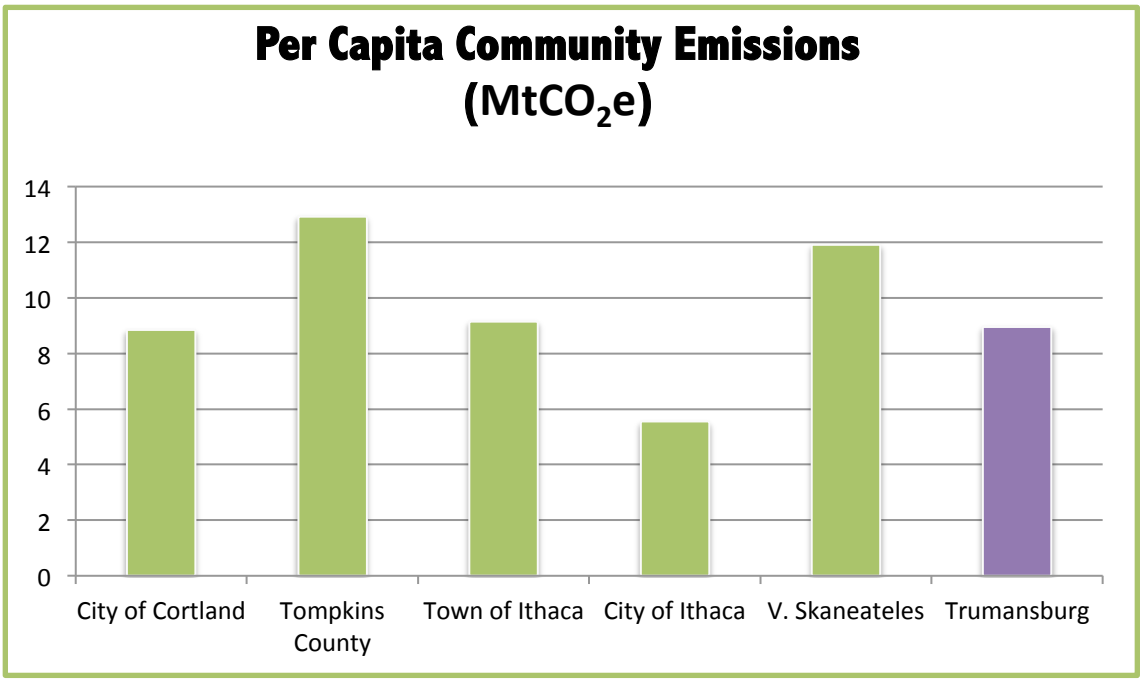

Figure 8: Per Capita Community Emissions ($MtCO_2e$)
This graph shows per capita emissions of nearby municipalities. This number is the number of emissions attributed to the greater community, divided by the number of residents.

In terms of per capita community emissions, Trumansburg residents are about average for the area, emitting approximately 8.95 $MtCO_2e$ per person annually. However, it is worth noting that the most closely related municipality in terms of size and characteristics, Skaneateles, has considerably more emissions per capita.

Below, government emissions are displayed on a per capita basis. In this comparison, Trumansburg is far higher than any other municipality, with the government emitting .58 $MtCO_2e$ per person annually. In comparison, the City of Ithaca emits .19 $MtCO_2e$ per person, about a third as much. In other words, the Village government is emitting a high amount of emissions based

on how many individuals live within its jurisdiction. In part, Trumansburg maintaining its own municipal Water and Sewer system for a relatively small population explains this. It may also be considered that some municipalities who do not maintain similar infrastructure may not be accounting for emissions from alternative methods of waste treatment and water delivery. Ultimately, the Trumansburg government is responsible for a relatively high level of emissions.

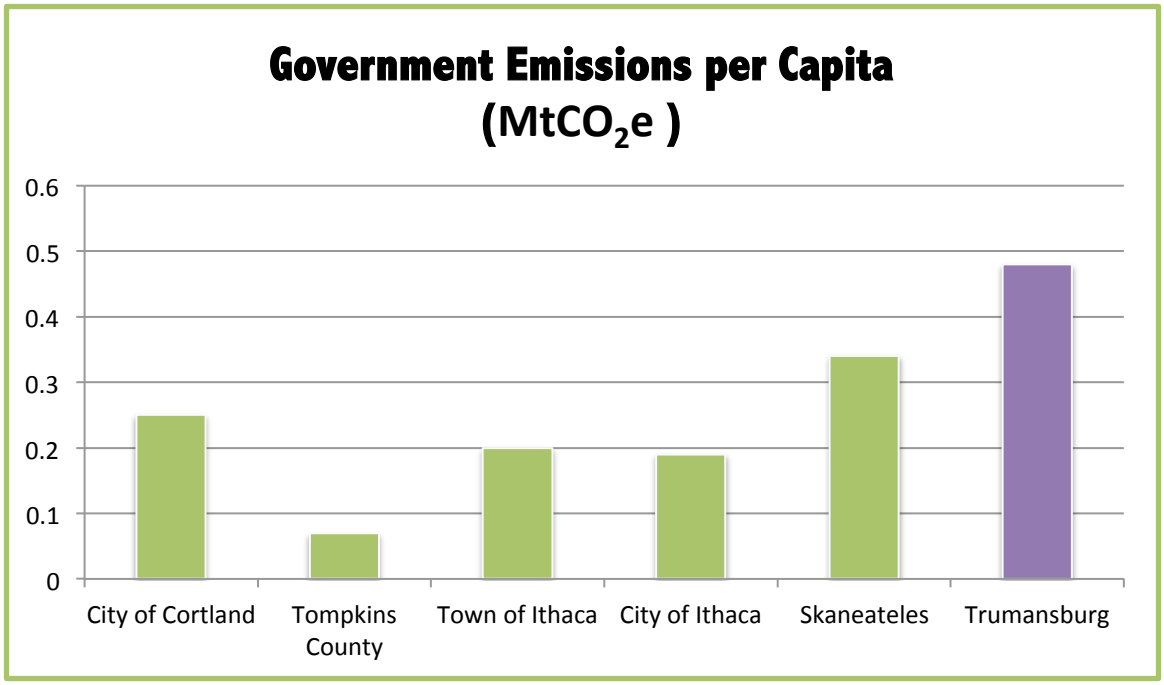

Figure 9: Government Emissions Per Capita ($MtCO_2e$)
This graph shows emissions for which the government is responsible as a per capita figure. Essentially, how high government emissions are based on how many residents they preside over.

