Community Greenhouse Gas Emissions Inventories

Town and Village of New Paltz, Ulster County, New York

Photo by Daniel Torres

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Abstract

Climate change is an existential threat to all of humanity, and, in order to prevent the catastrophes awaiting us at the now-inevitable 2°C of warming, we must cut global CO_2 emissions by at least 45% below 2010 levels by the year 2030, while eliminating emissions by 2075 (IPCC, 2018). Municipalities have an arsenal of policy options available to mitigate greenhouse gas emissions. Funded by a grant from DEC's Climate Smart Communities program, this project catalogued the greenhouse gas emissions in the Town and Village of New Paltz, New York. The total carbon dioxide equivalent (CO_2e)[1] generated by the Town and Village of New Paltz is about 120,000 metric tons per year, about half of which can be attributed to vehicular emissions on I-87, the New York State Thruway. 92% of New Paltz's emissions are due to traffic (with half of that coming from the Thruway), 6% are due to residential energy, with the remaining 2% covering all other sources. There are many possible approaches to reducing New Paltz's emissions to meet IPCC goals, including zoning for high density, tree planting programs, and creating a Climate Action Plan, and these will be discussed in the development of a subsequent Climate Action Plan for the community.

Executive Summary

> It is worse, much worse, than you think. The slowness of climate change is a fairy tale, perhaps as pernicious as the one that says it isn't happening at all, and comes to us bundled with several others in an anthology of comforting delusions: that global warming is an Arctic saga, unfolding remotely; that it is strictly a matter of sea level and coastlines, not an enveloping crisis sparing no place and leaving no life undeformed…that there is any analogue to the scale or scope of this threat, in the long span of human history, that might give us confidence in staring it down. None of this is true.
>
> **David Wallace Wells, The Uninhabitable Earth: Life After Warming**

The Climate Crisis

Climate change is an existential threat to all of humanity, and even if drastic efforts are launched to curb its worst excesses, industrialized humankind has unalterably damaged the world for centuries or millennia to come. Carbon dioxide levels and the temperature increases which accompany them have not been as high as they are today in almost 50 million years (LePage, 2017). Its myriad impacts are killing planetary biological, economic, and social systems.

We know that over the next few decades, annual global temperatures will rise dangerously, bringing more intense heat waves, inciting more frequent powerful wildfires, and damaging crops. The heat will cause sea level to swell, bringing coastal flooding to the large numbers of people living near the sea, with half of humanity, and three quarters of large cities located on or near coastlines (Goodell, 2018; Huang-Lachman and Lovett, 2016; Revi et al., 2014, World Bank, 2018). Precipitation patterns will change, though the details vary from place to place: in some higher rainfall, in others increased droughts, sometimes both. Storms will be more commonplace, and more severe. Yet these are only a handful of the changes we are now living through (IPCC, 2013). The problems we've caused seem endless, and the dangers to be prepared for particular to each given place.

According to the IPCC's 2018 "Special Report No. 15: Global Warming of 1.5°C," in order to prevent the catastrophes awaiting us at the now-inevitable two degrees C of warming, we must cut global CO_2 emissions by at least 45% below 2010 levels by the year 2030, while eliminating emissions by 2075 (IPCC, 2018). We *must* cut humanity's emissions in half in the next ten years, and get rid of greenhouse gases altogether in just fifty. Whether we can reduce our consumption of CO_2, and do it in time, is very much an open question. Jason Hickel (2018), writing in *Foreign Policy*, put it bluntly, "It would be difficult to overstate how dramatic this trajectory is. It requires nothing less than a total and rapid reversal of our present direction as a civilization."

[1] The three main greenhouse gases - carbon dioxide (CO_2), nitrous oxide (NO2), and methane (CH4) — have different impacts on global warming. Methane, for example, is roughly thirty times more effective at trapping heat than carbon dioxide is. Therefore, one ton of methane causes thirty times as much damage as one ton of carbon dioxide. To make things easier, it is common to talk about *carbon dioxide equivalent*, (CO_2e).

Climate Action and Local Government

New Paltz is an economic and cultural hub of 14,003 people whose economy is rooted in both ecotourism and the SUNY New Paltz campus. Climate change activism in New Paltz is a recent phenomenon: the Village of New Paltz formed a Global Warming Task Force in 2004 (since disbanded), and a citizen-based Climate Action Coalition was formed in 2007. Most recently, the Town and Village successfully applied for a grant from the New York State Department of Environmental Conservation to fund the process of becoming a certified Climate Smart Community. This funding is being used to create a suite of plans aimed at steering New Paltz's response to the climate crisis, including this community greenhouse gas inventory.

Since the mid 20th century, most large cities have already warmed twice as much as the planet as a whole (Stone and Habeeb, 2012). While the policy options for local governments to respond to climate change are legion, it can seem a distant problem when a city is faced with the immediate day-to-day needs of providing water, sewer, police, and other services. Although cities, by virtue of their position on the front lines of climate impacts, *must* adapt to climate change, it doesn't change the facts, however, that budgets are constrained, staff unlikely to grow, and resources generally scarce. As Betsill (2001) writes, "In many communities, environmental programs are viewed as 'luxury' expenditures; these programs are often hit first when there is a budget shortfall."

One solution to raising the profile and to putting these issues onto the public agenda, is the process of compiling a Greenhouse Gas Inventory and writing a Climate Action Plan. These tools can educate city and community leaders about the dangers of, and possible solutions to, climate change. In addition, they can raise the profile of the problem with the community, and therefore lead to potential reallocation of resources within the city or expanded grant funding availability due to the existence of the Plan (as with NYS' Climate Smart Communities program). Moreover, these climate planning exercises provide a roadmap to often ambitious emissions reductions targets, and are in many ways aspirational, offering a menu of important policy options.

Whether concern for climate change originates with government officials or from the general public, engaging the public is a necessary part of climate action. An active and engaged community drives political and social change, ideally articulating the wants and needs of that community in a more representative manner than provided for solely by local elections. Yet, this is made more difficult by the fact that there is a general lack of interest and knowledge about climate change (Whitmarsh et al., 2011). In 2017, only 31% of Americans regularly discussed climate change, down from 40% in 2008. Even worse, only 16% heard friends or family mention climate change at least monthly (Geiger et al., 2017).

One important barrier to increased public engagement with climate change is the psychological distance between a planetary, long-term, abstract problem with low immediate risk, and the tangible world of our everyday lives (Whitmarsh et al., 2011; Schuldt et al., 2018). One response to this problem is to "localize" the messaging to make the problem feel closer physically (Schuldt et al. 2018), as well as framing solutions as proportionate to the scale of the problem, emphasizing not only individual action, but cooperative action *at the community level* (Corner and Randall, 2007; Whitmarsh et al., 2011).

Mapping Our Carbon Footprint

Funded by a grant from DEC's Climate Smart Communities program, this project catalogued the greenhouse gas emissions in the Town and Village of New Paltz. This was accomplished using the industry standard (and DEC approved) ClearPath software and the "U.S. Protocol for Accounting and Reporting of Greenhouse Gases", both produced by ICLEI-USA. The total carbon dioxide equivalent (CO_2e)[2] generated by the Town and Village of New Paltz is 119,128 metric tons per year, of which 55,733 metric tons comes from I-87. This leaves 66,382 MT CO_2e created by everything in New Paltz except the Thruway. Comparisons with other communities is difficult, in part because few municipalities have done inventories. While comparison to communities with similar size, demographics, and other factors (i.e., SUNY, I-87) may be unavailable to date, there are other comparisons. New Paltz's per capita average of 4.5 MT CO_2e is less than the New York State per capita average of 11 MT CO_2e[3], and smaller even than the pedestrian-and-transit dominated New York City per capita average of 5.8 MT CO_2e.[4]

Of the various sources of emissions in the community, transportation contributes far and away the most emissions of any sector. Ninety-two percent of all greenhouse gas emissions in New Paltz comes from traffic. Residential energy is the next largest contributor at 6%, with all other sources combined responsible for only 2% of community emissions.

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[2] The three main greenhouse gases - carbon dioxide (CO_2), nitrous oxide (NO2), and methane (CH4) — have different impacts on global warming. Methane, for example, is roughly thirty times more effective at trapping heat than carbon dioxide is. Therefore, one ton of methane causes thirty times as much damage as one ton of carbon dioxide. To make things easier, it is common to talk about *carbon dioxide equivalent*, (CO_2e).

[3] https://www.dec.ny.gov/docs/administration_pdf/nyserdaghg2015.pdf

[4] https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/NYC_GHG_Inventory_2014.pdf

What Is To Be Done?

While there is little to nothing that we can do about the 55,733 metric tons of CO_2e coming off the Thruway, there is something we can do about the other 66,382 metric tons. Many things, in fact. Those options will be fully explored in a subsequent planning process to create a New Paltz Climate Action Plan. While we must wait for the results of that process, there are certain things we can begin working on now. A few of those ideas are listed in Chapter Four.

However, it is important to note that — for New Paltz at least — climate change is a land use problem. Ninety-eight percent of the greenhouse gas emissions created by New Paltz are because of the design of our transportation system and housing stock. New Paltz already has the tools at its disposal to reduce its carbon impact: zoning and building codes can govern what gets built, where it gets built, how it gets built, what materials it gets made from, and what it looks like. Compact, high-density, mixed-use development has been shown to be the most climate-friendly, reducing emissions from both the transportation and residential energy sectors (Nolon, 2009). Importantly for New Paltz, with very high transportation emissions, the creation of high density neighborhoods can have a significant effect on tailpipe emissions, as those in mixed-use areas drive less. In fact, they drive between twenty and forty percent less (Nolon, 2012).

Luckily, New Paltz has already devoted significant resources into devising solutions for too much traffic, though it wasn't because of climate change. From 2002-2007, armed with a $500,000 grant from NYSDOT, the community undertook a massive planning effort, engaging a broad coalition of stakeholders to tackle one of the most intransigent problems in town: traffic congestion. The Plan also identified a key solution to congestion (and to climate change): high density, mixed-use neighborhoods.

In addition to using zoning to require construction that reduces traffic and increases energy efficiency, municipalities in New York have the ability to legislate more stringent codes for buildings themselves. One example is a green building code, such as the U.S. Green Building Council's well-known Leadership in Environmental and Energy Design (LEED) standards, in particular LEED-ND (the ND is for "neighborhood design"). Another example are building energy codes that set a higher standard of efficiency than the default state standard.

If legally possible, the combination of "climate zoning" and green building/energy standards could powerfully reduce New Paltz's contribution to climate change significantly. If the state has pre-empted stricter energy and green building standards, it provides yet another opportunity for the Town and Village to lobby state legislatures, possibly gaining support from the NY Conference of Mayors and the NYS Association of Towns. If states are the laboratories of American democracy, then local government plays the same role for the states. Allowing experiments on building code design can only benefit not only New Paltz, but the state as well.

Since its carbon footprint is almost entirely based on cars and buildings, New Paltz has some difficult land use conversations and decisions ahead, though they are conversations well-informed by past planning studies. With the lessons learned from the recent re-zoning of Route 32 North, and guided by documents like the Comprehensive Plan, Transportation and Land Use Study, and Open Space Plan, New Paltz has significant power to zone for climate change, and reap the many co-benefits of traditional neighborhood design: walkability, support for more new businesses, increased tax revenue per parcel, more affordable housing, increased tourism, and more.

Conclusion

In the end, the next steps for New Paltz are clear. First is a recognition that New Paltz does not have the resources to mitigate 120,000 metric tons of CO_2e on its own. As part of a Climate Action Plan, New Paltz should devise a legislative agenda and organize to lobby for it. Second, since transportation is the largest local source of greenhouse gas emissions, New Paltz leaders should review the 2007 Transportation and Land Use Plan and revisit its' zoning recommendations. Third, using this greenhouse gas emissions inventory as a starting point, Town and Village leaders should create a thorough, broad stakeholder engagement process for the drafting of a Climate Action Plan. If the solutions proposed are commensurate with the crisis we face, such a Climate Action Plan is likely to engage more community members. Having the local governments push and promote this process will legitimize the process more than an entirely volunteer-run effort. Finally, New Paltz should pick a few obvious projects and begin seeking funding for: a massive tree-planting program, subsidies for community-wide solar, or investigating the possibility of stricter energy and green building codes. Even asking the community to vote for a Climate Action Fund, in line with the $2 million Open Space Bond that passed many years ago, would be a strong step forward. The policy options for New Paltz are varied and plentiful, and there is already political will in the community to take on climate change. The only question is whether we will be effective. Or in time.

Chapter 1: Background

[A]t just five degrees [warming], according to some calculations, whole parts of the globe would be literally unsurvivable for humans. At six, summer labor of any kind would become impossible in the lower Mississippi Valley, and everybody in the United States east of the Rockies would suffer more from heat than anyone, anywhere, in the world today. New York City would be hotter than present-day Bahrain, one of the planet's hottest spots, and the temperature in Bahrain "would induce hyperthermia in even sleeping humans."

David Wallace-Wells, The Uninhabitable Earth: Life After Warming

1.1

Climate Change

Carbon dioxide levels and the temperature increases which accompany them have not been this high in almost 50 million years (LePage, 2017). Human-induced climate change will continue to affect the planet's geology and biology for centuries to come (IPCC, 2013). The problems of climate change are unprecedented in human history. Its myriad impacts are a threat to planetary biological, economic, and social systems.

We know that annual global temperatures will rise, bringing more intense heat waves, inciting more frequent powerful wildfires, and damaging crops. The heat will cause sea level to rise, bringing coastal flooding to the large numbers of people living near the sea, with half of humanity, and three quarters of large cities located on or near coastlines (Goodell, 2018; Huang-Lachman and Lovett, 2016; Revi et al., 2014, World Bank, 2018). Precipitation patterns will change, though the details vary from place to place: in some higher rainfall, in others increased droughts, sometimes both. Storms will be more commonplace, and more severe. And these are only a handful of the first-order changes we are now living through (IPCC, 2013). The problems we've caused seem endless, and the dangers to be prepared for particular to each given place. In the face of observable climate change impacts, governments at the global, national, regional, state and local levels have all begun working to mitigate and adapt.

Sunset at Wallkill View Farms. Photo by Daniel Torres

On October 6th, 2018, the International Panel on Climate Change (IPCC) released a headline-grabbing report. Well known for both the reliability and the conservative estimates of their work, the IPCC's *Special Report No. 15: Global Warming of 1.5°C* contrasts a world of 1.5 degrees C warming with a world two degrees hotter. What caught the attention of most reporters was the the line the report's authors drew in the sand: in order to prevent the catastrophes awaiting us at two degrees C and higher, we must cut global CO_2 emissions by at least 45% by the year 2030 while creating zero emissions by about 2075 (IPCC, 2018)[5]. The language used by the IPCC is precise, expresses a range of confidence levels, and is vetted line-by-line by governments, including those whose national policies oppose the global scientific consensus, such as Saudi Arabia or the United States (Ward, 2018). We *must* cut humanity's emissions in half in the next ten years, and get rid of greenhouse gases altogether in just fifty.

The press was full of commentary on the meaning of this IPCC report (McGrath, 2018), whether things are worse than even the IPCC reports (Ward, 2018), on the feasibility of enacting its recommendations (Race, 2018), and on the possibility of the IPCC's most surprising recommendation: that 1.5°C is possible (*if* we drastically scale back our consumption) (Hickel,

[5] Specifically, the report's authors wrote:

> "In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO_2 emissions decline by about 45% from 2010 levels by 2030 (40-60% interquartile range), reaching net zero around 2050 (2045-2055 interquartile range). For limiting global warming to below 2°C CO_2, emissions are projected to decline by about 20% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2075 (2065-2080 interquartile range). Non-CO_2 emissions in pathways that limit global warming to 1.5°C show deep reductions that are similar to those in pathways limiting warming to 2°C. (high confidence)" (IPCC, 2018).

2018; McGrath, 2018; Meyer, 2018). Whether we can reduce our consumption of CO_2, and do it in time, is very much an open question. Jason Hickel (2018), writing in *Foreign Policy*, put it bluntly, "It would be difficult to overstate how dramatic this trajectory [laid out by the IPCC] is. It requires nothing less than a total and rapid reversal of our present direction as a civilization."

1.2

How Will Climate Change in New York?

The domestic standard for climate change research in the U.S. is the federally-mandated United States National Climate Assessment, the fourth and most recent of which was published in the fall of 2018. Climate change forecasts for New York paint a grim picture of what is in store leading up to the year 2100, even given multiple possible futures based on how successful our mitigation efforts are.

Temperature has already increased by ~3 degrees F since 1895, and will increase by another 3-10 degrees F by 2080. By 2035, projected northeast temperature increases of 3.5 degrees, "…would be the largest increase in the contiguous United States and would occur as much as two decades before global average temperatures reach a similar milestone" (Dupigny-Giroux et al., 2018). Increased temperatures will lead to more heat waves, forest fires, and a northward shift in ecological and agricultural zones, as well as an increase in infectious diseases. Cold snaps will become less common (Dupigny-Giroux et al., 2018; EPA, 2016; Frankson, 2017; Horton et al., 2014).

Huguenot Street after Hurricane Irene, 2011. Photo by Rick Rausch

Precipitation has increased 10% (~5") in the last century, with an additional 5%-20% increase in precipitation developing in the coming century, mostly in winter and spring. Precipitation from heavy storms has increased 70% since 1958 alone, and with increased temperature comes more frequent and more severe storms. More frequent intense storms will bring more frequent and more intense flooding, punctuated by more frequent droughts in summer and fall. We will see more rain overall, but concentrated in intense storms (Dupigny-Giroux et al., 2018; EPA, 2016; Frankson, 2017; Horton et al., 2014)

Sea level has risen about a foot in New York since 1900, and will rise another 1-4 feet by the end of the century. Sea level in New York is rising faster than the global average due to a coastline sinking since the glaciers retreated. A two foot sea level rise would "more than triple the threat of dangerous coastal flooding." The loss of coastal communities become more likely (Dupigny-Giroux et al., 2018; EPA, 2016; Horton et al., 2014)

These changes are predicted for the next eighty years. The further into the future we go, the less we know about how much things will change, whether those changes will cascade, or where the various tipping points are.

1.3

Climate Action in the Town and Village of New Paltz

New Paltz is an economic and cultural hub of 14,003 people whose economy is rooted in both ecotourism and the SUNY New Paltz campus. Climate change activism in New Paltz is a recent phenomenon: the Village of New Paltz formed a Global Warming Task Force in 2004 (since disbanded), and a citizen-based Climate Action Coalition was formed in 2007. Both have often focused on consumer choices such as public recycling bins, promoting cloth shopping bags, repair cafes, home composting, and light bulb replacement. The Climate Action Coalition was formed in the wake of the Step It Up campaign event, which showed conspicuous community interest in fighting climate change. Meetings have been held weekly ever since, as CAC has organized highly visible concurrent campaigns and public outreach events.

Most recently, the Town and Village successfully applied for a grant from the New York State Department of Environmental Conservation to fund the process of becoming a certified Climate Smart Community.

To help municipalities meet the State's twin goals of reducing emissions and adapting to unavoidable changes, New York State has created the Climate Smart Communities program under the Department of Environmental Conservation (DEC). Communities who are interested in becoming a certified Climate Smart Community must complete seven "pledges" (NYSDEC, 2018).[6] Grant funding for CSC certification has been made available directly through the Climate Smart Communities grants program, as well as other sources such as the Hudson River Estuary Program.[7] In 2016, the Town and Village of New Paltz successfully applied to the CSC grants program and were awarded $38,000.00 to support CSC Certification Actions:

- Action 6.17: Develop a natural resource inventory,
- Action 7.1: Conduct a vulnerability assessment,
- Action 7.3: Review existing community plans and projects, and
- Action 7.4: Develop climate adaptation strategies.

Climate Action Coalition at the Reformed Church's Earth Dav Fair

In addition to these CSC actions, the grant was awarded in order to undertake: three Greenhouse Gas Inventories (Town operations, Village operations, and Community), the development of GHG reduction goals, the development of resilience goals, and drafting three Climate Action Plans (again, Town operations, Village operations, and Community).

The following consultancy project for the Town and Village of New Paltz will entail two parts: the first is a series of three Community Greenhouse Gas Inventories - one each for the Town, the Village, and the Town-Outside-Village. The second is a report laying out the emissions findings for New Paltz to consider in the process of writing a community-wide Climate Action Plan. The inventories and report will be informed by both a literature review and the data collected using the sources and methods outlined in the Climate Smart Communities process. Specifically, the parameters of the Community Greenhouse Gas Inventories will meet the recommendations found in the *New York Community and Regional Greenhouse Gas Inventory Guidance: Methods and Data Sources for Community-wide (Geospatial) GHG Emissions Inventories.* The work will also refer as needed to both the *United States Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions* published by ICLEI: Local Governments for Sustainability, and the *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories: An Accounting and Reporting Standard for Cities,* published by ICLEI: Local Governments for Sustainability, C40 Cities Climate Leadership Group, and the World Resources Institute.

This set of Community Greenhouse Gas Emissions Inventories will meet the requirements of New Paltz's Climate Smart Communities grant, in line with the climate planning process articulated by NYSDEC. This Community Greenhouse Gas Inventories report will serve as a starting point for discussion of a subsequent Climate Action Plan.

1.4

The Potential for Municipal Climate Action

While there were early adopters, municipal responses to climate change first became widespread in the 1990's. Local policy work, and transnational municipal networks began proliferating in the wake of the 1997 Kyoto Protocol (Betsill, 2001; Betsill

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[6]
Pledge 1 - Adopt the Climate Smart Communities Pledge
Pledge 2 - Local Greenhouse Gas Inventories, Develop a Local Climate Action Plan
Pledge 3 - Reduce Utility Bills for Municipal Facilities & Operations, Reduce Municipal Energy Use for Transportation, Low-Energy Policies for Communities
Pledge 4 - Renewable Energy for Climate Smart Communities
Pledge 5 - Climate Smart Waste Management
Pledge 7 - Increasing Local Climate Resilience

[7] A joint program between NYSDEC and the Water Resources Institute (WRI) at Cornell University.

and Bulkeley, 2007). As the new century dawned, and climate change became both more irrefutable and the IPCC reports more dire, municipal work grew apace. As federal inaction highlighted the need for local initiatives, Climate Action Plans began to be developed, setting broad environmental agendas and often creating compendia of sustainability policies and projects (Boston, 2014; Hamburg, 2011).

Looking back over ten years of research on cities and climate change[8], Betsill and Bulkeley wrote in 2007 about the need for more work on adaptation measures, citing much work done on mitigation (Betsill and Bulkeley, 2007). If research on adaptation measures lagged in 2007, it has become a major area of research today (Horton et al., 2011; Broto and Bulkeley,, 2013; Baron and Petersen, 2015; Funfgeld, 2015; Cheng et al., 2017). The variety of measures studied is staggering, from watershed protection in the Charles River basin in Boston (Cheng et al., 2017), to exploring the formation of a public power utility for clean energy, improved service, and lower rates in Boulder, Minneapolis and Washington DC (Bull et al., 2014; Cardwell, 2013; Vitolo et al., 2017), to urban forestry programs in Los Angeles (Pincetl et al., 2012). The variety is understandable, since each municipality faces not only a different baseline climate, but widely varying types of climate changes over the next century.

State-level action also grew in the early 21st century. New York State, for example, created the "Climate Smart Communities" program, with the creation of greenhouse gas emissions inventories and climate action plans central to the grant-funded certification process (NYSDEC, 2018). The financing and technical support provided by the Climate Smart Communities program provides municipalities with the tools they need to develop individualized greenhouse gas inventories and Climate Action Plans, creating a multiplier effect for local climate action.

An electric vehicle charging station at Peace Park. Photo courtesy of the Office of the Village Clerk.

At the strategic level, Lamb et al. (2018) reviewed the literature on a 1.5 degree C temperature increase and cities, identifying four key drivers in urban emissions: transportation, buildings, waste management, and urban form. Deetjen et al. (2018), reviewing twenty-nine climate action plans, identified twenty-two types of urban climate change policies loosely grouped into five different strategies: shifting transportation modes, reducing building energy consumption, reducing power sector emissions, improving public utilities and green spaces, and addressing regional impacts. While not producing identical lists, Lamb and Deetjen's emphases point the way towards organizing adaptation policy for local governments. The major sectors identified as needing adaptation work form the backbone of Climate Action Plans. They also roughly mirror the sectors to be mapped by a Greenhouse Gas Emissions Inventory. The commonly recommended sectors for inclusion in such inventories are power generation, buildings, transportation, solid waste, agriculture, and water/wastewater (ICLEI, 2013; Fong et al., 2014; NYSDEC, 2016). Theses sectors account for the majority of emissions in a given community, as well as important areas for adaptation planning.

At the tactical level, many policies can have a synergistic effect, addressing several strategic categories simultaneously. Outka (2016) has described the multiple benefits of municipalizing power generation to increase clean energy portfolios while reducing rates and improving service. Simply beginning the process has even been shown to result in clean energy concessions from utilities, as in Minneapolis, where XCel energy pledged to increase usage of clean energy and lower rates in response to public discussions of municipalization. While there are hundreds of U.S. communities already with public power, interest in switching from corporate to public energy continues, with major cities like Boulder, Colorado, and Washington D.C. exploring municipalization expressly for the purpose of cleaner energy, lower rates, and more reliable service (Cardwell, 2013; Outka, 2016; Vitolo et al., 2017).

Since the mid 20th century, most large cities have already warmed twice as much as the planet as a whole. Global temperature increases in the coming years will bring even greater increases in temperatures and heatwaves, made worse in cities due to the heat-trapping properties of impermeable surfaces. Developing responses to this urban heat island effect (with a thorough street tree planting program, for example) can simultaneously reduce energy consumption while mitigating the public health impacts of microclimates hotter than the surrounding countryside (Stone and Habeeb, 2012).

The creation of green building codes, such as those found in Boston, New York, Portland, or Toronto, can curb energy use in one of the largest greenhouse gas-emitting sectors while reducing reliance on unsustainable building materials. Many green building standards, like those found in the aforementioned cities, address both new construction and retrofitting of existing buildings through a combination of regulation, financial incentives, and third-party certification (McArdle, 2016). One such system in the United States Green Building Council's

[8] Bai, looking forward to future research prospects in 2018, could confidently call for the kind of high-resolution analysis that has so far been lacking in urban climate change research (Bai et al., 2018). With the advent of technologies like more robust GIS systems, LIDAR imagery and mass-produced drones, the future of urban climate change research may lie in the datasets these new technologies are capable of generating.

"Leadership in Energy and Environmental Design", or LEED system[9]. LEED is a globally-recognized green building rating system which advertises itself as the most widely used in the world, which it likely is.

The policy options for local governments are legion.

Climate change, however, can seem a distant problem when a city is faced with the immediate day to day needs of providing water, sewer, police, and other services. Although cities, by virtue of their position on the front lines of climate impacts, *must* adapt to climate change, it doesn't change the facts, however, that budgets are constrained, staff unlikely to grow, and resources generally scarce. As Betsill (2001) writes, "In many communities, environmental programs are viewed as 'luxury' expenditures; these programs are often hit first when there is a budget shortfall." Budgets for city Environment Departments (where they exist at all) may not be up to the task (Funfgeld, 2015).

One solution to raising the profile/putting these issues onto the public agenda, the process of compiling a Greenhouse Gas Inventory and writing a Climate Action Plan can educate city and community leaders about the dangers and possible solutions to climate change, can raise the profile of the problem with the community, and therefore lead to potential reallocation of resources within the city or expanded grant funding availability due to the existence of the Plan (as with NYS' Climate Smart Communities program). These climate planning exercises provide a roadmap to often ambitious emissions reductions targets, and are in many ways aspirational, offering a menu of important policy options.

Municipal networks can help, with organizations like ICLEI: Local Governments for Sustainability, and the C40 Cities Climate Change Group providing technical support and advice. In fact, the prevalence of transnational municipal networks are one of the key factors affecting climate change governance at the local level. Such networks as the U.S. Mayors' Climate Protection Agreement, the United Nations Urban Environmental Accords, as well as ICLEI, C40 and others, serve as important nodes of policy diffusion and sources of morale and *esprit du corps*, as well as providing specific metrics cities can use to use to both measure their progress and measure that progress against other cities (Funfgeld, 2015).

However, even the best designed policy initiatives can only be successful if there is a municipality ready to implement them, complete with dedicated staff and/or volunteers committed to patiently seeing the project through, often working for years on a single local project[10]. Almost twenty years ago, Betsill (2001) warned that many local greenhouse gas initiatives are simply projects the municipality would have done anyway or for different reasons (i.e., installing LED lights, encouraging more pedestrian-based neighborhood design). These efforts are repackaged as "climate smart" efforts for the purposes of climate planning and (one assumes) grant applications. She writes that: "Meaningful local action to address climate change will require municipal governments to develop *new* policies and programs to achieve *additional* emissions reductions above what would have happened anyway" [emphasis in the original].

Given the broad nature of climate change and the large number of arenas it will impact, it is perhaps understandable that local governments approach climate change mitigation and adaptation from an 'everything and the kitchen sink' approach. However, while enumerating lists of environmental goals is useful and necessary, it can be easy to get lost in details. This is especially true because the constraints of municipal budgets and overall dearth of implementation funding conspire to leave Climate Action Plans (and efforts like it) collecting dust on a shelf (Funfgeld, 2015). Starting a climate planning process with a Greenhouse Gas Inventory seems one way to increase the chances that a Climate Action Plan will be implemented, for any municipality. A clear, finite, and measurable target to aim for may help local volunteers stay on task, and possibly attract implementation resources. Whether pursuing specific funding sources, or designing targets for local climate policy, a Greenhouse Gas Emissions Inventory is an invaluable tool, and the first step towards a comprehensive and effective Climate Action Plan.

1.5

Public Engagement and Community Buy-In

Whether concern for climate change originates with government officials or from the general public, engaging the public is a necessary part of climate action. At the very least, a minimum of public engagement is a legal requirement for certain municipal actions like adopting local laws, or passing a budget. New York State has set a minimal threshold of public notifications, public hearings, and formal public comment periods for certain government action, but public engagement can be a more effective and powerful tool than simply meeting the minimum requirements. An active and engaged community drives political

[9] https://new.usgbc.org/leed

[10] One potential source of staffing and other resources are the federally designated (and funded) Metropolitan Planning Organizations, or MPOs. Mason and Fragkias (2018) note that regional actors may be able to sidestep some problems of collective action at the municipal level by disseminating information and dedicating staff time to the local problems of climate change at the regional level. They found that better staffed MPOs are more willing to engage in climate action, as long as there is some regionally perceived need to act on the issue. In other words, given the right staffing levels, MPOs are in a good position to take leadership on climate change on behalf of a region, regardless of whether some of the constituent municipalities of that MPO believe climate change to be a threat. Interestingly, they found that neither county-level voting patterns (i.e. Democrat or Republican counties) nor the presence of state-level climate action mandates determined whether a given MPO took action on the issue.

and social change, ideally articulating the wants and needs of that community in a more representative manner than provided for by local elections.

Incorporating the public into government decision making has a long history. In terms of broad natural resource management such as climate mitigation/adaptation, it could be said to being in the late 19th century with a "Scientific Expertise Era" (Marshall, 2005). This era saw the specialists and technicians at the head of natural resource agencies were seen to produce objective scientific knowledge, and had little need for the input of laypeople. This era ended with the passage in 1969 of the National Environmental Policy Act, ushering in an era of NEPA participation. This era saw the proliferation of Environmental Impact Statements for certain government actions. NEPA created a Council on Environmental Quality to implement the statute, and the CEQ regulations encouraged public involvement through formal notification and hearing requirements, opening the doors to public engagement wider than they had been. This model, still prevalent today and often replicated (for instance, by New York's State Environmental Quality Review Act, or SEQRA), has weaknesses: a reliance on overly technical documents, public input is sought only after major decisions are made, and those stakeholders involved are often not representative of the population (Marshall, 2005). Summarizing this period, Marshall (2005) wrote:

Senator Jen Metzger and Senator James Skoufis host a community conversation on climate legislation facing New York at New Paltz Village Hall in 2019. Photo by the Office of Senator Jen Metzger

> Low attendance at public hearings is often interpreted, by default, as support for the status quo or public apathy…In short, public hearings are primarily held to fulfill legal requirements rather than to stimulate authentic public input. Encouraging citizens to participate who are representative of the impacted community was simply not a goal of resource agencies during this era.

In the decades since NEPA set the midcentury standard for participation, other approaches have been developed, among them the ecosystem-based approach, and the watershed-based approach. Both importantly emphasize authentic public participation by those impacted by the decisions under consideration. This is most prominent in the self-conscious incorporation of representative stakeholders from the very beginning, including in the framing of the issue at hand, as well as policy development. Besides leading to more democratic, and effective policy, collaborative approaches have added benefits, including an, "increased sense of political efficacy and more trust in government" (Marshall, 2005).

For most issues, most of the time, the NEPA-style legal minimums of public engagement are all local governments can manage effectively. With little or no money for marketing budgets, consultants, or polling, the legal minimum of public engagement has to do. However, the scale and universality of the climate change issue demands a deeper level of engagement wherever practical. There are many tools available to increase public engagement for those with the political will and funding to execute them.

Simply talking about climate change with friends, family, and neighbors can lead to positive changes as the numbers of people discussing it diffuses into constituent action; carbon education can remove informational barriers to engagement (Whitmarsh et al., 2011). However, there is a general lack of interest and knowledge about the crisis (Whitmarsh et al., 2011). In 2017, only 31% of Americans regularly discussed climate change, down from 40% in 2008. Even worse, only 16% heard friends or family mention climate change at least monthly (Geiger et al., 2017). 'Knowledge-Based Interventions' are efforts to distill climate messages into easily understood and remembered interactions, in order to get more people talking about climate change (Geiger et al., 2017). A successful knowledge-based intervention, 1) clearly explains the link between climate change causes to impacts, and 2) provides solutions achievable at the community level. When done well, these interventions have shown to improve peoples' confidence in talking about climate change (self efficacy), as well as their confidence in their ability to make change through discussion (response efficacy) (Geiger et al., 2017).