Forecasts and Goals

According to the U.S. Energy Information Agency's 2013 Energy Outlook, energy-related emissions in the United States are expected to decline .2 percent annually through 2040, due to increased renewable energy use, an extended recovery from economic decline, efficiency improvements, and other improvements. Emissions are affected by a wide array of variables and therefore trends are difficult to predict. However, for the purpose of this study Trumansburg may expect to roughly expect to follow National trends. Given this information, 2030 emissions will represent a small decrease in 2013 level emissions. It is worth noting again that emissions trends are extremely difficult to predict and the EIA forecast outlined in the 2013 Energy Outlook is sensitive to change, and should be taken lightly.

Given this forecast, however, Trumansburg government emissions may be expected to decrease marginally from 865 to 860 under a business as usual scenario. Community emissions under the same forecast will shift from 16,090 to 15,575 $MtCO_2e$.

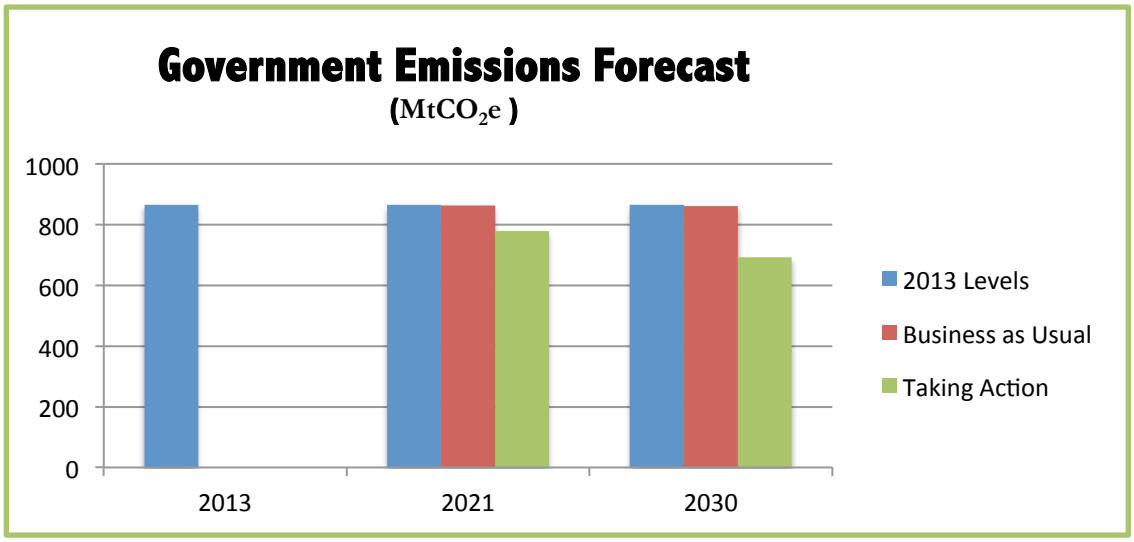

Figure 10: Government Emissions Forecast ($MtCO_2e$)

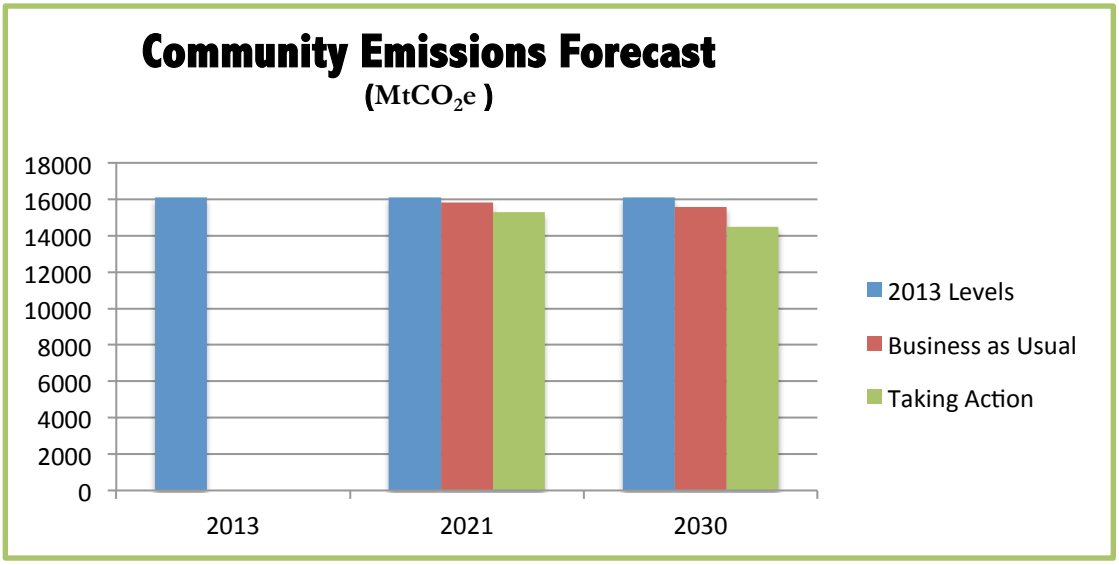

Figure 11: Community Emissions Forecast ($MtCO_2e$)

In conclusion, emissions totals were 865 $MtCO_2e$ for the Village of Trumansburg government and 16,090 $MtCO_2e$ for the greater community. Even with the anticipated small 'background' reduction, Trumansburg maintains a desire to reduce emissions further, both at government and community levels. Based on the emissions inventory, the context of emissions amongst other municipalities, and emissions forecasts, the Village has identified reduction goals to achieve by 2030.

First, the Village hopes to reduce government emissions to 80% of 2013 levels by 2030, or 692 $MtCO_2e$. This would require an annual decrease of 1.17% over the next seventeen years. An ambitious target that has been chosen based on high emissions at government level and a high level of control over those emissions.