One important barrier to increased public engagement with climate change is the large psychological distance between a planetary, long-term, abstract problem with low immediate risk, and the tangible world of our everyday lives (Whitmarsh et al., 2011; Schuldt et al., 2018). One response to this phenomena is to "localize" the messaging to make the problem feel closer physically. Schuldt et al. (2018), found this strategy to be ineffective at increasing climate engagement. Instead, they found messaging that reduced psychological distance to be more likely to increase individual engagement. This psychological distance barrier is also layered on top of an already powerful "value-action gap", where individuals tend not take action on the things they believe in (Whitmarsh et al., 2011). One critical part to overcoming the value-action gap barrier to engagement is to frame the solutions as proportionate to the problem, emphasizing not only individual action, but cooperative action at the community level (Corner and Randall, 2007; Whitmarsh et al., 2011).

Even the language we use to discuss climate change can influence public engagement. Whether in casual conversation, or as part of an expensive social marketing campaign, how we frame the problem and its solutions is important. This is especially true if recruiting conservatives to the climate change cause is important, as the very belief in the existence of the problem has become a partisan issue (Whitmarsh and Corner, 2017). Finding ways of framing the issue that sidestep right-left divides will be necessary in the coming years. Whitmarsh and Corner (2017) found that narratives emphasizing climate change efforts as waste reduction, or leading to national energy independence were more effective than climate just narratives in engaging conservatives in the U.K. Brink and Wamsler (2018) have found that emphases on the inner dimensions of the climate change issue, such as those used in value-driven communications, can be effective engagement tools, as well. In order to promote more active engagement, climate change messaging should in all cases aim to increase a sense of 'felt responsibility'; whatever communications tactic is chosen, the goal is always to increase the target audience's sense of personal responsibility for action (Bateman and O'Connor, 2016), while channeling that sense of responsibility into proportionate community-level action wherever possible (Corner and Randall, 2007; Whitmarsh et al., 2011).

The full landscape of public engagement strategies and tactics is broad. At its most basic, the act of talking about climate change, and the way in which we talk about it, can affect other peoples confidence in both their own knowledge of the subject, and their confidence to act. This can be amplified by an engaged local government providing resources and fora for the public to meaningfully act on the community level, in a response proportionate to the threat. But engaging the public also requires maintaining that engagement, in this case for the foreseeable future, and that comes with its own challenges.

1.6

Maintaining Involvement

Once the public is initially engaged, it becomes important to plan strategies to maintain that engagement over the long haul that climate adaptation/mitigation requires. One common metaphor among community organizers is the idea of turning sprinters into long distance runners. What can a community do to encourage and support a large cadre of climate change activists essentially forever, as the impacts of current climate changes will only amplify in the coming decades?

New Paltz already faces an obstacle to increased civic participation in its high number of renters, approximately 75% of the Village population. It is often assumed that homeownership has a positive relationship to civic participation based on anecdotal evidence, McCabe (2013) showed that homeowners are in fact more likely to vote in local elections and to join civic groups. This is due to 1) having significant assets tied to the community, 2) the increased residential stability of homeowners. Increased residential stability led to an increase in participation in local elections, but did not lead to an increase in joining community groups. Controlling for residential stability, homeowners were found to be more active in both local elections and organizations (McCabe, 2013). For New Paltz, this means that the large number of renters will likely take more care and effort to mobilize, and more resources may have to be spent to engage them. Added care will have to be taken recruiting and maintaining a pool of climate organizers amidst a population with higher turnover and less stability in the community (McCabe, 2013).

Once engaged *at some level*, an added challenge is that of deepening that engagement (Corner and Randall, 2007). Increasing public engagement on climate change at any level, even that of discussion alone, does increases the likelihood of further climate action (Geiger et al., 2017). However, given the scale of the problem and the brief window in which to act, we need more than mere engagement, we need engagement on a scale proportionate to the current crisis (Corner and Randall, 2007).

A large part of the responsibility of maintaining public engagement lies with the local government. A supportive municipality can (with enough public support) raise taxes to provide financial resources to climate action focused community groups, public commissions, or specific policy projects. Private, federal, and state grant funds are also available for both planning and implementation work.

Ultimately, maintaining public engagement will involve a constellation of factors. Messaging and framing of the issue, increasing the number of people talking about the issue, financial backing, strong local leadership, and the ability to identify and overcome barriers to participation as they arise will all play a role.

1.7

Conclusions

Climate change is an imminent threat not only to the human species, but to ecosystems around the planet. The longer we delay meaningful action to a) mitigate the damage done, while at the same time b) adapting to the change those damages will

cause, then the longer, more difficult, and more expensive the necessary changes to our behavior will be. It is in the best interest of everyone, everywhere, to find the fastest, most effective ways to reduce greenhouse gas emissions.

Local governments are a logical first place to look to make meaningful emissions reductions. And many cities have. Hundreds of municipalities, possibly thousands, have researched, written, and published Climate Action Plans in an effort to devise a path towards some form of a greener city. Often the outcome of this process is a CAP that contains a laundry list of sustainability objectives with little differentiation as to their importance or impact on climate change mitigation, adaptation, or resilience. Goals are articulated, but little strategy, or even triage is evident. One way to reduce the chances of an unfocused Climate Action Plan is to begin the process with a Greenhouse Gas Emissions Inventory. Such an inventory, by quantifying the problem, allows for measurable progress towards a discrete end point. New Paltz, like many communities around the world, has begun this process of mapping the extent of our carbon footprint. The policies and programs that the community identifies to reduce or eliminate that footprint may very well help to pull humanity out of the downward spiral we find ourselves in.

Chapter 2: Findings and Results

It is worse, much worse, than you think. The slowness of climate change is a fairy tale, perhaps as pernicious as the one that says it isn't happening at all, and comes to us bundled with several others in an anthology of comforting delusions: that global warming is an Arctic saga, unfolding remotely; that it is strictly a matter of sea level and coastlines, not an enveloping crisis sparing no place and leaving no life undeformed; that it is a crisis of the "natural" world, not the human one; that those two are distinct, and that we live today somehow outside or beyond or at the very least defended against nature, not inescapably within and literally overwhelmed by it; that wealth can be a shield against the ravages of warming; that the burning of fossil fuels is the price of continued economic growth; that growth, and the technology it produces, will allow us to engineer our way out of environmental disaster; that there is any analogue to the scale or scope of this threat, in the long span of human history, that might give us confidence in staring it down. None of this is true.

David Wallace-Wells, The Uninhabitable Earth: Life After Warming

2.1

What Isn't in These Inventories

There are two categories of data that are not included in this report. The first are those emissions sources created by local government operations. The New Paltz Climate Smart Communities Task Force is currently compiling a Greenhouse Gas Inventory for both Village operations, and Town operations. This means, for instance, that the electricity used by the Village has been subtracted from the total community electricity use for purposes of this Community inventory, in order to avoid double counting. For the same reason, this inventory does not include any emissions generated by the Village's wastewater treatment plant (or for lack of data, the Town's Sewer District No. 6). This means that while nearly half the New Paltz population in on the central sewer system, those emissions are being counted in the Local Government Operations Inventory, and not here. In total, municipal operations not included in this inventory are: central sewer, water treatment, and municipal use of electricity, fuel oil, natural gas and propane.

Methane emissions due to livestock is not included in these inventories due to a lack of data. Also an apparent lack of livestock. Photo by Jason West

In addition to municipal operations, some data is incomplete or missing due to a lack of data itself. In several cases, specifically commercial fuel oil, propane, and natural gas use, and agricultural emissions, there is no data to collect. After asking Cornell Cooperative Extension, Ulster County Soil and Water Conservation District, and the Ulster County Planning Department, it was clear that no one is keeping records on livestock populations at the municipal level.

Commercial energy usage is tracked by Central Hudson Gas and Electric. While Central Hudson was able to provide data on commercial electricity usage, they withheld their data on commercial fuel oil, propane, and natural gas use. John Maserjian of Central Hudson explode that since there are so few accounts (~250 CH commercial accounts), the data was withheld due to privacy concerns. With a limited number of accounts, Central Hudson does not want the public to be able to infer an individuals utility bills. Similarly, while the United States Census breaks up household energy use by many fuel types, there are no records as to how many New Paltz households use firewood for heat.

Despite these informational gaps, the results of this Greenhouse Gas Inventory are sound. Compared to the emissions generated by transportation and residential energy, the emissions sources listed above are minor: the largest likely increase would come from measuring commercial fuel oil use. Given New Paltz's lack of industry, it seems fair to assume that commercial fuel types would roughly mirror residential fuel types. That is, electricity and fuel oil as the most common energy types. We have commercial electricity use already; adding an equivalent amount of fuel oil emissions would increase the commercial energy sector's emissions, but likely not enough to compete with the emissions output of transportation or residential energy. The other missing data are even less impactful — how many cows are there in town, and what impact are they having?

2.2

New Paltz's Carbon Footprint

2.2.1

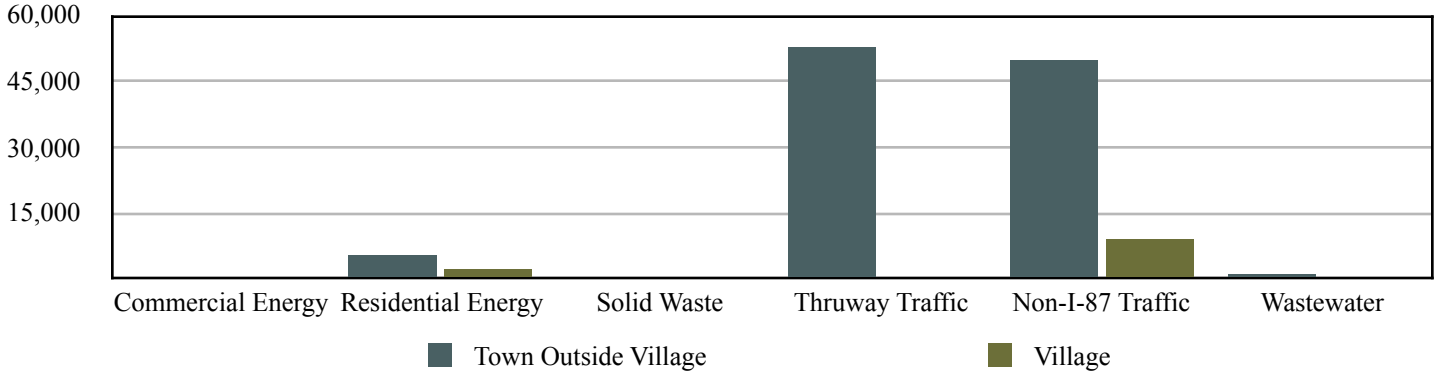
How Does New Paltz Compare?

The joint Town and Village total carbon dioxide equivalent (CO_2e)[11] is ~120,000 metric tons per year (66,382 without the Thruway). It is difficult to compare this result to other municipalities. Both DEC's Climate Smart Communities program, and ICLEI confirmed this: there are simply too few local governments who have undertaken the greenhouse gas inventory process using this methodology to make apples-to-apples comparisons easy. Even the MidHudson Regional Economic Development Council's set of thumbnail inventories use a different methodology than the protocols designed by ICLEI. (which is the basis for DEC's Climate Smart Communities process.) While comparison to communities with similar size, demographics, and other factors (i.e., SUNY, I-87) may be unavailable to date, there are other comparisons. New Paltz's per capita average of 4.5 MT CO_2e is less than the New York State per capita average of 11 MT CO_2e[12], and smaller even than the pedestrian-and-transit dominated New York City per capita average of 5.8 MT CO_2e.[13]

Figure 1. Total Greenhouse Gas Generated by Sector in MT CO2e

Sector and Records	Town+ Village	Town Outside Village	Village
Commercial Energy	**341.75**	**160.62**	**181.13**
Commercial Electricity	341.75	160.62	181.13
Residential Energy	**7,581.63**	**5,316.94**	**2,264.69**
Residential Electricity	3,748.28	2,694.42	1,054.26
Residential Natural Gas	236.07	33.51	202.56
Residential Propane	449.77	262.66	187.11
Residential Fuel Oil	3,147.50	2,326.75	820.76
Solid Waste	**311.97**	**160.08**	**151.90**
Collection/Transportation	18.62	9.68	9.07
Municipal Solid Waste	293.35	150.52	142.83
Transportation	**110,018.69**	**101,243.00**	**8,776.00**
I-87/NYS Thruway Traffic	52,745.00	52,745.00	0.00
Non-Thruway Traffic	57,273.69	48,497.69	8,776.00
Wastewater	**872.95**	**838.81**	**34.14**
Septic Systems	872.95	838.81	34.14
TOTALS	**119,126.99**	**107,558.83**	**11,407.86**

Figure 2. Emissions Created by New Paltz (in MT CO2e)

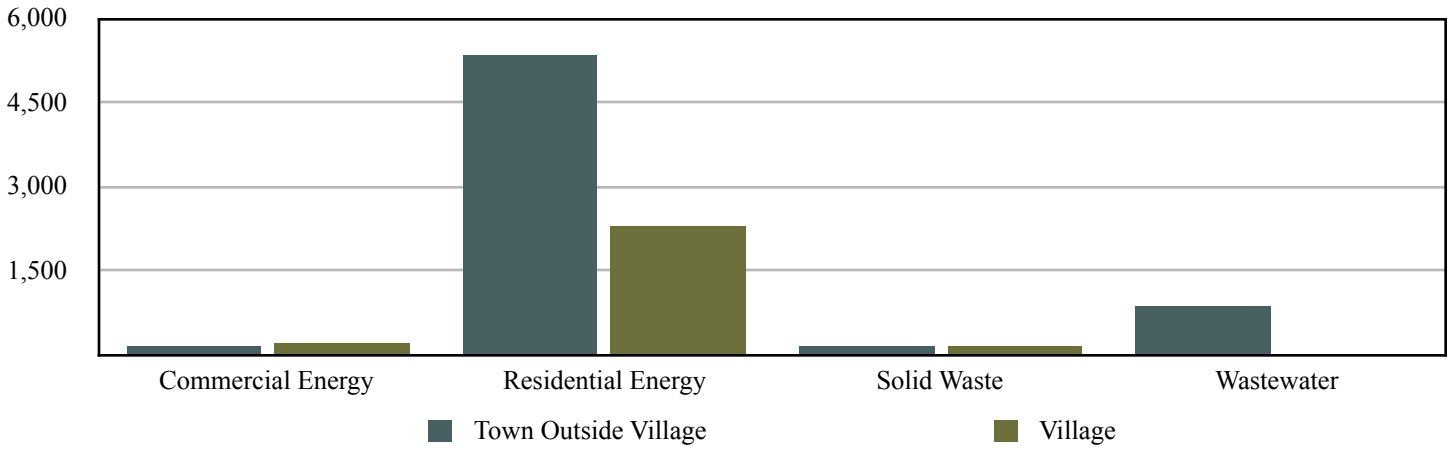


[11] The three main greenhouse gases - carbon dioxide (CO_2), nitrous oxide (NO2), and methane (CH4) — have different impacts on global warming. Methane, for example, is roughly thirty times more effective at trapping heat than carbon dioxide is. Therefore, one ton of methane causes thirty times as much damage as one ton of carbon dioxide. To make things easier, it is common to talk about *carbon dioxide equivalent*, (CO_2e).

[12] https://www.dec.ny.gov/docs/administration_pdf/nyserdaghg2015.pdf

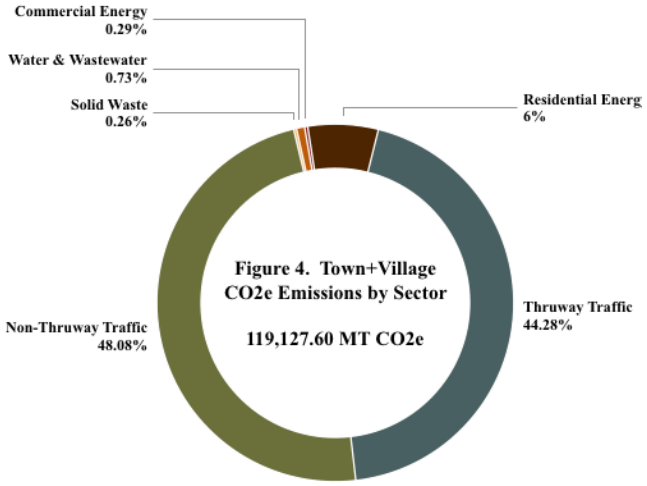
[13] https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/NYC_GHG_Inventory_2014.pdf

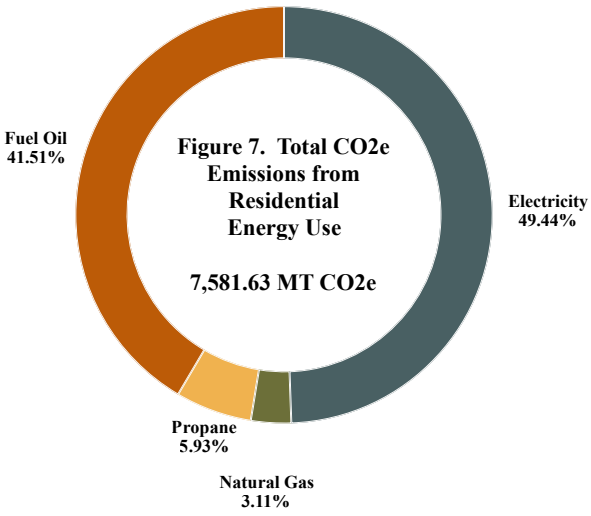
Figure 3. Emissions Created by New Paltz Except Transportation (in MT CO2e)

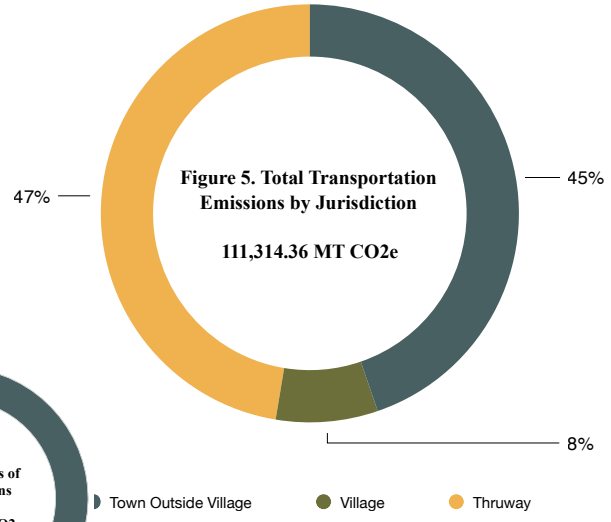


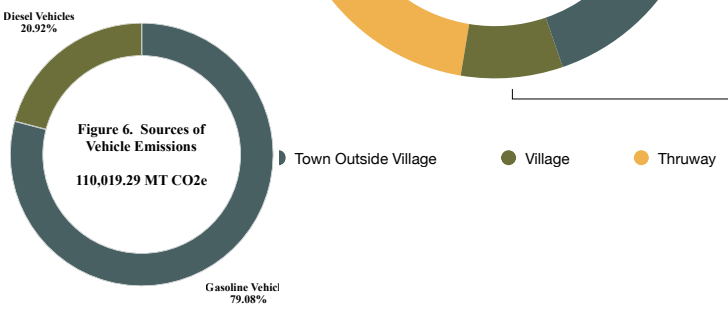
2.2.2
How Does I-87/New York State Thruway Fit In?