A slightly less ambitious target of 90% of 2013 levels by 2030 has been set for community emissions. This amount to a 2030 total of 14,481 $MtCO_2e$ emitted annually, a .58 percent annual reduction. This is not only due to Trumansburg's average amount of emissions per capita amongst its peers, but

also reflects Village Hall's understanding that these emissions will be more difficult to influence. Based on these goals, the Village will pursue reductions strategies in the following Action Plan.

The Village may also consider subsequent emissions inventories to examine progress both during and after the seventeen-year timeline.

Emissions Reduction Strategies

In order to address the goals outlined in the Emissions Inventory (20 percent reduction in government emissions, and 10 percent reduction in community emissions by 2030), the Village will have to pursue multiple methods of emissions reduction that encompass efficiency improvements, reduced energy consumption, and renewable energy production. The goals outlined in this strategy guide reflect the need for a multi-linear approach to emissions reduction.

These strategies were selected based on their applicability, relevance, feasibility, and efficiency. In other words: do they have an impact on emissions, are they relevant to Trumansburg's emissions scope, are they feasible, and do they present other tangible gains that make them attractive from multiple perspectives, such as beautification or livability improvements.

The figures provided with these strategies are estimates. Exact costs of certain actions cannot be determined until they are actually carried out and factors such as savings are susceptible to changes in energy costs over time. In general, the figures are meant as a guideline to predict rough costs, savings, and emission reductions were the action undertaken. Some of the figures were calculated with help from ICLEI's Climate and Air Pollution Planning Assistant (CAPPA) tool, and others used independent data and calculations.

Variables that influence the strategies' applicability to Trumansburg's situation are discussed below, as well as identified and explained individually in each of the specific actions.

Goal: The degree to which the strategy should be pursued. For example, for a strategy that recommends replacing light bulbs, the goal may be to replace 30 light bulbs.

Investment: The financial cost of undertaking the project for the party bearing the costs in the particular strategy. Neither the goal nor the investment need be carried out entirely at once, but may be accomplished in stages.

Annual Reduction: The reduction in greenhouse gas emissions, measured in metric tons of CO_2 equivalent.

Annual Savings: The dollar amount that the strategy will save annually once completed to the extent outlined in the goal.

Payback: Based on the investment cost and annual cost savings, the amount of time the project will take to achieve a return on the investment.

Implementation Timeframe: An estimate of the time the strategy will take to be become fully effective once initiated. For instance, planting trees will require around 7 years to reach maturity and begin sequestering significant amounts of CO_2.

Bonus: Any other positive effects of the strategy that, although not quite measurable in $MTCO_2e$ or dollars, should be acknowledged.

Scale

In some Climate Action Plans, actions that a municipality has no influence over are included in their own efforts towards emission reduction. For instance, in Tompkins County's 2020 Energy Strategy, policy decisions being made at regional, state, or national level that were expected to be enacted during the plan's timeline were calculated into emissions reductions goals.

While this is helpful in achieving future reductions on paper, there are complications with counting these external factors as part of a municipality's Climate Action Plan. First, a local government has little influence over regulations at state or federal level, and these regulations could change before the end of a Climate Action Plan's timeline. The further removed the level of regulation, the less control the municipality has over whether it is implemented, removed, or enhanced during the length of the Plan. Second, it somewhat dilutes the purpose of the plan, which in this case, represents *Trumansburg's* decision to take action, rather than that of the federal or state government. Thus, reductions in emissions should be set, measured, and reviewed as independent of external efforts and regulations as possible. Thus, while federal and state initiatives may help reduce emissions in the future, it is better to consider them an additional bonus, rather than a crucial aspect of the plan.

Timeline

The earlier action is taken, the more emissions will be prevented over the long term. That being said, neither the time nor the resources are available to carry out every action to its maximum potential in the early stages of the Climate

Action Plan's lifetime. To an extent reductions are limited by how quickly actions can feasibly be taken.

The reductions goals outlined earlier are based on annual emission levels, rather than total emissions prevented over time. Therefore, strategies are not time-stressed and as long as they are enacted before 2030, the Climate Action Plan's goal will be accomplished. Failure to take action early, however, will result in lack of time and resources to achieve the target reductions before 2030. With this in mind, a balanced approach that takes action gradually as resources allow is the best option. It follows that pursuing the strategies that cut costs for the Village as early as possible allows the Village to capture savings as soon as possible, and even help fund the more expensive emissions reduction projects later on.

Government Strategies

The following strategies address the greenhouse gas emissions generated by the Village of Trumansburg's governmental operations. The Emissions Inventory determined that as of 2013, the Village government emits 855 MTCO2e annually. The sources of emissions were spread somewhat equally across sectors and sources. Thus, the following strategies reflect that, and seek to address a variety of sources with a variety of efforts. There is no single solution.

The goal identified by Village Board was to lower emissions to 80% of the 2013 level by 2030. The below strategies, were they to be fully implemented by 2030, would achieve this goal.

Street Lighting

Street and area lighting consumes over 204,000 kWh and costs the Village approximately $20,550 annually. It also is responsible for 143 $MtCO_2e$ per year, which is about 17% of the total government emissions. Street light energy consumption is relatively simple to reduce, and results in great cost savings for the Village over time.

ACTION I: Reduce Streetlight Runtime

Reducing running time of streetlights requires no upfront investment, and immediately begins saving money and reducing emissions. Careful thought should be given to times that streetlights are and are not necessary, and perhaps whether any specific streetlights around town can be turned off entirely. There are also safety concerns with eliminating area lighting that should be evaluated before taking action.

Table 3: Action I: Reduce Streetlight Runtime

Investment	Annual Savings	Payback Time	Annual Reduction
Free, negotiating with NYSEG	**$3,335**[1]	**Immediate**	**11** $MtCO_2e$
Bonus: Reduces light pollution on Village streets.			

Goal: 161 street lamps reduced by 3 hours daily
Implementation Timeframe: <1 year

ACTION II: Convert Streetlights to LED

Light Emitting Diode (LED) bulbs operate at a much higher efficiency than both Mercury and High Pressure Sodium lights. LED streetlights use up to

[1] Based on $.1004/kWh

63% less electricity, and also need to be replaced less often than High Pressure Sodium[14]. Currently, the Village runs about 161 streetlights nightly, none of which are LED bulbs. LED bulbs also enhance safety by creating better nighttime visibility, reduce light pollution by reflecting less light upward, and are more attractive through better color rendering[15].

Table 4: Action II: Convert Streetlights to LED

Investment	Annual Savings	Payback Time	Annual Reduction
$35,000	**$4,850**	**7.2 years**	**21** $MTCO_2e$
Bonus: Reduces light pollution on Village streets, increases visibility, reduces maintenance.			

Goal: 161 street lamps converted to LED
Implementation Timeline: 1-2 years.

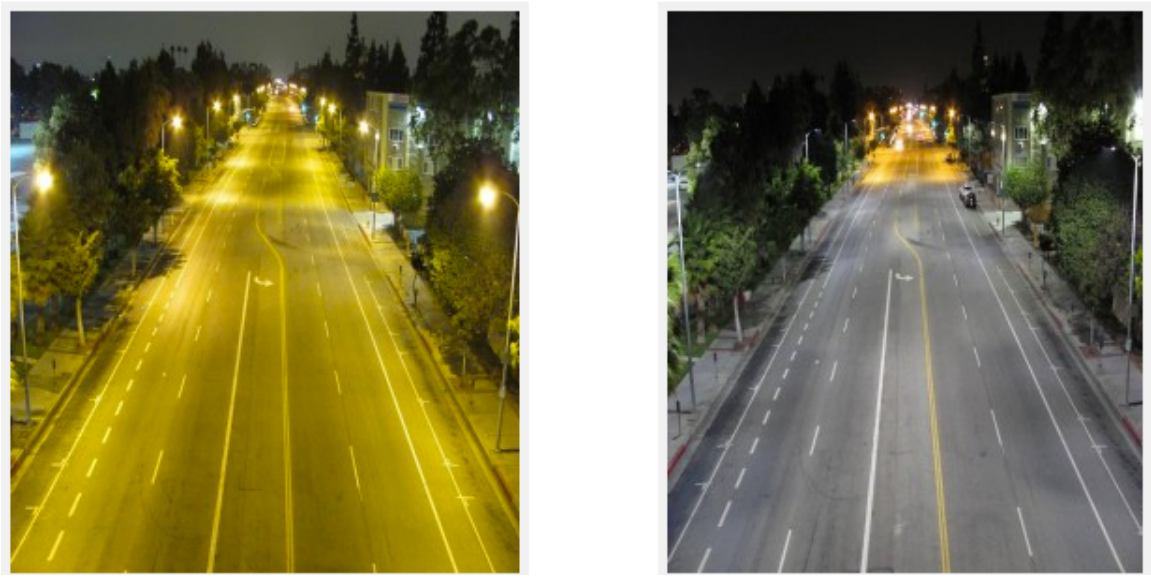

Figure 12: Before and after the Los Angeles street lighting retrofit project.
On the right, LED lighting provides a clear vision with less distortion and reflection. Source: Los Angeles Bureau of Street Lighting.

ACTION III: Energy Efficiency Retrofitting

The Village of Trumansburg's main offices occupy an old building on Main Street. The building is a prime candidate for energy efficiency retrofitting. Retrofitting could consist of updating insulation, replacing windows, updating HVAC systems, and so forth. While the building does not represent a high percentage of total Village energy consumption or expenditure, bringing it 'up to date' would capture both financial and emissions savings. Retrofitting Village Hall can also serve as an excellent example, as many visitors will be able to see the upgrades. Lastly, retrofitting results in increased comfort and air quality inside the building.

Table 5: Action III: Energy Efficiency Retrofitting

Investment	Annual Savings	Payback Time	Annual Reduction
$10,000	**$1,157**[2]	**8.6 years**	**4** $MTCO_2e$
Bonus: Improves comfort and indoor air quality.			

Goal: Retrofit approximately 5,000 ft^2 of Village property.
Implementation Timeline: 1-2 years

ACTION IV: Water and Wastewater Efficiency

The Village is already undergoing major upgrades to the Water and Wastewater facilities. Additional efficiency upgrades can be easily undertaken at a time when the significant project is already being financed. It offers a perfect opportunity for the Village to drastically reduce the major contributor to government emissions. A conservative estimate for efficiency improvement – 10% reduction in energy consumption across both systems – results in considerable annual savings and a reduction of 46 $MTCO_2e$. The Village

[2] Based on $.1004 per kWh and $2.14 per therm, calculated in CAPPA v. 1.5

should pursue greater efficiency improvements over the course of this project, as the system currently being installed will be in place for a long period of time.

Table 6: Action IV: Water and Wastewater Efficiency

Investment	Annual Savings	Goal	Annual Reduction
Simple Upgrade (No cost)	**$6,600**	**10% Reduction in Electricity**	**46** $MTCO_2e$
Bonus: Investment is already required for the water and wastewater systems.			

Goal: Reduce electricity consumption across both systems by at least 10%.
Implementation Timeframe: In Progress, 3 years

Energy Production

ACTION V: Purchase Renewable Energy

NYSEG offers a wind energy program that currently allows up to 600 kWh per month to be purchased from wind farms. Opting for this program or a similar purchasing agreement is straightforward way to offset emissions as it has a strong impact and is uncomplicated. A 600 kWh per month purchasing arrangement would result in 7200 kWh per year from wind energy, or less than 1% of Village electricity consumption. If alternative green energy purchasing agreements are sought out, a more significant percentage of total Village consumption could be achieved. Without a high upfront cost, purchasing green energy is a quick, affordable, and scalable means for the Village to offset emissions.

NYSEG electricity is generally sourced from Nuclear (23%), Hydroelectric (23%), Coal (12%), Natural Gas (36%), Oil (4%), and Other (1%)[16].

Therefore, purchasing wind energy represents a massive improvement over the environmental impact of generic NYSEG electricity, as the existing contribution from clean energy is miniscule.

Table 7: Action V: Purchase Renewable Wind Energy

Investment	Annual Savings	Payback Time	Annual Reduction
None	**-$30,000**	**N.A.**	**49** $MTCO_2e$
Bonus: Supporting alternative energy can help pave the way for it to become more successful and therefore a stronger, more affordable share of the market in the future.			