Given the overwhelming impact of traffic on New Paltz greenhouse emissions, an obvious question is to ask how much of those emissions are because of the Thruway. While there is an argument to be made that the people of New Paltz should not be responsible for emissions coming from I-87, separatelyDEC confirmed that New York State's protocols do require each municipality to account for the passthrough emissions from interstate highways. For educational purposes, Figure 5 shows the breakdown of traffic-based emissions by government jurisdiction. Note that transportation emissions (including the Thruway) account for 113,314.36 MT CO_2e. This is out of a total MT CO2e of 119,127.60 for all emissions from the town and village combined, as shown in Figure 4. Were we to remove from our calculations the 47% (roughly 55,000 MT) of transportation emissions from the Thruway, transportation-related emissions would still be by far the greatest contributor from New Paltz to global climate change.









2.3

Village Emissions [14,15]

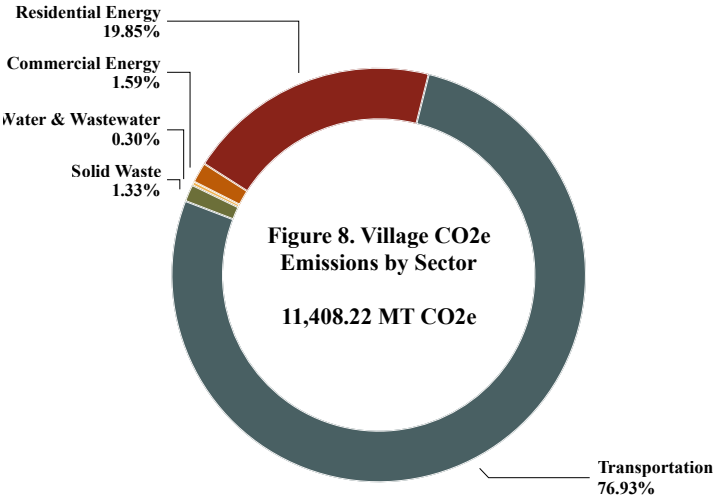


Figure 8. Village CO2e Emissions by Sector

11,408.22 MT CO2e

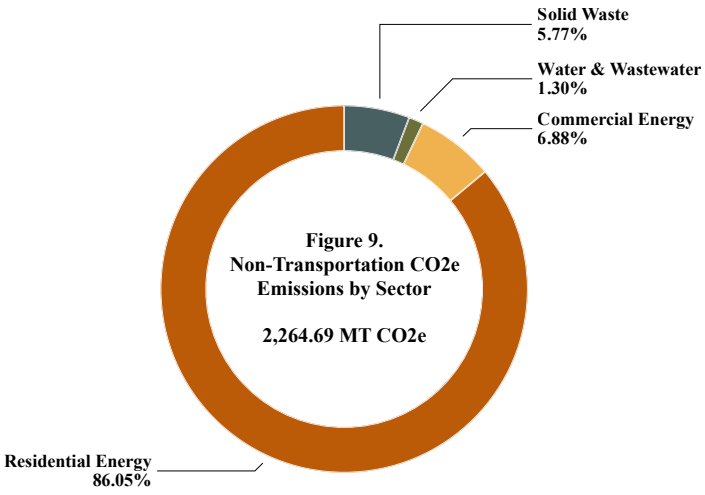


Figure 9. Non-Transportation CO2e Emissions by Sector

2,264.69 MT CO2e

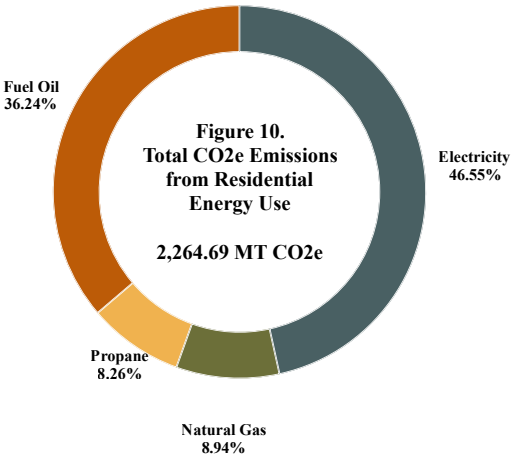


Figure 10. Total CO2e Emissions from Residential Energy Use

2,264.69 MT CO2e

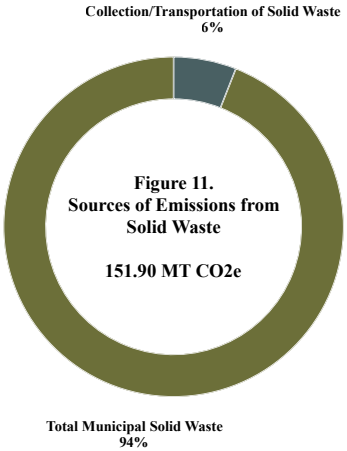


Figure 11. Sources of Emissions from Solid Waste

151.90 MT CO2e

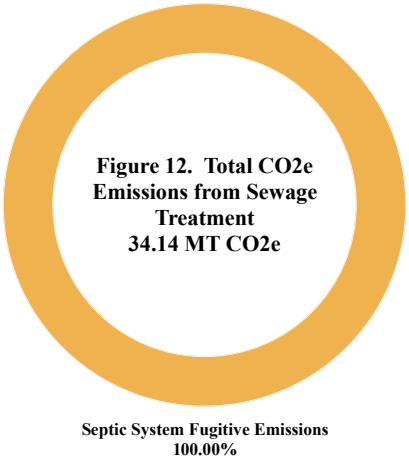


Figure 12. Total CO2e Emissions from Sewage Treatment

34.14 MT CO2e

[14] See Appendix B for more detail about emissions from the Village.

[15] Figure 12 does not include the majority of wastewater emissions, which would come from the sewer treatment plant. Emissions from centralized sewer collection and treatment are found in the Village of New Paltz Local Government Operations Greenhouse Gas Emissions Inventory, written separately.

2.4

Town Outside Village Emissions [16,17]

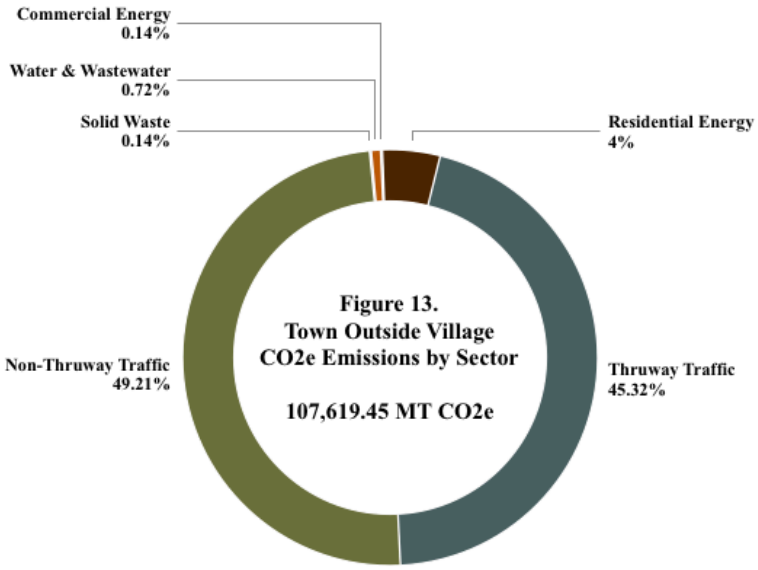


Figure 13.
Town Outside Village CO2e Emissions by Sector

107,619.45 MT CO2e

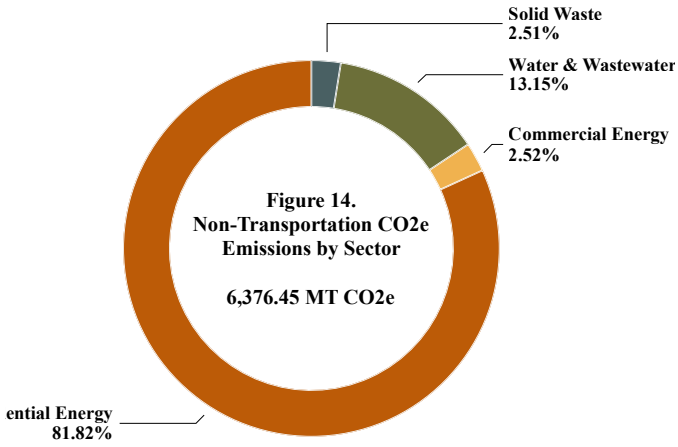


Figure 14.
Non-Transportation CO2e Emissions by Sector

6,376.45 MT CO2e

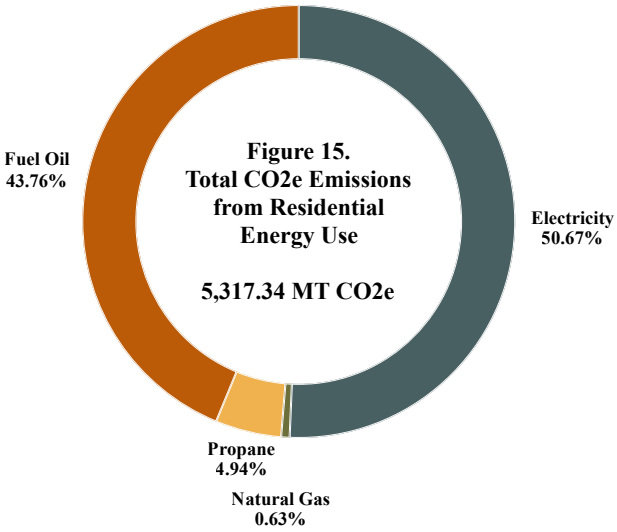


Figure 15.
Total CO2e Emissions from Residential Energy Use

5,317.34 MT CO2e

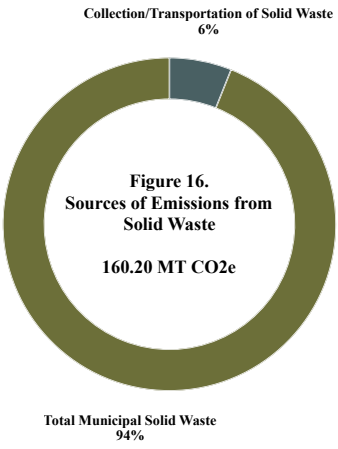


Figure 16.
Sources of Emissions from Solid Waste

160.20 MT CO2e

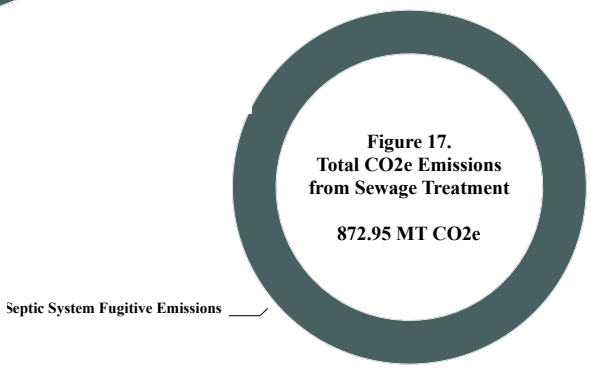


Figure 17.
Total CO2e Emissions from Sewage Treatment

872.95 MT CO2e

[16] See Appendix C for more detail about Town Outside Village emissions.

[17] Figure 17 does not include the emissions from the Town's sewer districts, which goes to either the Village sewer treatment plant, or the plant serving Sewer District No. 6. Emissions from centralized sewer collection and treatment are found in the Town of New Paltz Local Government Operations Greenhouse Gas Emissions Inventory, written separately.

2.5

How Many Trees is That?

Hudson River Estuary Program's Trees for Tribs volunteer. Photo by Beth Roessler.

One common way that communities use to offset carbon is to start a tree planting program. There are many reasons to plant more trees, only one of which is their ability to remove carbon dioxide from the atmosphere, but that is what we will narrowly focus on here.

An average mature tree can sequester up to 48 pounds (0.02 MT) of CO_2 per year.[18] Absorbing all 66,382 MT CO_2e generated by New Paltz (not counting the Thruway) would therefore take planting 3,048,906 trees. That's 218 trees per person.

As mentioned in Chapter 1, the UN's International Panel on Climate Change (IPCC) has unequivocally stated that we need to cut global emissions 45% by 2030 to stay below two degrees C of warming. **To meet the IPCC's 45% reduction target with trees alone, New Paltz would need 1,372,008 new (mature) trees. At $400 per tree (McPherson, 2007), it would cost $548,803,080.00 worth of trees to capture 45% of New Paltz's emissions (not counting I-87).**

2.6

How Many Solar Panels Would It Take?

Water Street Market. Photo by Lighthouse Solar

Like planting trees, there are many reasons to go solar even if climate change were not an issue. However, any source of clean energy will reduce emissions, so how many solar panels would it take to eliminate New Paltz's 66,382 MT CO_2e (without the Thruway)? 66,382 MT CO_2e is equal to about 157,886,515 KWh of electricity. 142 MW worth of solar panels are needed to generate about 157 million kilowatt hours of electricity. **At approximately $1 million per megawatt, New Paltz would need to install $64 million worth of solar to offset the IPCC's goal of 45% of our carbon footprint (not counting I-87). That's roughly 160,000 solar panels, or 11 panels per person.**

2.7

How Much Less Would We Have to Drive?

Main Street. Photo by Daniel Torres

Just like planting trees and going solar, driving less (or using public transportation) is a good idea no matter what. Since traffic is New Paltz's largest source of emissions, just how much less are we talking per person to get rid of emissions altogether? A typical gasoline car emits 404 grams of CO_2e per mile driven, that's 0.0004 metric tons per car, per mile. To eliminate 66,382 metric tons of CO_2e (again not counting the Thruway), New Paltz would collectively have to drive 158,487,500 fewer miles per year. That's driving 11,318 fewer miles per person, per year. Including children. **To meet the IPCC's 45% reduction target by driving less alone, New Paltz would need to drive 71,319,375 miles less per year, or 5,093 miles per person.**

[18] https://projects.ncsu.edu/project/treesofstrength/treefact.htm

Chapter Three: Climate Change is a Land Use Issue

One way to combat this projected rise in [Vehicle Miles Traveled] is to promote urban settlement, as urban residents generally drive less…residents of compact urban neighborhoods drive between twenty to forty percent less than suburban residents… Climate change mitigation requires that we create a less car- dependent society

John R. Nolon, Esq.

New Paltz has clearly identified areas where increased, dense, and mixed use growth should occur in the future…New Paltz needs to complement growth center zoning with provisions to prevent sprawl outside of the growth centers. Sprawl-like growth will defeat the major objective of this Project, which is to mitigate congestion.

New Paltz Transportation and Land Use Plan

3.1

Climate Change and Land Use

Of the approximately 120,000 metric tons of CO_2 equivalent (MT CO_2e) created annually within the New Paltz Town limits, about 110,000 is due to traffic emissions alone. Just over 92% of Town-wide emissions. A further six percent of total emissions (7,500 MT CO_2e) is due to residential energy use. The final two percent of emissions are due to solid waste disposal, methane from septic systems, and commercial electricity use.[19] Ninety-eight percent of the greenhouse gas emissions created by New Paltz are because of the design of our transportation system, as well as the design of our housing stock. Fortunately, New York State home rule law devolves the power over land use to local cities, towns, and villages. Traffic and building design both fall under the purview of a New York municipality's zoning and building codes. Climate change is a land use problem, and while reducing emissions to acceptable levels[20] may seem an overwhelming task, New Paltz already has the tools at its disposal to reduce its carbon impact.