Goal: Purchase 15% of Village electricity from Renewable Sources annually.
Implementation Timeline: <6 months

ACTION VI: PV Solar

In December 2011, the Town of Ulysses installed solar panel systems on two buildings, totaling an annual output of around 44,000 kWh. The cost of the system was $278,460 before rebates, and after NYSERDA incentives, the price dropped to $203,490. Average cost savings were predicted to be $1,900 annually. NYSERDA offers incentives for photovoltaic installations 25 kW or less. A 25 kW system, producing an estimated 36,500 kWh annually, would represent an offset of 4% of total Village electricity consumption. There are several options for installing PV Solar, from traditional user-owned installations to leasing agreements that allow the panels to be owned by the installation company. Both present benefits under different circumstances, but there are several companies in and around Ithaca capable of installing PV systems. Working with a local company should allow for better customer service, and also help support renewable energy companies in the region.

Table 8: Action VI: PV Solar - Option I

Investment	Annual Savings	Payback Time	Annual Reduction
$130,000[3] before rebate	**$3,665**	**36 years** before rebate	**13** $MTCO_2e$
Bonus: Visible, provides a strong message for Village intent.			

Goal: 25 kW system, or approximately 36,500 kWh annually[17]
Implementation Timeframe: 1-2 years

Table 9: Action VI: PV Solar - Option II

Investment	Annual Savings	Payback Time	Annual Reduction
$260,000 before rebate	**$7,330**	**36 years** before rebate	**26** $MTCO_2e$
Bonus: Visible, provides a strong message for Village intent.			

Goal: 50 kW system, or approximately 73,000 kWh annually

Other

ACTION VII: Tree Planting

Tree planting can shade buildings to reduce cooling costs, but trees also sequester carbon. The Village of Trumansburg has various properties that could serve as a growing area for trees. It could also pursue partnerships with other organizations (such as the Trumansburg School District) to plant trees elsewhere in the Village. This option is best pursued early, as trees take time to reach maturity and begin sequestering significant amounts of CO2 (around seven years). Trees also provide a host of other benefits, such as habitat for wildlife, natural appeal, and higher air quality.

[3] Estimate based on cost of Town of Ulysses' solar panels.

Table 10: Action VII: Tree Planting - Option I

Investment	Annual Savings	Goal	Annual Reduction
$10,000	**N.A.**	**100 Trees planted**	**25** $MTCO_2e$
Bonus: Natural appeal, increases air quality, can reduce energy costs of buildings if planted appropriately.			

Goal: 100 trees planted
Implementation Timeframe: Approximately 7 years

Table 11: Action VII: Tree Planting - Option II

Investment	Annual Savings	Goal	Annual Reduction
$20,000	**N.A.**	**200 Trees planted**	**50** $MTCO_2e$
Bonus: Natural appeal, increases air quality, can reduce energy costs of buildings if planted appropriately.			

Summary

The above strategies would combine for a reduction of 169 $MTCO_2e$, which is approximately 19.5% of 2013 Village emissions. This would represent an ambitious reductions target, but one that is feasible for the Village of Trumansburg. This composition of strategies presents a variety of costs, implementation timeframes, paybacks, and 'bonus' benefits, which is appealing because it allows for certain actions to be taken as variables such as finances or needs of the community allow. Several of the strategies will capture immediate financial savings for the Village, while others will require a stronger commitment to greenhouse gas reduction.

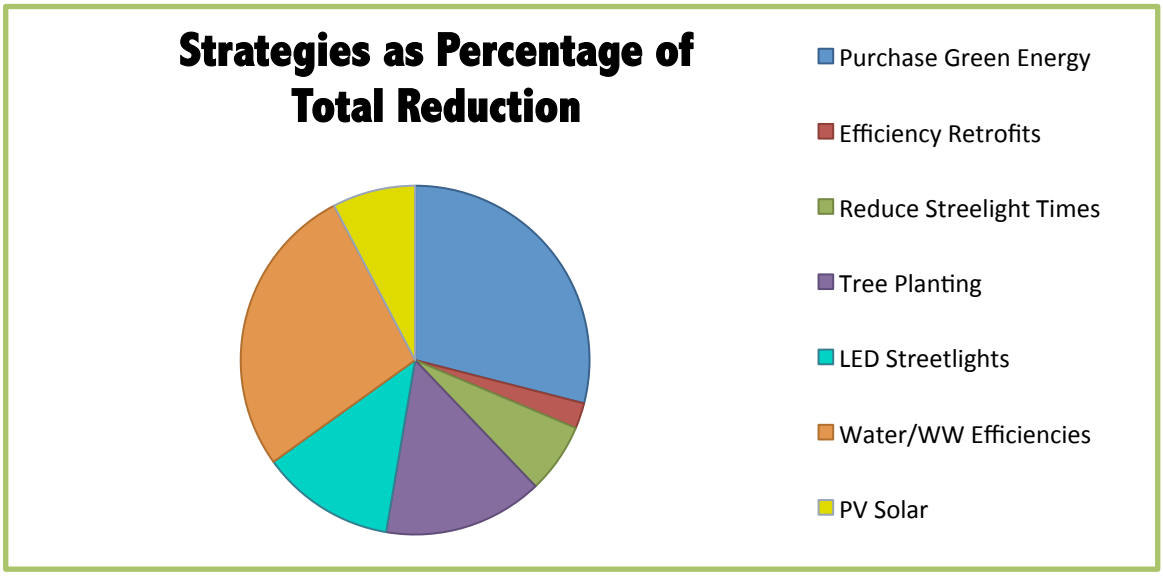

Figure 13: Strategies as Percentage of Total Reduction

Under this plan, solar generation, green energy purchasing, and efficiency upgrades to the Water and Wastewater systems equate to nearly three quarters of total emissions reductions. While those few strategies may seem to be overwhelmingly important, there are other variables to consider besides the simple amount of emissions reductions.

Below, a table displays the results of an analysis providing a price per ton figure for each of the government strategies. An initial cost, as well as a present value of future costs or savings are used to provide a net present value for each project. The net present value is then applied to the amount of emissions eliminated by the strategy. As one can see, some of the strategies earn money for each metric ton they eliminate, while others cost money. The strategies that are providing both savings and reduced emissions are the low-hanging fruit, while the strategies that provide reductions at a cost will require more commitment, and perhaps alternative funding measures. It is important to note that the below table does not factor in co-benefits of any of the strategies, such as beautification, livability or safety.

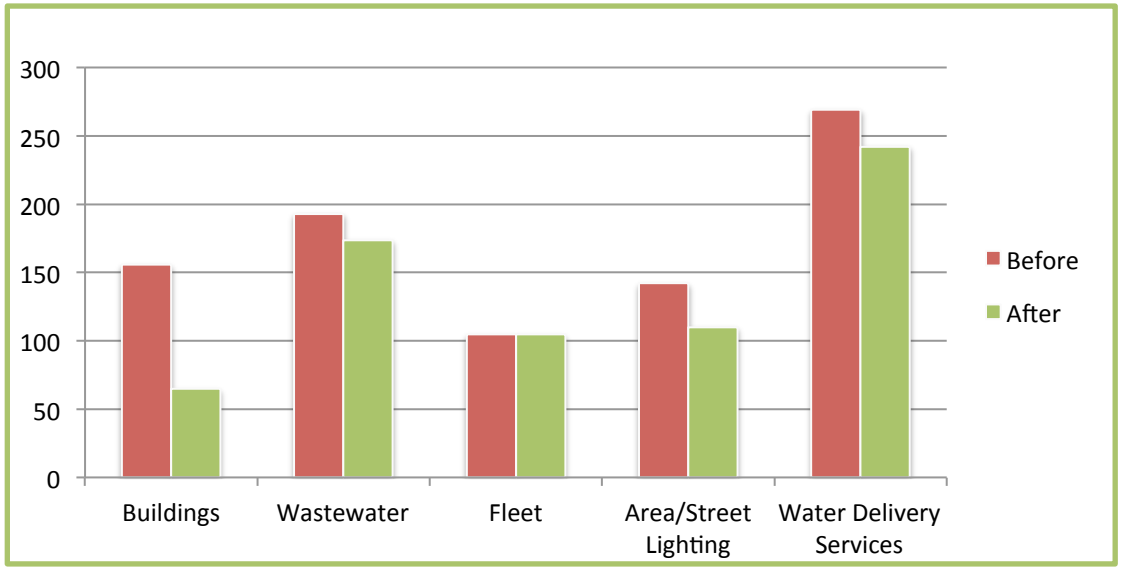

Figure 14: Emissions Reductions by Sector
This graph displays the emissions reductions by sector. All general efficiency upgrades or energy production/procurement are applied to offset the Buildings sector.

Government Strategies Pricing

17 Year Timeline Strategy	Initial Investment	Annual Costs	Annual Savings	NPV (6%)	Emissions Reductions	Price p. ton
Reduce Street Light Runtime	$0	$0	$3,335	$32,964	11	**$2,997**
Convert street light to LED	-$35,000	-$500	$4,850	$9,977	21	**$475.10**
Energy Efficiency Retrofitting	-$10,000	$0	$1,150	$1,933	4	**$483.25**
Waste Water Upgrades	$0	$0	$6,600	$65,236	46	**$1,418.17**
Renewable Energy Purchasing	$0	-$3,000	$0	-$32,483	49	**-$6,629.14**
PV Solar	-$100,000	-$500	$3,665	-$63,056	13	**-$4,850.46**
PV Solar II	-$200,000	-$1,000	$7,330	-$126,112	26	**-$4,850.46**
Reforestry	-$10,000	-$500	$0	-$14,376	25	**-$575.04**
Reforestry II	-$20,000	-$500	$0	-$23,810	50	**-$476.20**

Figure 15: Estimated Price of Reductions

This table shows the estimated price of each MTCO2e avoided by the strategy. Note that this analysis does not include co-benefits such as beautification, livability, or safety. All costs and savings are estimates.

While the above analysis is based on the 17-year timeline, it is also important to note that many of these projects have lifetimes that surpass that duration. The timeline was chosen based on the lifetime of the plan, rather than the length of any individual project. Likewise, the values of these projects will extend beyond the 2030 benchmark year. Figure 14 below displays the impact of the strategies on each sector's emissions.

Community Strategies

These strategies apply to the greater Village of Trumansburg community. Despite the actual action usually being the residents' responsibility, in many cases the Village government will play a key role in helping residents to reduce their own emissions either through funding projects or providing education. Investment costs, in many cases, fall on a combination of residents and government. Despite the government's investment role, these strategies are targeted only at community emissions, generated by residents, businesses, visitors, etc. The groups from whom financial investment will be required are mentioned in each strategy.

Energy

Energy Efficiency Education for Residents

Utility bills frustrate many homeowners, but the frustration is not always followed by change. Many homeowners do not have time to research ways to improve energy efficiency, or even to assess that they are wasting energy in the first place. Education programs can inspire, but also simply spread awareness over simple steps to reduce home energy costs, and therefore, emissions.

Table 12: Energy Efficiency Educations for Residents

Investment	Annual Savings (Homeowners)	Payback Time	Annual Reduction
$4,000	**$138**	**N.A.**	**312** $MTCO_2e$
Bonus: Homes who decide to partake or take steps to improve their efficiency will enjoy more comfortable homes as well as increased property value.			

Investment: The Village would need to sponsor the education campaign, while energy efficiency would require some minor investments, such as purchasing lightbulbs, for Village residents.
Goal: 800 households targeted with energy efficiency education (100%)

CFL Giveaway

Compact Fluorescent Lamps, or CFL light bulbs, offer great improvements for interior lighting, and recent technology has enhanced their lighting performance and reduced their cost. CFL's not only save energy and money, but need to be replaced far less often, with a lifetime more than four times that of a traditional incandescent bulb. One bulb will save nearly $100 and about 460 kWh[18] of electricity over its lifespan.

Table 13: CFL Giveaway

Investment	Annual Savings (Homeowners)	Payback Time	Annual Reduction
$1,250	**$20 per bulb**	**N.A.**	**8** $MTCO_2e$
Bonus: Giveaway can be used as a way to spread awareness about climate effort.			