Many of these tools have been studied, promulgated, and popularized by Professor John Nolon, founder of the Pace Land Use Law Center. In two articles (from a series of four) begun a decade ago, Nolon laid out the case and the toolboxes for using local land use authority to mitigate climate change (Nolon, 2009; Nolon, 2012). Many states, including New York, delegate a portion of their police power to municipalities through home rule laws. Among the powers that flow from this act of the State Legislature are the right to adopt Comprehensive Plans, as well as enact zoning and building codes to translate those Plans into built reality (Nolon, 2009; Nolon, 2012). Zoning and building codes can govern what gets built, where it gets built, how it gets built, what materials it gets made from, and what it looks like. Compact, high-density, mixed-use development has been shown to be the most climate-friendly, reducing emissions from both the transportation and residential energy sectors (Nolon, 2009). Importantly for New Paltz, with very high transportation emissions, the creation of high density neighborhoods can have a significant effect on tailpipe emissions, as dwellers in mixed-use areas simply drive less. In fact, they drive between twenty and forty percent less (Nolon, 2012).

The tools available to local governments to shape the nature of their community are extensive, and commonly practiced. They include, but are not limited to the following:

- *Comprehensive Plan*. Each city, town, and village in New York State is required to adopt a Comprehensive Plan for their community, which may subsequently be amended by action of the city council, town board, or

[19] As noted previously, no data is available on commercial natural gas, propane, or fuel oil use. Nor is there data on livestock from which to calculate methane emissions from enteric fermentation.

[20] "Acceptable" in this case needs to be defined by the community. For some, a 50% reduction by 2030 an acceptable goal? For others becoming carbon neutral may be the only acceptable target.

village board. The plan is used to guide the development or revision of the local zoning code. All zoning laws, and development projects must meet the terms of the Comprehensive Plan.

- *Zoning Code*. Municipalities can designate areas for high density, mixed use development by writing it into their zoning code. Local control of building height, floor-area ration, required setbacks, minimum lot size and other elements mean that local governments can at any time create new climate-friendlier neighborhoods. As long as the new zoning does not conflict with the Comprehensive Plan.

- *Overlay Districts*. These are a particular type of zoning. It may be that the community likes the basic zoning of a place but wants to improve it while keeping the base zoning. Or more commonly, a community may want to set certain conditions for development that cross zoning district lines. In this case, they may create an Overlay Zone with special requirements for construction or preservation within its boundaries. For instance, the Town of Wallkill in Orange County created a "Shawangunk Kill Overlay Zone" to restrict development within a certain distance from an important local waterway.

- *Transfer of Development Rights*. A TDR is a mechanism allowing a developer to purchase the 'development rights' of one property, and apply those development rights to another parcel in order to buy greater density. For example, Developer X wants to build 50 units of housing on the acre he owns in the Village, but the zoning only allows him to build 25 units. Under a TDR program, Developer X could buy the development rights to a local farm faced with development pressure, and in exchange for those rights, be allow to double the density on his Village project. This way, the community both saves critical open space from sprawl while creating the high-density traditional neighborhood development the community needs in the Village core.

Local leaders participating in the Pace Land Use Law Center 'Land Use Leadership Alliance' training.

There are other tools available, and various iterations of the techniques described above.[21] In the end, local governments have an impressive array of powers at their disposal to shape the physical nature of their community. The existential crisis of climate change should provide a powerful incentive to revisit the Comprehensive Plan and zoning code. We may be planning for our lives.

Luckily, New Paltz has already devoted enormous resources into devising solutions for too much traffic, though it wasn't because of climate change. From 2002-2007, armed with a $500,000 grant from NYSDOT, the community undertook a massive planning effort, engaging a broad coalition of stakeholders to tackle one of the most intransigent problems in town: traffic congestion.

3.2

The New Paltz Transportation and Land Use Plan

A significant milestone towards more carbon-neutral growth for New Paltz was achieved in 2007. That year, the Town and Village Boards formally adopted the New Paltz Transportation and Land Use Study, the result of a decade's worth of work. In the mid 1990's, traffic congestion was becoming a growing problem on Main Street. A bypass had been proposed periodically over the years, and the issue needed studying. After years of conversation between the Town, Village, SUNY New Paltz, and the New York State Department of Transportation (NYSDOT), a study with a broader scope was commissioned, and paid for

[21] For a more thorough discussion of using land use to achieve environmental ends, see the various publications of Pace University's Land Use Law Center for Sustainable Development at https://law.pace.edu/publications-resources.

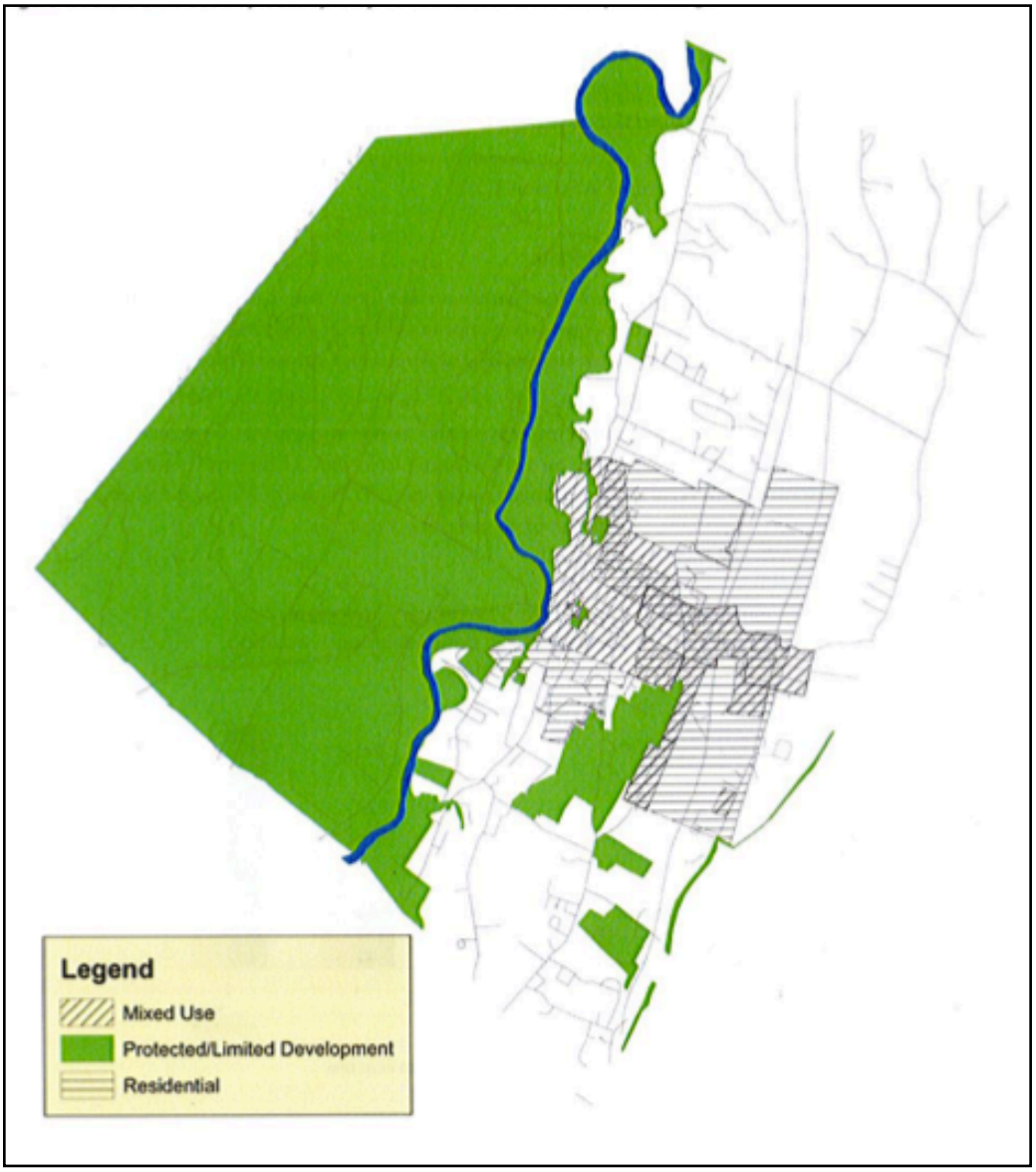


Fig. 18. Future land uses recommended by New Paltz residents in 2003-2005 (Resource Systems Group, 2005)

by a half million dollar grant from NYSDOT. With a mandate to study traffic conditions and their relationship to land use, the Transportation Study brought together hundreds of community members over the course of five years, resulting in a series of recommendations, an a three-volume final report. The project was marked by a serious commitment from all parties to thorough public engagement. While a Steering Committee oversaw the project as a whole, much of the work was done by a large Citizens Advisory Committee, as well as regular public workshops and discussions at municipal meetings.

At no point was climate change an important, or even existent, part of the transportation conversation.

However, by exhaustively studying how to reduce traffic congestion, a roadmap to mitigating transportation emissions was also created. Many of the Transportation Plan's recommendations deal with improving the flow of traffic that already exists: replacing traffic lights with roundabouts, improving signage, reducing the number of curb cuts, etc. However, several important recommendations in the Transportation Plan deal with reducing traffic volume, rather than making traffic flow more efficient.

The key land use accomplishment of the Plan is the articulation of a community vision for land use in New Paltz broadly: where should we build, and what should we preserve? Figure 1 represents that vision, developed with the stakeholder-driven Citizens' Advisory Committee members as well as workshop participants for future growth in New Paltz, and the Town and Village Boards (Resource Systems Group, 2005). This vision is not particularly surprising. It can be found echoed in both the Town and Village Comprehensive Master Plans, as well as the joint New Paltz Open Space Plan, for instance.

New Paltz has clearly identified areas where increased, dense, and mixed use growth should occur in the future. In order to prevent dense growth from occurring simultaneous with sprawl-like growth, New Paltz needs to complement growth center zoning with provisions to prevent sprawl outside of the growth centers. Sprawl-like growth will defeat the major objective of this Project, which is to mitigate congestion (Resource Systems Group, 2006b).

The Plan identified seven areas for new "priority growth districts," all in or surrounding the Village (see Figure 2). These areas are well suited for the kind of high density, mixed-use development John Nolon advocates will mitigate climate change through increased energy efficiency and reduced need for driving, among other factors. The recognition of the need for "Traditional Neighborhood Development", broadly defined

as high density, mixed-use, pedestrian-oriented planning[22], is matched by an emphasis on the need to preserve open space outside the downtown core. Preserving open space, too, helps to mitigate climate change by creating carbon sinks. Though again, climate change did not play a role in conversations about growth centers versus open space preservation, the community was explicit about linking the two, identifying several specific tools to achieve both:

> "The Citizens Advisory Committee (CAC) has discussed the importance of the land use assumptions underlying the technical modeling of future conditions. The CAC generally endorsed a future land use pattern combining the Route 32 Mixed Use pattern with the High Concentration pattern. The CAC strongly advises that any zoning changes seeking to increase density within designated growth centers be complemented with simultaneous efforts to downzone or protect open spaces outside of designated growth centers. Policies and initiatives to accomplish this include:
>
> - Downzoning rural residential areas through increasing minimum lot sizes for development.
> - Conservation Overlay zoning for protecting key natural values such as productive soils, wildlife habitats, ridge-lines, etc. (See Phase B report for details)
> - Purchase of development rights on properties with significant natural or recreational value.
> - Establishing a Transfer of Development Rights[23] program designating areas outside of Growth Centers as "sending areas" (Resource Systems Group, 2006b)

The devil, of course, is always in the details. How dense should the revised zoning be? While the dividing line between healthy density and overcrowding is inevitably subjective, population density is one of the keys to planning a climate-smart land use policy. Faced with population growth and the housing and transportation construction that comes with it, the 87% of Americans who live in places with less than 1,000 people per square kilometer will see "substantial increases" in emissions in coming decades (Gately, Hutyra, and Wing, 2015). This includes the Town outside the Village, with a population density of 572 people per square kilometer. Illustrating the New Paltz urban/suburban divide, the Village has a population density of 9,810 people per square kilometer. Gately, Hutyra, and Wing (2015) have found a significant reduction in emissions beginning at approximately 1650 people per square kilometer.

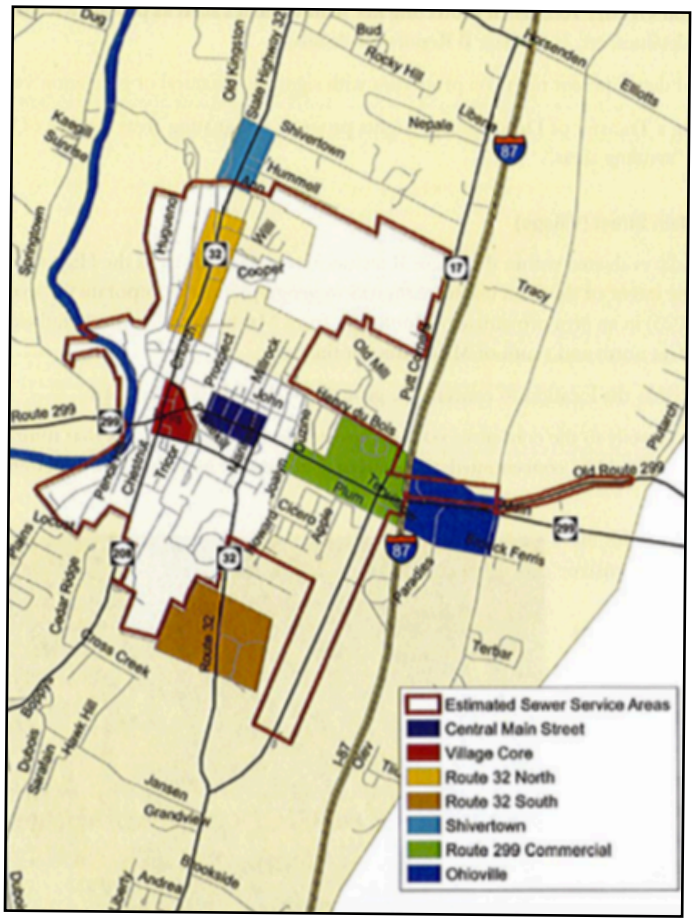


Fig. 19. Recommended areas for high density, mixed-use development (Resource Systems Group, 2006b)

Density of the kind advocated by Gately, Hutyra, and Wing (2015) is also helpful for the development of a robust, well-used public transit system. New Paltz is currently serviced by the Adirondack Trailways bus line[24], the Ulster County Area Transit (UCAT) bus network, and at least six taxicab companies, as well as the more distant Poughkeepsie train station. In addition, the Transportation Study discovered that (as of 2007),

[22] "Transit-Oriented Development" is another planning tool that can achieve even greater mitigation impacts than a TND alone. In a TOD, traditional mixed use neighborhoods are clustered around transportation hubs, train stations being a popular option. Projects that develop neighborhoods near transit help to mitigate the same emissions as a TND. Such projects also amplify those emissions reductions by making it easier to use mass transit to travel outside the neighborhood, or between neighborhoods/hamlets. The same effects can be found in major cities when a new subway stop is installed in an area previously without convenient service.

[23] A "transfer of development rights", or TDR, is a zoning tool by which a municipality allows the purchase and transfer of the development rights from ecologically sensitive areas (farms, wetlands, etc.) in order to gain benefits in a "receiving district" in exchange. TDR's are often offered as an incentive to builders to increase density in priority growth areas, thereby increasing density in the core while simultaneously protecting open space on the peripheries.

[24] From New Paltz north, Trailways provides 'rural' service: one can be dropped off anywhere along the route, and picked up anywhere with prior notice.

15% of New Paltz residents walked or biked to work, an unusually large percentage (Resource Systems Group, 2007b). Working with Ulster County to increase local UCAT ridership is an important corollary project to the land use decisions described above: public transit produces 95% less carbon monoxide, 45% less CO_2, and 48% less NO2 than using private vehicles does (Kwan and Hashim, 2016). Were UCAT to use 100% renewable energy in their fleet, it would of course only increase the appeal of public transit as a climate mitigation option.

By the middle of the twenty-first century, the population of the United States will increase by more than 100 million people (Nolon, 2012). Given New Paltz's natural appeal and proximity to New York City, one can assume that population growth will be a factor resulting in development pressure in coming years. The housing and transportation networks that will inevitably be built to accommodate this growth will drive a large portion of New Paltz's greenhouse gas emissions, especially transportation. Compact, urban development to achieve critical population density, has been shown to reduce greenhouse gas emissions from the two largest sectors affecting New Paltz: transportation, and residential energy (Gately, Hutyra, and Wing, 2015; Nolon, 2009; Nolon, 2012). Should the Town and Village Boards implement the "growth area" zoning recommendations in the Transportation and Land Use Study, the community will have taken an important step towards reducing its carbon debt.

3.3 Making Buildings More Efficient

In addition to using zoning to require construction that reduces traffic and increases energy efficiency, municipalities in New York have the ability to legislate more stringent codes for buildings themselves. One example is a green building code, such as the U.S. Green Building Council's well-known Leadership in Environmental and Energy Design (LEED) standards, in particular LEED-ND (the ND is for "neighborhood design"). Another example are building energy codes that set a higher standard of efficiency than the default state standard.