Investment: The Village purchases all light bulbs and provides them to residents free of charge.
Goal: 500 light bulbs given away to community, along with information on proper disposal

Purchase Green Electricity

The NYSEG Wind Energy program is an easy way for homeowners to offset their emissions for a modest cost (200 kWh can be offset for an additional $10 per month). If residents opting into this program offset 25% of residential electricity use, a large amount of emissions are eliminated.

Table 14: Purchase Green Electricity

Investment	Annual Savings (Homeowners)	Goal	Annual Reduction
-	-$43,200	**25% of homes**	**483** $MTCO_2e$

Investment: The residents opt to purchase green energy.
Goal: 25% of residential electricity use sourced from wind energy.

Green Business Program

Businesses volunteer to participate in an efficiency program. The program could take many forms, from a competition to a simple targeted savings goal for each business. Businesses would be educated on ways to reduce energy consumption and increase efficiency, and volunteer to make efforts to do so.

Table 15: Green Business Program

Investment	Annual Savings	Goal	Annual Reduction
$5,000	-	**10 Participating Businesses**	**18** $MTCO_2e$
Bonus: Facilitates creativity, cuts costs, and increases sense of community. Businesses would be acknowledged for their participation.			

Investment: The Village would sponsor and administer the program, while the businesses would need to make minor investments to reduce energy consumption.
Goals: Encourage businesses to reduce energy consumption

PV Solar in Community

Solar Panels are increasing in popularity throughout Tompkins County. As more options become available, homeowners are interested not only in reducing their environmental impact through PV Solar, but also enjoying the reduced energy bills.

Table 16: PV Solar in Community

Investment	Annual Savings (Homeowners)	Goal	Annual Reduction
$800,000	**$800**	**200 kW installed across Village (about 40 homes)**	**101** $MTCO_2e$

Investment: Residents would likely make the investment in solar power across the community. Rebates are available, and the Village should look into funding support for interested community members.

Goals:

- Facilitate residential renewable energy projects
- Incentivize solar installations

Transportation

Livable Development

The Village should encourage development that reduces reliance on automobiles. This means working to increase the amenities that are walking distance from Village residents. Striving to ensure that residents have nearby access to recreation can help, but significant reduction in VMT also requires that people can purchase necessities without having to drive. This could be accomplished by making existing businesses more accessible, and adding more businesses that suit residents' needs. A market study to determine what businesses residents will support is one way the Village could work to establish businesses downtown. The Village can also invest in amenities downtown, making opening a business a more attractive venture.

Table 17: Livable Development

Village Investment	Annual Savings	Goal	Annual Reduction
$50,000	**$9,400**	**800 households reduce VMT by 100 annually**	**100** $MTCO_2e$

Investment: The Village will need to fund projects that increase downtown livability, including market studies to promote business growth, as well as Transportation Improvement Program projects. As these projects may require significant capital investment, grant-funding opportunities should be pursued.
Goals:

- Provide and continue to attract amenities downtown that reduce need to drive
- Continue to enhance zoning to allow residents to meet their own needs (gardens, chickens)
- Reduce sprawl development by ensuring land use laws protect open space and that development is pedestrian friendly

Bicycling Paths and Facilities

Bicycle paths and facilities are a long-term investment, but they provide a host of benefits that will ultimately make the Village of Trumansburg much more climate-friendly, a better place to live, and a more attractive place for businesses. Efforts to enhance cycling facilities can range from providing ample bike racks to painting bike lanes on Village streets.

Table 18: Bicycling Paths and Facilities

Village Investment	Annual Savings (Community)	Goal	Annual Reduction
$200,000	**$5,000**	**500 weekly trips**	**12** $MTCO_2e$
Bonus: Increases foot traffic for businesses, improves individual health, reduces costs of transportation, and enhances Village safety.			

Investment: The Village will need to pursue grant funding to supplement their own resources to finance these projects.
Goals

- Provide bike racks downtown
- Pursue on-street bike lanes on low traffic streets that access downtown such as Congress, Whig, Elm, and South.
- Identify and connect isolated areas to non-automobile network

Increase Bus Ridership

Trumansburg benefits from decent TCAT bus service, particularly at commuting times. By increasing bus use, residents can reduce the amount of emissions from their cars.

Table 19: Increase Bus Ridership

Village Investment	Annual Savings (Homeowners)	Annual Reduction
-$15,000	**$13,000**	**14** $MTCO_2e$
Bonus: Reduces traffic.		

Investment: Residents will be purchasing bus passes of their own volition.
Goals:

- Add 25 additional daily bus passengers to TCAT
- Educate youth on transit options and supply them with bus passes at discount prices.

Walk Friendly Environments

The Village of Trumansburg is geographically small in size, and if residents walked downtown rather than drove, there would be considerable emissions reductions. What Trumansburg has in size it lacks in sidewalks; most are in disrepair or non-existent. Creating walk friendly environments provides a host of subsidiary benefits. It is an equal, affordable means of transportation, increases community health, supports businesses, and enhances safety. Enhancing the walking environment means ensuring pedestrian right-of-ways,

improving walkways, and also, simply increasing the number of people walking.

A 2010 Walkability Study by Tompkins County Planning Department identified key projects for Trumansburg to pursue the Village's high potential for walkability. These projects should be pursued first as they address the areas of high need.

Table 20: Walk Friendly Environment

Village Investment	Annual Savings (Community)	Goal	Annual Reduction
-$500,000	**$8,720**	**2000 trips/week**	**50** $MTCO_2e$
Bonus: Increases foot traffic for businesses, improves individual health, reduces costs of transportation, and enhances Village safety.			

Investment: Creating a walk friendly environment would require a substantial financial investment, one that the Village would need to locate funding for.
Goals:

- Establish Safe Routes to School Program
- Repair unsafe sidewalks, and expand current network to provide access on key streets currently lacking sidewalks such as South and Lake.
- Improve and define a pedestrian area on Elm Street where it intersects with Main Street.
- Ensure there the pedestrian network provides access to current (schools, downtown), and anticipated amenities (recreational trails).

Education on Low-Carbon Transportation

A small reduction in vehicle miles traveled across the board makes a big difference in transportation emissions. Educating residents on the negative side effects of driving, as well as methods to reduce transportation emissions can help them lower their own VMT. Actions such as combining trips, knowing about how to use other forms of transportation, and particularly how much money can be saved in doing so, is strong motivation.