New York State has set a minimum energy code for use by building inspectors and builders statewide. However, local governments can in general adopt local laws that are stricter than state law, but may not pass less restrictive statutes. For example, the state protects wetlands that are 12.4 acres (1 hectare) in area or greater. A Town may pass a local law protecting smaller wetlands, and increasing protection of wetlands of greater than 12.4 acres (i.e., by requiring a 100 foot buffer around them). That Town may not adopt a local law that only protects wetlands of 20 acres or more, since that would be relaxing a state law rather than tightening it. According to Village Attorney Will Frank, it is unclear whether New York State allows a local energy code that would require greater efficiency than the state requires.[25]

Some of the pre-emption issues faced by energy codes may apply to green building codes as well. More research by the municipal attorneys would be needed. However, it seems clear that with certain standard, notably LEED, the requirements are flexible enough that it may be usefully adopted by the Boards to raise the standards on building materials, site design, and other factors that impact a particular building's energy use. Here, too, the Village and Town attorneys would need to weigh in.

If legally possible, the combination of "climate zoning" and green building/energy standards could powerfully reduce New Paltz's contribution to climate change. If the state has preempted stricter energy and green building standards, it provides yet another opportunity for the Town and Village to lobby state legislatures, possibly gaining support from the NY Conference of Mayors and the NYS Association of Towns. If states are the laboratories of American democracy, then local government plays the same role for the states. Allowing experiments on building code design can only benefit not only New Paltz, but the state as well.

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[25] Excerpts from an email to the author from Village Attorney Will Frank:

…However, a municipality may adopt more stringent local standards provided it petitions the NYS Code Council for a determination of whether such local laws or ordinances are reasonably necessary because of special conditions prevailing within the local government and that such standards conform with accepted engineering and fire prevention practices and the purposes of the Uniform Code. Executive Law §383. The adoption of more stringent laws that have successfully petitioned the NYS Code Council are available at https://www.dos.ny.gov/dcea/mrls.html (the majority of which relate to sprinklers or fire prevention codes)…

…The state legislature has spoken on this issue but to the extent that they have not regulated a specific issue, ***the question remains open whether local municipalities can pass more stringent regulations.*** It might help to confer with NYSERDA or NYCOM on this topic…" (emphasis mine)

Given a carbon footprint almost entirely created by cars and buildings, New Paltz has some difficult land use conversations decisions ahead, though they are conversations well-informed by past planning studies. With the lessons learned from the recent re-zoning of Route 32 North in hand, and guided by documents like the Comprehensive Plan, Transportation and Land Use Study, and Open Space Plan, New Paltz has significant power to zone for climate change, and reap the many common sense co-benefits of traditional neighborhood design: walkability, support for more new businesses, increased tax revenue per parcel, more affordable housing, increased tourism, and more.
A few years ago, the editors of *Building and Environment* devoted a special issue looking forward to the problems of climate change in their field. They rightly point out that:

> [Buildings'] long lifetime (in the range of 50-100 plus years) correspond to the timescale over which the climate is expected to show substantial change. This implies that buildings built today need to be designed to work successfully in both the current and future climate, and with the aim of reducing the greenhouse emission burden they place on this and future generations (Editors, 2012).

While the state may pre-empt New Paltz from enacting a more climate-friendly building/energy code, the right to do so is a goal worth lobbying for. It is hoped that the New Paltz community will already be in district offices to talk about the need for more state intervention to offset the carbon that New Paltz can't mitigate on its own.

The vast majority of New Paltz emissions, of course, comes from traffic. Even accounting for the traffic from I-87, transportation emissions are the single largest climate mitigation problem in both the Town and the Village. Shifting as much traffic as possible to clean-energy powered public transit will help, but does nothing to address the need to drive in the first place.

Building out the community in a way that enables people to walk or bike to where they need to go — in the way recommended by the Transportation and Land Use Plan — will do even more to mitigate emissions. Ultimately, we need to do it all: shift from sprawl to hamlets, shift from cars to public transit, shift from inefficient buildings to requiring top of the line energy certifications like LEED. And much more besides that.

In the end, the next steps for New Paltz are clear. First is a recognition that New Paltz does not have the resources to mitigate 120,000 metric tons of CO_2e on its own. As part of a Climate Action Plan, New Paltz should devise a legislative agenda and organize to lobby for it. Second, since transportation is the largest local source of greenhouse gas emissions, New Paltz leaders should review the 2007 Transportation and Land Use Plan and revisit its' zoning recommendations. Third, using this greenhouse gas emissions inventory as a starting point, Town and Village leaders should create a thorough, broad stakeholder engagement process for the drafting of a Climate Action Plan. If the solutions proposed are commensurate with the crisis we face, such a Climate Action Plan is likely to engage more community members. Having the local governments push and promote this process will legitimize it, helping it to become the centerpiece of New Paltz planning and possibly the seed of a new Comprehensive Plan.

Chapter Four: Recommendations[26]

A goal without a plan is just a wish.

Antoine de Saint-Exupéry

The Town and Village of New Paltz annually generate 66,382 metric tons of carbon dioxide equivalent (CO_2e) per year, not counting I-87. That works out on average to 4.75 metric tons per person, per year. Ninety-two percent of those emissions come from traffic, and another 6% from residential energy. Those two sectors together account for almost all of the emissions generated by the New Paltz community. While direct comparison to communities with a similar size, mitigating factors (i.e., SUNY, I-87) and demographics may be unavailable to date,[27] some comparisons are available to us. New Paltz's per capita average of 4.75 MT CO_2e is less than the New York State per capita average of 11 MT CO_2e[28], and smaller even than the pedestrian-and-transit dominated New York City per capita average of 5.8 MT CO_2e.[29] While the community may take some pride in being below average in this regard, much work remains to be done to significantly reduce emissions, let alone eliminate them completely. Here are a few ideas to start with, in no particular order.

Recommendation No. 1 — Develop a Local Climate Lobbying Effort

120,000 metric tons of emissions (including the Thruway) is a lot to eliminate, and it is clear the New Paltz community can't tackle the whole problem on our own. While some of the community gets to work on 'low hanging fruit' emissions reductions strategies, others could focus their energy on lobbying Albany and Washington for greater action. Bring in veteran lobbyists to train a cadre of community lobbyists - a Climate Lobby Initiative. A formal, well-funded apparatus created by the Town and Village Boards to pressure our elected representatives on climate issues could be based on a "Legislative Climate Agenda" drafted by the joint Boards. It could also easily take the form of an inter-municipal council of likeminded municipalities each cooperating to draft a legislative agenda and support a team of community lobbyists.

Recommendation No. 2 — Rezone for High Density, Mixed-Use Development

The New Paltz Transportation and Land Use Plan, when used in conjunction with the Town and Village Master Plans, the Open Space Plan, and others, lays the groundwork for rezoning parts of the community to be high density mixed-use, pedestrian-oriented developments. This advice, vetted by the community repeatedly over the years, should guide the rezoning of several 'priority growth districts', possibly tied to a Transfer (or Purchase) of Development Rights program to simultaneously protect valuable open space. Other tools, such as overlay zones, green building codes, and stricter energy codes should be explored where legally permissible.

Recommendation No. 3. — Ensure a Robust Climate Action Plan Process

This study does not presume to describe even a fraction of the impacts climate change will have on the lives of the people of New Paltz, nor does it offer a full suite of possible solutions. Its only aim is to quantify the greenhouse gas emissions of the community, and place those numbers into context. To fully explore what we can do about our collective carbon footprint requires deep conversations amongst diverse stakeholders representing all aspects of the community. The writing of a Climate Action Plan, while ideally coordinated by a qualified consultant, should be driven by the Town and Village Boards. Their active participation could give the process the kind of gravitas needed to deal seriously with the climate crisis facing New Paltz.

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[26] One minor recommendation. These Inventories are meant to be updated regularly, at least every few years. Before the next update, the Town and Village Boards could secure resources to undertake a "Climate Census" to fill in the identified data gaps, commercial businesses and agricultural facilities in particular. Adding commercial energy and agricultural methane emissions to the Inventories would only improve their accuracy, though it is likely the added data would not significantly alter the results.

[27] See section 2.2.1 of this report

[28] https://www.dec.ny.gov/docs/administration_pdf/nyserdaghg2015.pdf

[29] https://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/NYC_GHG_Inventory_2014.pdf

Recommendation No. 4. — Implement a Large-Scale Urban Forestry Project

The Town of New Paltz has recently published a management plan for the potential of an urban forestry program in New Paltz (Daveys Research Group, 2018). In addition, the DEC's Hudson River Estuary Program has a "Trees for Tribs" program in which they plant trees along waterways. The Village has had a Shade Tree Commission for many years, which may serve as a vehicle for implementation of the management plan, in coordination with the Estuary Program. While it is unlikely that the community could plant the 1,372,008 trees needed to offset 45% of our emissions in the next ten years, a wide-ranging municipal tree planting program is a necessary element in reducing New Paltz's contribution to global warming. In addition, carbon offset programs that fund tree plantings in other regions of the world are available.

Recommendation No. 5 — Organize a Community-Wide Solar Program

Solar power is clearly one facet of a larger climate strategy, and there are many options available to municipalities to increase the amount solar generated in their community. One starting point is to assess the solar potential of the entire town. This could include not only municipally owned properties, but private property and SUNY, in order to map those areas of the Town with the greatest solar potential. Priority public sites could be targeted for grant-funded installations. Lobbying may also be needed, as at the least a a robust net metering law that incentivized solar installations is needed to expanding clean energy usage.

Recommendation No. 6. — Investigate the Potential for Green Building and Energy Codes

The Town Board and Village Board should ask their respective municipal attorneys about the feasibility of building codes that are stricter than the state minimums. It is possible that the state has 'pre-empted' local governments from creating green building codes or more robust energy codes than those promulgated by New York State. If allowed by law, systems like the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) can be referenced as an existing green building rating system. With residential energy creating 6% of New Paltz's emissions, reducing energy use through building and appliance efficiency is achievable.

Recommendation No. 7 — Create a Climate Action Fund Modeled on the Open Space Bond

In November of 2006, voters in the Town approved a ballot measure for an Open Space Bond, 65%-35%. A $2 million fund for open space protection was created. Given the severity of the climate crisis, New Paltz should again place a measure on the ballot, this time for a $2 million Climate Action Fund. These funds should be earmarked for grants writing and research, in order to leverage the most out of the project.

Appendix A: Inventory Details for the Town+Village

Commercial Energy

Inventory Record	Notes
Commercial Electricity Use (2017)	Number of commercial establishments estimated by the total number of commercial electric accounts with Central Hudson.

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor
Commercial Electricity Use (2017)	340.15	0.02	0.0035	341.75	8,684.81	0.04

Inventory Record	CH4 Emissions Factor	N2O Emissions Factor	Electricity Used	CO2 lbs/MWh	CH4 lbs/GWh	N2O lbs/GWh
Commercial Electricity Use (2017)	0.0000028	0.0000004	2544.65	294.70	21.00	3.00

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Commercial Electricity Use (2017)	Scope 2	I.2.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity

Residential Energy

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Residential Electricity Use (2017)	Scope 2	I.1.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity
Residential Natural Gas Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Propane Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Fuel Oil Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Electricity Energy Equivalent (MMBtu)	MMBtu per Household	CO2e per Household (MT)	CO2 Emissions Factor
Residential Electricity Use (2017)	3,730.77	0.27	0.04	3,748.28	95,254.37	0.00	0.00	0.04
Residential Natural Gas Use (2017)	235.33	0.02	0.0004	236.07		9.97	0.53	
Residential Propane Use (2017)	445.43	0.08	0.01	449.77		12.50	0.78	
Residential Fuel Oil Use (2017)	3,126.52	0.46	0.03	3,147.50		17.09	1.27	

Inventory Record	CH4 Emissions Factor	N2O Emissions Factor	CO2 lbs/ MWh	CH4 lbs/ GWh	N2O lbs/ GWh	Energy Equivalen (MMBtu)	CO2 Emissions Factor (kg/ MMBtu)	CH4 Emissions Factor (kg/ MMBtu)	Fuel Use	Data Source
Residential Electricity Use (2017)	0.000003	0.0000004	294.70	21.00	3.00					
Residential Natural Gas Use (2017)						4,438.55	53.02	0.01	4,438.55	EIA usage
Residential Propane Use (2017)						7,247.44	61.46	0.01	7,247.44	EIA usage
Residential Fuel Oil Use (2017)						42,273.14	73.96	0.01	42,273.14	EIA usage

Inventory Record	Notes
Residential Electricity Use (2017)	Population and Households: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF Only incomplete data was available from Central Hudson Gas & Electric. (https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data) Feb 2016 values were substituted for "withheld" records for Feb 2017. December and January were missing from both 2016 and 2017 records. Values for the closest calendar month to the missing data was used as an estimate in those cases. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Natural Gas Use (2017)	Usage data from Central Hudson Gas and Electric is withheld due the low number of accounts causing privacy concerns if the data is released. The 2017 American Community Survey lists 445 households (~10%) in New Paltz using "utility gas": https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has natural gas use for NY State https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with gas (4,228,093), and use that to calculate average usage per household in New Paltz. 4,228,093 households in NYS use a combined 423.9 trillion Btu (or 423,900 MMBtu) of natural gas annually. Using these figures, we can calculate the per household natural gas usage of 9.97 MMBtu. From this, we can establish that New Paltz's 445 natural gas using households produce an estimated 4,438.55 MMBtu's. Electricity usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Propane Use (2017)	The American Community Survey lists 580 (13.1%) of households using propane ("bottled gas" or "LP"). https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has propane use for NY State (https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf) in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with propane (274,348), and use that to calculate average usage per household in New Paltz. 274,348 households in NYS use a combined 21.2 trillion Btu (or 21,200 MMBtu) of propane annually. Using these figures, we can calculate the per household propane usage statewide of 12.94 MMBtu per year. From this, we can establish that New Paltz's 580 propane using households produce an estimated 7,505.20 MMBtu's. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Fuel Oil Use (2017)	The American Community Survey lists 2,474 (55.7%) of households using fuel oil, or distillate fuel no. 2. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has fuel oil use for NY State https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with gas (4,228,093), and use that to calculate average usage per household in New Paltz. 1,663,074 households in NYS use a combined 89.5 trillion Btu (or 89,500 MMBtu) of fuel oil annually. Using these figures, we can calculate the per household fuel oil usage statewide of 18.58 MMBtu. From this, we can establish that New Paltz's 2,474 fuel oil using households produce an estimated 45,966.92 MMBtu's. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.

Solid Waste

Inventory Record	Notes
Composted Branches and Food Waste (2017)	Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Collection/Transportation of Solid Waste (2017)	Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Total Municipal Solid Waste (2017)	Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.

Inventory Record	GPC Scope	GPC Ref Number	Global Warming Potential	Activity Source	CH4 (MT)
Composted Branches and Food Waste (2017)	Scope 1	III.2.1	IPCC 5th Assessment 100 Year Values	Source	
Collection/Transportation of Solid Waste (2017)	Scope 3	VI.1	IPCC 5th Assessment 100 Year Values	Activity	
Total Municipal Solid Waste (2017)	Scope 3	III.1.2	IPCC 5th Assessment 100 Year Values	Activity	10.48

Inventory Record	CO2e (MT)	Waste Generated (wet tons)	Waste per Household	CO2e per Household	Total Waste Generated	Disposal Location
Composted Branches and Food Waste (2017)						Generated and disposed in-boundary
Collection/Transportation of Solid Waste (2017)	18.62					
Total Municipal Solid Waste (2017)	293.35	297.68	0.07	0.06	297.68	Outside the Jurisdiction

Inventory Record	Percentage Newspaper	Percentage Office Paper	Percentage Corrugated Cardboard	Percentage Magazines / Third Class Mail	Percentage Food Scraps	Percentage Grass
Composted Branches and Food Waste (2017)						
Collection/Transportation of Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02
Total Municipal Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02

Inventory Record	Percentage Dimensional Lumber	Waste Composted (tons)	Total Waste Collected and/ or Transported (wet tons)	Collection Emissions (MTCO2e)	Transportation Emissions (MTCO2e)	Emissions per Capita (MTCO2e/Person	Collection Emissions Factor
Composted Branches and Food Waste (2017)		4412.15					
Collection/Transportation of Solid Waste (2017)	3.49		297.68	5.95	12.67	0.0013	0.02
Total Municipal Solid Waste (2017)	3.49						

Inventory Record	Collection Emissions Factor	Transportation Emissions Factor	Mass of Solid Waste	Fuel Type	Round-Trip miles traveled to disposal site	Population Served
Composted Branches and Food Waste (2017)						
Collection/Transportation of Solid Waste (2017)	0.02	0.00014	297.68	Diesel	304	14003
Total Municipal Solid Waste (2017)						

Transportation

Inventory Record	Notes
Vehicle Emissions, Gasoline (2017)	From NYS DOT daily Vehicle Miles Travelled for Town of New Paltz, based on actual traffic counts.
Vehicle Emissions, Diesel (2017)	From NYS DOT daily Vehicle Miles Travelled for Town of New Paltz, based on actual traffic counts.

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	On Road VMT	Fossil Fuel Energy Equivalent (MMBtu)
Vehicle Emissions, Gasoline (2017)	86,062.69	4.49	3.06	86,999.66	251,485,000.00	1,225,266.11
Vehicle Emissions, Diesel (2017)	23,019.62	0.00	0.00	23,019.62	251,485,000.00	311,351.62

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Vehicle Emissions, Gasoline (2017)	Scope 1	II.1.1	eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values	Source and Activity
Vehicle Emissions, Diesel (2017)			eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values	

Inventory Record	Emissions per Capita (MT CO2 per Person)	Emissions per Mile (g CO2e per mile)	CO2 Emissions Factor	Biogenic CO2 Emission s Factor	CH4 Emissions Factor	N2O Emissions Factor
Vehicle Emissions, Gasoline (2017)	6.21	345.94	0.07	0.07	0.00000002	0.00
Vehicle Emissions, Diesel (2017)	1.64	91.53	0.07	0.07	0.00000000	0.00

Inventory Record	Calculation Method	VMT Location	Fuel Type	VMT	Percent Passenger Vehicles	Percent Light Trucks
Vehicle Emissions, Gasoline (2017)	VMT & MPG	In-Boundary	Gasoline	251,485,000.00	60.6	32.4
Vehicle Emissions, Diesel (2017)	VMT & MPG	In-Boundary	Diesel	251,485,000.00	0.3	1.3

Inventory Record	Percent Heavy Tucks	Population	CO2 lbs/ MWh	CH4 lbs/ GWh	N2O lbs/ GWh	Gas Passenger Vehicle Fuel Economy (MPG)	Gas Passenger Vehicle g CH4/mi
Vehicle Emissions, Gasoline (2017)	0	14,003	294.70	21	3	23.86	0.0187
Vehicle Emissions, Diesel (2017)	5.4	14,003	294.70	21	3	23.86	0.0187

Inventory Record	Gas Light Truck Fuel Economy (MPG)	Gas Light Truck g CH4/mi	Gas Light Truck g N2O/mi	Gas Heavy Truck Fuel Economy (MPG)	Gas Heavy Truck g CH4/mi	Gas Heavy Truck g N2O/mi
Vehicle Emissions, Gasoline (2017)	23.86	0.0201	0.017	5.36	0.0333	0.0134
Vehicle Emissions, Diesel (2017)	23.86	0.0201	0.017	5.36	0.0333	0.0134

Inventory Record	Gas Transit Bus g CH4/ mi	Gas Transit Bus g N2O/ mi	Gas Para Transit Bus Fuel Economy (MPG)	Gas Para Transit Bus g CH4/mi	Gas Para Transit Bus g N2O/mi	Diesel Heavy Truck Fuel Economy (MPG)
Vehicle Emissions, Gasoline (2017)	0.0201	0.017	17.34	0.0201	0.017	6.02
Vehicle Emissions, Diesel (2017)	0.0201	0.017	17.34	0.0201	0.017	6.02

Water and Wastewater

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Septic System Fugitive Emissions (2017)	Scope 1	III.4.1	eGrid 2016	IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	Notes	CH4 (MT)	CO2e (MT)	Daily Septic System BOD5 Load (kg/day)	CO2e per Capita (MT)
Septic System Fugitive Emissions (2017)	Data from Chris Jaeger, Village of New Paltz Sewer Plant Operator.	31.18	872.95	646.65	0.12

Inventory Record	CH4 Emissions Factor	Population Served	CO2 lbs/MWh	CH4 lbs/GWh	N2O lbs/GWh
Septic System Fugitive Emissions (2017)	0.048213	7185	294.7	21	3

Appendix B: Inventory Details for the Village

Commercial Energy

Inventory Record	Notes	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
Commercial Electricity Usage (2017)	Number of commercial establishments estimated by the total number of commercial electric accounts with Central Hudson.	180.28	0.01	0.002	181.13

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Commercial Electricity Usage (2017)	Scope 2	I.2.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity

Inventory Record	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor	CH4 Emissions Factor	N2O Emissions Factor	Electricity Used	CO2 lbs/ MWh	CH4 lbs/ GWh	N2O lbs/ GWh
Commercial Electricity Usage (2017)	4,603.00	0.04	0.00	0.00	1,348.68	294.70	21.00	3.00

Residential Energy

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Residential Electricity Use (2017)	Scope 2	I.1.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity
Residential Natural Gas Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Fuel Oil Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Propane Use (2017)	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Energy Equivalent (MMBtu)	MMBtu per Household	CO2e per Household (MT)	MMBtu per Person	CO2e per Person (MT)	CO2 Emissions Factor (kg/ MMBtu)
Residential Electricity Use (2017)	1,049.34	0.07	0.0107	1,054.26		53.26	2.10	0.00	0	
Residential Natural Gas Use (2017)	201.93	0.02	0.0004	202.56	3808.54	9.97	0.53	0.56	0.03	53.02
Residential Fuel Oil Use (2017)	815.28	0.12	0.0080	820.76	11023.32	14.86	1.11	0.00	0	73.96
Residential Propane Use (2017)	185.30	0.03	0.0033	187.11	3015.02	12.94	0.80	0.00	0	61.46

Inventory Record	CH4 Emissions Factor (kg/ MMBtu)	N2O Emissions Factor (kg/ MMBtu)	Fuel Use	Data Source	Number of Households	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor
Residential Electricity Use (2017)					503	26,791.706	0.039
Residential Natural Gas Use (2017)	0.005	0.0001	3,808.54	EIA usage	382		
Residential Fuel Oil Use (2017)	0.011	0.001	11,023.32	EIA usage	742		
Residential Propane Use (2017)	0.011	0.0011	3,015.02	EIA usage	233		

Inventory Record	CH4 Emissions Factor	N2O Emissions Factor	Electricity Used	CO2 lbs/MWh	CH4 lbs/ GWh	N2O lbs/ GWh
Residential Electricity Use (2017)	0.000	0.000	7,849.970	294.700	21.000	3.000
Residential Natural Gas Use (2017)						
Residential Fuel Oil Use (2017)						
Residential Propane Use (2017)						

Inventory Record	Notes
Residential Electricity Use (2017)	Population and Households: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF Only incomplete data was available from Central Hudson Gas & Electric. (https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data) Feb 2016 values were substituted for "withheld" records for Feb 2017. December and January were missing from both 2016 and 2017 records. Values for the closest calendar month to the missing data was used as an estimate in those cases. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Natural Gas Use (2017)	Usage data from Central Hudson Gas and Electric is withheld due the low number of accounts causing privacy concerns if the data is released. The 2017 American Community Survey lists 445 households (~10%) in New Paltz using "utility gas": https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has natural gas use for NY State https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with gas (4,228,093), and use that to calculate average usage per household in New Paltz. 4,228,093 households in NYS use a combined 423.9 trillion Btu (or 423,900 MMBtu) of natural gas annually. Using these figures, we can calculate the per household natural gas usage of 9.97 MMBtu. From this, we can establish that the Village of New Paltz's 382 natural gas using households produce an estimated 3,808.54 MMBtu's.
Residential Fuel Oil Use (2017)	The American Community Survey lists 2,474 (55.7%) of households using fuel oil, or distillate fuel no. 2. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has fuel oil use for NY State https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with gas (4,228,093), and use that to calculate average usage per household in New Paltz. 1,663,074 households in NYS use a combined 89.5 trillion Btu (or 89,500 MMBtu) of fuel oil annually. Using these figures, we can calculate the per household fuel oil usage statewide of 18.58 MMBtu. From this, we can establish that the Village of New Paltz's 742 fuel oil using households produce an estimated 13786.36 MMBtu's. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Propane Use (2017)	The American Community Survey lists 580 (13.1%) of households using propane ("bottled gas" or "LP"). https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has propane use for NY State (https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf) in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with propane (274,348), and use that to calculate average usage per household in New Paltz. 274,348 households in NYS use a combined 21.2 trillion Btu (or 21,200 MMBtu) of propane annually. Using these figures, we can calculate the per household propane usage statewide of 12.94 MMBtu per year. From this, we can establish that the Village of New Paltz's 233 propane using households (found via American Factfinder) produce an estimated 3,015.02 MMBtu's per year. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.

Solid Waste

Inventory Record	Notes
Composted Branches and Food Waste (2017)	Municipal solid waste per capita was calculated using New Paltz Transfer Station Annual Reports, as well as U.S. Census figures. Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Collection/Transportation of Solid Waste (2017)	Municipal solid waste per capita was calculated using New Paltz Transfer Station Annual Reports, as well as U.S. Census figures. Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Total Municipal Solid Waste (2017)	Municipal solid waste per capita was calculated using New Paltz Transfer Station Annual Reports, as well as U.S. Census figures. Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Composted Branches and Food Waste (2017)	Scope 1	III.2.1		IPCC 5th Assessment 100 Year Values	Source
Collection/Transportation of Solid Waste (2017)	Scope 3	VI.1	Waste Characterization (2017)	IPCC 5th Assessment 100 Year Values	Activity
Total Municipal Solid Waste (2017)	Scope 3	III.1.2	Waste Characterization (2017)	IPCC 5th Assessment 100 Year Values	Activity

Inventory Record	CH4 (MT)	CO2e (MT)	Waste Generated (wet tons)	Does the receiving landfill have Methane Collection?	Disposal Location
Composted Branches and Food Waste (2017)	0	0			Generated and disposed in-boundary
Collection/Transportation of Solid Waste (2017)		9.07			
Total Municipal Solid Waste (2017)	5.10	142.83	144.94	No	Outside the Jurisdiction

Inventory Record	Percentage Newspaper	Percentage Office Paper	Percentage Corrugated Cardboard	Percentage Magazines / Third Class Mail	Percentage Food Scraps	Percentage Grass	Percentage Dimensional Lumber
Composted Branches and Food Waste (2017)							
Collection/Transportation of Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02	3.49
Total Municipal Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02	3.49

Inventory Record	Waste Composted (tons)	Quantity of Waste Composted	Total Waste Collected and/ or Transported (wet tons)	Collection Emissions (MTCO2e)	Transportation Emissions (MTCO2e)	Emissions per Capita (MTCO2e/ Person	Collection Emissions Factor
Composted Branches and Food Waste (2017)	2,148.26	2,148.26					
Collection/Transportation of Solid Waste (2017)			144.94	2.90	6.17	0.00	0.02
Total Municipal Solid Waste (2017)							

Inventory Record	Transportation Emissions Factor	Would you like to calculate collection or transportation emissions, or both together?	Mass of Solid Waste	Fuel Type	Round-Trip miles traveled to disposal site	Population Served
Composted Branches and Food Waste (2017)						
Collection/Transportation of Solid Waste (2017)	0.00	Collection and Transportation Emissions	144.94	Diesel	304.00	6,818.00
Total Municipal Solid Waste (2017)						

Transportation

Inventory Record	Notes	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)
Vehicle Emissions (Diesel)	From 2010 Ulster County Travel Demand Model, courtesy of Ulster County Planning Department.	1,836.30	0.00	0.00	1,836.30
Vehicle Emissions (Gasoline)	Data estimated from 2010 Ulster County Travel Demand Model, courtesy of Ulster County Planning Department.	6,865.32	0.36	0.24	6,940.06

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Vehicle Emissions (Diesel)	Scope 1	II.1.1	eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values	Source and Activity
Vehicle Emissions (Gasoline)	Scope 1	II.1.1	eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	On Road VMT	Fossil Fuel Energy Equivalent (MMBtu)	Emissions per Capita (MT CO2 per Person)	Emissions per Mile (g CO2e per mile)	CO2 Emissions Factor
Vehicle Emissions (Diesel)	20,061,239	24,836.87	0.27	91.53	0.07
Vehicle Emissions (Gasoline)	20,061,239	97,740.84	1.02	345.94	0.07

Inventory Record	Biogenic CO2 Emissions Factor	CH4 Emissions Factor	N2O Emissions Factor	Calculation Method	VMT Location	Travel Type	Type of VMT or Emissions Data
Vehicle Emissions (Diesel)	0.07			VMT & MPG	In-Boundary	Freight	
Vehicle Emissions (Gasoline)	0.07	0.00000002	0.00000001	VMT & MPG	In-Boundary	Passenger	In Boundary

Inventory Record	Type of VMT or Emissions Data	Type of Freight VMT or Emissions Data	Fuel Type	VMT	Percent Passenger Vehicles	Percent Light Trucks	Percent Heavy Tucks	Population
Vehicle Emissions (Diesel)		In-boundary from Travel Model	Diesel	20,061,239	0.30	1.30	5.40	6,818.00
Vehicle Emissions (Gasoline)	In Boundary		Gasoline	20,061,239	60.60	32.40	0.00	6,818.00

Inventory Record	CH4 lbs/ GWh	N2O lbs/ GWh	Gas Passenger Vehicle Fuel Economy (MPG)	Gas Passenger Vehicle g CH4/mi	Gas PassengerVehicle g N2O/mi	Gas Light Truck Fuel Economy (MPG)
Vehicle Emissions (Diesel)	21.00	3.00	23.86	0.02	0.01	23.86
Vehicle Emissions (Gasoline)	21.00	3.00	23.86	0.02	0.01	23.86

Inventory Record	Gas Light Truck g CH4/mi	Gas Light Truck g N2O/mi	Gas Heavy Truck Fuel Economy (MPG)	Gas Heavy Truck g CH4/mi	Gas Heavy Truck g N2O/mi	Gas Transit Bus Fuel Economy (MPG)	Gas Transit Bus g CH4/mi
Vehicle Emissions (Diesel)	0.02	0.02	5.36	0.03	0.01	17.34	0.02
Vehicle Emissions (Gasoline)	0.02	0.02	5.36	0.03	0.01	17.34	0.02

Inventory Record	Gas Transit Bus g N2O/mi	Gas Para Transit Bus Fuel Economy (MPG)	Gas Para Transit Bus g CH4/mi	Gas Para Transit Bus g N2O/mi	Diesel Heavy Truck Fuel Economy (MPG)
Vehicle Emissions (Diesel)	0.02	17.34	0.02	0.02	6.02
Vehicle Emissions (Gasoline)	0.02	17.34	0.02	0.02	6.02

Water and Wastewater

Inventory Record	Notes
Septic Systems (2017)	According to Village Treasurer Nancy Branco, there are 54 accounts in the Village which are water-only (in otherwise no central sewer). With a population of 6,818 spread over 1,818 households, each household has an average of 3.75 people per household. 75 Village accounts with septic systems, times 3.75 people per household gives 281 people in the Village on septic systems.

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Septic Systems (2017)	Scope 1	III.4.1	eGrid 2016	IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	CH4 (MT)	CO2e (MT)	Daily Septic System BOD5 Load (kg/day)	CO2e per Capita (MT)	CH4 Emissions Factor	Population Served	CO2 lbs/ MWh	CH4 lbs/ GWh	N2O lbs/ GWh
Septic Systems (2017)	1.22	34.14	25.29	0.12	0.05	281.00	294.70	21.00	3.00

Appendix C: Inventory Details for the Town Outside Village

Residential Energy

Inventory Record	Calculator	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Residential Electricity Use (2017)	Emissions from Grid Electricity	Scope 2	I.1.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity
Residential Natural Gas Use (2017)	Emissions from Stationary Fuel Combustion	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Propane Use (2017)	Emissions from Stationary Fuel Combustion	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity
Residential Fuel Oil Use (2017)	Emissions from Stationary Fuel Combustion	Scope 1	I.1.1		IPCC 5th Assessment 100 Year Values	Source and Activity

Inventory Record	Notes
Residential Electricity Use (2017)	Population and Households: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF Only incomplete data was available from Central Hudson Gas & Electric. (https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Communities/Community-Energy-Use-Data) Feb 2016 values were substituted for "withheld" records for Feb 2017. December and January were missing from both 2016 and 2017 records. Values for the closest calendar month to the missing data was used as an estimate in those cases. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Natural Gas Use (2017)	
Residential Propane Use (2017)	The American Community Survey lists 580 (13.1%) of households using propane ("bottled gas" or "LP"). https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has propane use for NY State (https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf) in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with propane (274,348), and use that to calculate average usage per household in New Paltz. 274,348 households in NYS use a combined 21.2 trillion Btu (or 21,200 MMBtu) of propane annually. Using these figures, we can calculate the per household propane usage statewide of 12.94 MMBtu per year. From this, we can establish that the Town-Outside-Village's 347 propane using households (found via American Factfinder) produce an estimated 4,490.18 MMBtu's per year. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.
Residential Fuel Oil Use (2017)	The American Community Survey lists 2,474 (55.7%) of households using fuel oil, or distillate fuel no. 2. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF The federal Environmental Information Agency (EIA) has fuel oil use for NY State https://www.eia.gov/state/seds/sep_use/res/pdf/use_res_NY.pdf in trillion BTU. One can run the census data at a state level (https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF) to get statewide households heating with gas (4,228,093), and use that to calculate average usage per household in New Paltz. 1,663,074 households in NYS use a combined 89.5 trillion Btu (or 89,500 MMBtu) of fuel oil annually. Using these figures, we can calculate the per household fuel oil usage statewide of 18.58 MMBtu. From this, we can establish that the Town-Outside-Village's 1,732 fuel oil using households produce an estimated 32,180.56 MMBtu's. Energy usage due to government operations has been deducted from this inventory, as it is accounted for in the Local Government Operations inventory being prepared separately.