Table 21: Education on Low-Carbon Transportation

Village Investment	Annual Savings (Community)	Goal	Annual Reduction
$15,000	**$135,000**	**5% trip reduction**	**398** $MTCO_2e$
Bonus: Increases foot traffic for businesses, improves individual health, reduces costs of transportation, and enhances Village safety.			

Investment: The education program would be coordinated and sponsored by the Village, but minor costs would be borne by residents changing their habits.

Goals:

- Educate residents on low-carbon transportation methods and options.
- Achieve a 5% VMT reduction community wide.

Initiate Carshare

Carshare members reportedly drive 50 percent less. While some of this may be due to the fact that people who drive less are naturally more interested in a Carshare program, there is something to be said for simply not owning a car. Carshares also save users money, costing up to 90 percent less than owning a car[19].

Table 22: Initiate Carshare

Village Investment	Annual Savings (Community)	Goal	Annual Reduction
$15,000	**$85,000**	**100 participants**	**121** $MTCO_2e$
Bonus: Reduces automobile costs for residents, reduces traffic, increases downtown foot traffic, etc.			

Investment: Village residents would purchase Carshare memberships, however the Village may have to lead the campaign to encourage Ithaca Carshare to service Trumansburg.

Goals:

- Work with Ithaca Carshare to examine potential of providing vehicle in downtown Trumansburg

Summary

The above strategies, as outlined, represent a total reduction of 1,617 $MTCO_2e$ from community emissions. This would present a 10% reduction from the 2013 levels (16,090 $MTCO_2e$). Although the impact may seem minor, community emissions are much more difficult to control and reduce, as it is largely up to individuals themselves to decide whether or not they want to contribute to certain efforts. Due to this lack of control, it is practical to keep goals achievable, rather than abstract. Importantly, many of the strategies outlined in the Plan leave room for continual emissions reductions over time. For instance, bicycle paths and facilities can continue to be enhanced, and gain more use as time goes on.

Table 23: Estimated Price of Reductions

17 Year Timeline / Strategy	Initial Investment	Annual Costs	Annual Savings	NPV (6%)	Emissions Reductions	Price per ton
Energy Education Program	-$15,000	-$80,000	$110,400	$286,329	312	$918
CFL Giveaway	-$1,250	$0	$10,000	$97,663	8	$12,208
Purchase Renewable Energy	$0	-$43,200	$0	-$426,997	483	-$884
Green Businesses Program	-$5,000	-$1,000	$5,000	$34,820	18	$1,934
PV Solar in Community	-$800,000	-$1,000	$29,320	-$474,796	101	-$4,700
Liveable Development	-$50,000	-$5,000	$14,400	$45,742	100	$457
Bicycling Infrastructure	-$200,000	-$5,000	$4,680	-$191,842	12	-$15,987
Increase Bus Ridership	-$15,000	-$15,000	$28,080	$115,134	14	$8,224
Walking Infrastructure	-$500,000	-$10,000	$18,720	-$385,508	50	-$7,710
Transportation Education	-$15,000	-$5,000	$131,518	$1,236,379	398	$3,106
Carshare Service	-$15,620	-$10,620	$96,996	$839,022	121	$6,934

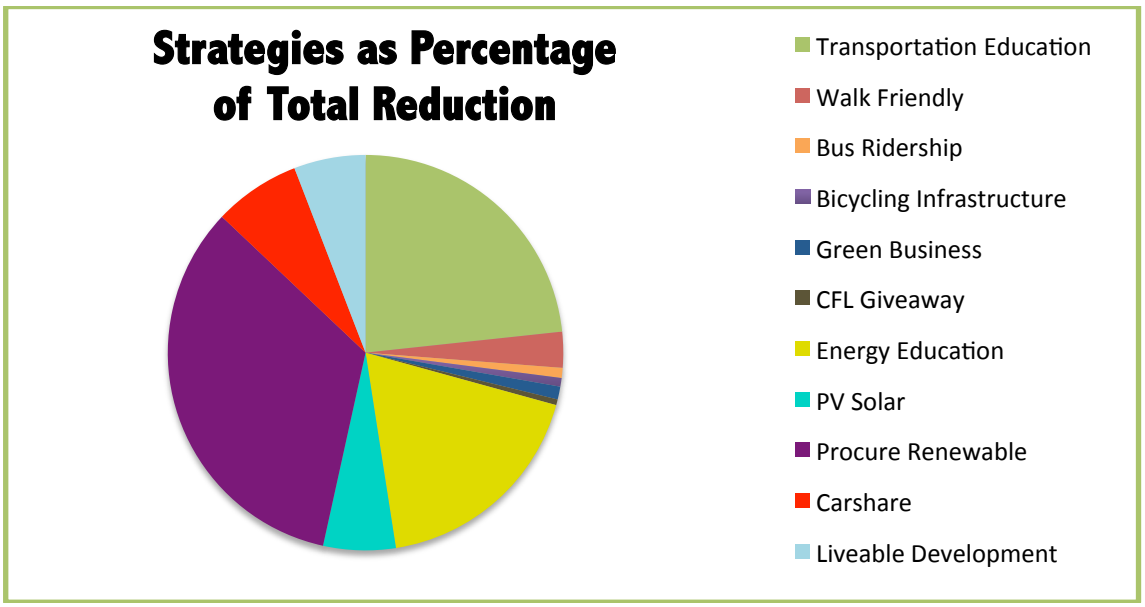

Figure 15: Strategies as Percentage of Total Reduction

Conclusion

The outlined strategies are recommended as part of a portfolio to decrease emissions in Trumansburg at both the government and community scales. Each strategy presents a unique level of costs, benefits, and overall effectiveness on emissions. When combined into a Climate Action Plan portfolio of projects, they combine to form an effective unit, diluting costs, multiplying benefits, and accruing savings.

Some strategies present immediate economic savings *while* reducing emissions. Others are not as cost-effective, but present other benefits that are extremely valuable to the community. Yet others are costly investments, but greatly reduce Trumansburg's emissions, while simultaneously increasing the Village's resilience in the face of climate change and rising energy costs. Therefore, many of the outlined strategies not only bring the community toward its goals of sustainability, but also prepare Trumansburg and its residents for a changing world.

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