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Energy Equivalent (MMBtu)	MMBtu per Household	CO2e per Household (MT)
Residential Electricity Use (2017)	2,681.84	0.19	0.03	2,694.42		0.00	0.00
Residential Natural Gas Use (2017)	33.40	0.003	0.0001	33.51	630.01	10.00	0.53
Residential Propane Use (2017)	260.12	0.05	0.005	262.66	4,232.42	12.20	0.76
Residential Fuel Oil Use (2017)	2,311.24	0.34	0.02	2,326.75	31,249.82	18.04	1.34

Inventory Record	CO2 Emissions Factor (kg/MMBtu)	CH4 Emissions Factor (kg/MMBtu)	N2O Emissions Factor (kg/MMBtu)	Fuel Use	Data Source
Residential Electricity Use (2017)					
Residential Natural Gas Use (2017)	53.02	0.01	0.0001	630.01	Estimation using EIA usage
Residential Propane Use (2017)	61.46	0.01	0.0011	4,232.42	Estimation using EIA usage
Residential Fuel Oil Use (2017)	73.96	0.01	0.0007	31,249.82	Estimation using EIA usage

Inventory Record	Number of Households	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor	CH4 Emissions Factor	N2O Emissions Factor	Electricity Used	CO2 lbs/MWh	CH4 lbs/GWh	N2O lbs/GWh
Residential Electricity Use (2017)		68,472.90	0.04	0.000003	0.00	20,062.56	294.70	21.00	3.00
Residential Natural Gas Use (2017)	63.00								
Residential Propane Use (2017)	347.00								
Residential Fuel Oil Use (2017)	1,732.00								

Commercial Energy

Inventory Record	Calculator	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source
Commercial Electricity Use (2017)	Emissions from Grid Electricity	Scope 2	I.2.2	eGrid 2016	IPCC 5th Assessment 100 Year Values	Activity

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	Electricity Energy Equivalent (MMBtu)	CO2 Emissions Factor
Commercial Electricity Use (2017)	159.87	0.01	0.00	160.62	4,081.81	0.04

Inventory Record	CH4 Emissions Factor	N2O Emissions Factor	Is this a Direct Entry Record?	Electricity Used	CO2 lbs/MWh	CH4 lbs/GWh	N2O lbs/GWh
Commercial Electricity Use (2017)	0.00	0.00	No	1,195.97	294.70	21.00	3.00

Solid Waste

Inventory Record	Calculator	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential
Composted Branches and Food Waste (2017)	Biologic Treatment of Solid Waste (Composting)	Scope 1	III.2.1		IPCC 5th Assessment 100 Year Values
Collection/Transportation of Solid Waste (2017)	Collection and Transportation Emissions	Scope 3	VI.1	Waste Characterization (2017)	IPCC 5th Assessment 100 Year Values
Total Municipal Solid Waste (2017)	Waste Generation	Scope 3	III.1.2	Waste Characterization (2017)	IPCC 5th Assessment 100 Year Values

Inventory Record	Category	Activity Source	Notes
Composted Branches and Food Waste (2017)	Solid Waste	Source	Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Collection/Transportation of Solid Waste (2017)	Solid Waste	Activity	Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.
Total Municipal Solid Waste (2017)	Solid Waste	Activity	Municipal solid waste per capita was calculated using New Paltz Transfer Station Annual Reports, as well as U.S. Census figures. Data from New Paltz Transfer Station Annual Report (2017), and Town of New Paltz Recycling Coordinator Laura Petit.

Inventory Record	CH4 (MT)	N2O (MT)	CO2e (MT)	Waste Generated (wet tons)	Does the receiving landfill have Methane Collection?	Disposal Location
Composted Branches and Food Waste (2017)						Generated and disposed in-boundary
Collection/Transportation of Solid Waste (2017)			9.68			
Total Municipal Solid Waste (2017)	5.38		150.52	152.74	No	Outside the Jurisdiction

Inventory Record	Percentage Newspaper	Percentage Office Paper	Percentage Corrugated Cardboard	Percentage Magazines / Third Class Mail	Percentage Food Scraps	Percentage Grass
Composted Branches and Food Waste (2017)						
Collection/Transportation of Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02
Total Municipal Solid Waste (2017)	4.06	2.86	10.16	3.11	17.65	5.02

Inventory Record	Percentage Dimensional Lumber	Total Waste Collected and/or Transported (wet tons)	Collection Emissions (MTCO2e)	Transportation Emissions (MTCO2e)
Composted Branches and Food Waste (2017)				
Collection/Transportation of Solid Waste (2017)	3.49	154.74	3.0948	6.5857344
Total Municipal Solid Waste (2017)	3.49			

Inventory Record	Collection Emissions Factor	Transportation Emissions Factor	Would you like to calculate collection or transportation emissions, or both together?	Mass of Solid Waste	Fuel Type	Round-Trip miles traveled to disposal site
Composted Branches and Food Waste (2017)						
Collection/Transportation of Solid Waste (2017)	0.02	0.00	Collection and Transportation Emissions	154.74	Diesel	304.00
Total Municipal Solid Waste (2017)						

Inventory Record	Waste Composted (tons)	CH4 Emissions Factor (MT CH4 / Ton)	N2O Emissions Factor (MT N2O / Ton)	Quantity of Waste Composted
Composted Branches and Food Waste (2017)	2263.89	0	0	2263.89
Collection/Transportation of Solid Waste (2017)				
Total Municipal Solid Waste (2017)				

Transportation

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential
Vehicle Emissions, Gasoline (2017)	Scope 1	II.1.1	eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values
Vehicle Emissions, Diesel (2017)	Scope 1	II.1.1	eGrid 2016 and National Default Vehicle Fuel Efficiency & Emissions Factors 2015	IPCC 5th Assessment 100 Year Values

Inventory Record	Activity Source	Notes
Vehicle Emissions, Gasoline (2017)	Source and Activity	From 2010 Ulster County Travel Demand Model, courtesy of Ulster County Planning Department, and from NYS DOT daily Vehicle Miles Travelled for Town of New Paltz, based on actual traffic counts.
Vehicle Emissions, Diesel (2017)	Source and Activity	From 2010 Ulster County Travel Demand Model, courtesy of Ulster County Planning Department, and from NYS DOT daily Vehicle Miles Travelled for Town of New Paltz, based on actual traffic counts.

Inventory Record	CO2 (MT)	CH4 (MT)	N2O (MT)	CO2e (MT)	On Road VMT	Fossil Fuel Energy Equivalent (MMBtu)	Emissions per Capita (MT CO2 per Person)
Vehicle Emissions, Gasoline (2017)	21,846.16	0.49	0.23	21,919.82	231,423,761.00	311,021.61	3.05
Vehicle Emissions, Diesel (2017)	21,183.32	0.00	0.00	21,183.32	231,423,761.00	286,514.76	2.95

Inventory Record	Emissions per Mile (g CO2e per mile)	CO2 Emissions Factor	Biogenic CO2 Emissions Factor	Calculation Method	VMT Location	Travel Type	Type of VMT or Emissions Data
Vehicle Emissions, Gasoline (2017)	94.72	0.07	0.07	VMT & MPG	In-Boundary	Passenger	In Boundary
Vehicle Emissions, Diesel (2017)	91.53	0.07	0.07	VMT & MPG	In-Boundary	Freight	In Boundary

Inventory Record	Fuel Type	VMT	Percent Passenger Vehicles	Percent Light Trucks	Percent Heavy Tucks	Population	CO2 lbs/ MWh	CH4 lbs/ GWh
Vehicle Emissions, Gasoline (2017)	Gasoline	231,423,761	0.30	1.30	5.40	7,185	294.70	21.00
Vehicle Emissions, Diesel (2017)	Diesel	231,423,761	0.30	1.30	5.40	7,185	294.70	21.00

Inventory Record	N2O lbs/ GWh	Gas Passenger Vehicle Fuel Economy (MPG)	Gas Passenger Vehicle g CH4/mi	Gas PassengerVehicle g N2O/mi	Gas Light Truck Fuel Economy (MPG)
Vehicle Emissions, Gasoline (2017)	3.00	23.86	0.02	0.01	23.86
Vehicle Emissions, Diesel (2017)	3.00	23.86	0.02	0.01	23.86

Inventory Record	Gas Light Truck g CH4/mi	Gas Light Truck g N2O/mi	Gas Heavy Truck Fuel Economy (MPG)	Gas Heavy Truck g CH4/mi	Gas Heavy Truck g N2O/mi	Gas Transit Bus Fuel Economy (MPG)	Gas Transit Bus g CH4/mi
Vehicle Emissions, Gasoline (2017)	0.02	0.02	5.36	0.03	0.01	17.34	0.02
Vehicle Emissions, Diesel (2017)	0.02	0.02	5.36	0.03	0.01	17.34	0.02

Inventory Record	Gas Transit Bus g N2O/mi	Gas Para Transit Bus Fuel Economy (MPG)	Gas Para Transit Bus g CH4/mi	Gas Para Transit Bus g N2O/mi	Diesel Heavy Truck Fuel Economy (MPG)
Vehicle Emissions, Gasoline (2017)	0.02	17.34	0.02	0.02	6.02
Vehicle Emissions, Diesel (2017)	0.02	17.34	0.02	0.02	6.02

Water and Wastewater

Inventory Record	GPC Scope	GPC Ref Number	Factor Profiles	Global Warming Potential	Activity Source	CH4 (MT)	CO2e (MT)
Septic System Fugitive Emissions (2017)	Scope 1	III.4.1	eGrid 2016	IPCC 5th Assessment 100 Year Values	Source and Activity	31.18	872.95

Inventory Record	Daily Septic System BOD5 Load (kg/day)	CO2e per Capita (MT)	CH4 Emissions Factor	Calculation Type	Population Served	CO2 lbs/ MWh	CH4 lbs/ GWh	N2O lbs/ GWh
Septic System Fugitive Emissions (2017)	646.65	0.12	0.05	Population Based	7,185	294.70	21.00	3.00

Appendix D: Bibliography

Bai, X., Dawson, R. J., Urge-Vorsatz, D., Delgado, G. C., Barau, A. S., Dhaka, S., Bodman, D., Leonardsen, L., Masson-Delmotte, V., Roberts, D., Schultz, S. (2018). Six research priorities for cities and climate change. Nature. 555.

Baron, N., Petersen, L. K., (2015). Understanding controversies in climate change adaptation: A case study of the role of homeowners in the process of climate change adaptation in Copenhagen. Nordic Journal of Science and Technology Studies.

Bateman, T.S., and O'Connor, K. (2016). Felt responsibility and climate engagement: Distinguishing adaptation from mitigation. Global Environmental Change, 41.

Belfer-Cohen, A., Bar-Yosef, O. (2002) Early sedentism in the near east: A bumpy ride to village life. In Kuijt, I. (eds) Life in Neolithic Farming Communities. Fundamental Issues in Archaeology. Springer, Boston, MA

Betsill, M. M. (2001). Mitigating climate change in U.S. cities: opportunities and obstacles. Local Environment, 6:4.

Betsill, M. M., Bulkeley, H. (2007). Looking back and thinking ahead: A decade of cities and climate change research. Local Environment. 12:5.

Boston, Massachusetts. (2014). Greenovate Boston: 2014 Climate Action Plan update. City of Boston.

Brink, E., and Wamsler, C. (2019). Citizen engagement in climate adaptation surveyed: The role of values, worldview, gender, and place. Journal of Cleaner Production, 209.

Broto, V. C., Bulkeley, H. (2013). A survey of urban climate change experiments in 100 cities. Global Environmental Change, 23.

Bull, M., Edwards, J., Hoye, M., Nelson, C., Strom, S. Brennan, K., Bagnoli, J., Ross, B., Campbell, K., Koenigs, C. (2014). Minneapolis energy pathways: A framework for local energy action. Center for Energy and Environment; McGrann, Shea, Carnival, Straight, & Lamb; CR Planning.

Burch, S. (2016). Uncovering the implications of the Paris Agreement: Climate change as a catalyst for transformative sustainability in cities. CIGI: Centre for International Governance Innovation. Policy Brief No. 72.

Cardwell, D. (2013). Cities weigh taking over from private utilities. New York Times. http://www.nytimes.com/2013/03/14/business/energy-environment/cities-weigh-taking-electricity-business-from-private- utilities.html pagewanted=all&utm_source=&utm_medium=email&utm_campaign=6526&_r=1&http://

Cheng, C., Yang, Y. C. E., Ryan, R., Yu, Q., Brabec, E. (2017). Assessing climate change-induced flooding mitigation for adaptation in Boston's Charles River watershed, USA. Landscape and Urban Planning, 167.

Corner, A., Randall, A. (2011). Selling climate change? The limitations of social marketing as a strategy for climate change public engagement. Global Environmental Change, 21.

Dahal, K, Niemela, J. (2017). Cities' greenhouse gas accounting methods: A study of Helsinki, Stockholm, and Copenhagen. Climate. 5:31.

Davey Research Group. (2018). Tree Management Plan for New Paltz, New York. Prepared for the Town of New Paltz.

Deetjen, T. A., Conger, J. P., Leibowicz, B. D., Webber, M. E. (2018). Review of climate action plans in 29 major U.S. cities: Comparing current policies to research recommendations. Sustainable Cities and Society. 41.

Dupigny-Giroux, L.A., Mecray, E.L., Lemcke-Stampone, M.D., Hodgkins, G.A., Lentz, E.E., Mills, K.E., Lane, E.D., Miller, R., Hollinger, D.Y., Solecki, W.D., Wellenius, G.A., Sheffield, P.E., MacDonald, A.B., Caldwell, C. (2018) Northeast. In impacts, risks,

and adaptation in the United States: Fourth National Climate Assessment, Volume II. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18

Editorial. (2012). The implications of a changing climate for buildings. Building and Environment. 55.

Editorial. (2016). Climate change and transport. Transportation Research Part D. 45

EPA. (2016). What climate change means for New York. Fact Sheet. EPA 430-F-16-034.

Fong, W. K., Sotos, M., Doust, M., Schultz, S., Marques, A., & Deng-Beck, C. (2014). Global protocol for community-scale greenhouse gas emission inventories: An accounting and reporting standard for cities. ICLEI: Local Governments for Sustainability, C40 Climate Change Group, World Resources Institute.

Frankson, R., Kunkel, K., Champion, S., Stewart, B., Sweet, W., DeGaetano, A. T. (2017) New York State Climate Summary. *NOAA Technical Report NESDIS 149-NY,* 4 pp.

Funfgeld, H. (2015). Facilitating local climate change adaptation through transnational municipal networks. Current Opinion in Environmental Sustainability. 12.

Gately, C. K., Hutyra, L. R., and Wing, S. (2015). Cities, traffic, and CO2: A multidecadal assessment of trends, drivers, and scaling relationships. Proceedings of the National Academy of Sciences. 112 (16).

Gavrilova, O., Vilu, R. (2012). Production-based and consumption-based national greenhouse gas inventories: An implication for Estonia. Ecological Economics. 75.

Geiger, N., Swim, J.K., Fraser, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. Journal of Environmental Psychology, 51.

Goodell, J. (2017). The water will come: rising seas, sinking cities, and the remaking of the civilized world. Little, Brown, and Company.

Hamburg, Germany. (2011). Update of the Hamburg Climate Action Plan 2007-2012: Report on further development of programme, implementation of the measures in 2010, and planned allocation of funds in 2011 (third update). Communication of the Senate to Parliament. 19th Electoral Period. Document number 19/8311, 4/01/11.

Hickel, J. (2018). The hope at the heart of the apocalyptic climate change report. Foreign Policy. Retrieved from https://foreignpolicy.com/2018/10/18/the-hope-at-the-heart-of-the-apocalyptic-climate-change-report/

Horton, R., Yohe, G., Easterling, W., Kates, R., Ruth, M., Sussman, E., Whelchel, A., Wolfe, D., Lipschultz, F. (2014) Chapter 16: Northeast. *Climate Change Impacts in the United States: The Third National Climate Assessment,* J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 16-1-nn.

Huang-Lachman, J-T., Lovett, J.C. (2016). How cities prepare for climate change: Comparing Hamburg and Rotterdam. Cities, 54.

ICLEI: Local Governments for Sustainability. (2013). U.S. community protocol for accounting and reporting of greenhouse gas emissions. ICLEI: Local Governments for Sustainability USA.

IPCC. (2013). Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC. (2018). Global warming of 1.5^0 C. Special Report No. 15. Summary for Policymakers. First Joint Session of Working Groups I, II, and III of the IPCC. 48th Session of the IPCC.

Karunathilake, H., Perera, P., Ruparathna, R., Hewage, K., and Sadiq, R. (2018). Renewable energy integration into community energy systems: A case study of new urban residential development. Journal of Cleaner Production. 173.

Kwan, S. C., and Hashim, J. H. (2016). A review on co-benefits of mass public transportation in climate change mitigation. Sustainable Cities and Society. 22.

Lamb, W. F., Callaghan, M. W., Creutzig, F., Khosla, R., Minx, J. C. (2018). The literature landscape on 1.5 ^{o}C climate change and cities. Current Opinion in Environmental Sustainability. 30.

LePage, M. (2017). CO_2 set to hit levels not seen in 50 million years by 2050. New Scientist. Daily News, April 4th, 2017. https://www.newscientist.com/article/2126776-co2-set-to-hit-levels-not-seen-in-50-million-years-by-2050/

Lombardi, M., Laiola, E., Tricase, C., Rana, R. (2017). Assessing the urban carbon footprint: An overview. Environmental Impact Assessment Review. 66.

Markolf, S. A., Matthews, H. S., Azevedo, I. I., Hendrickson, C. (2017). An integrated approach for estimating greenhouse gas emissions from 100 U.S. metropolitan areas. Environmental Research Letters. 12.

Marshall, B.K. (2005). Citizen participation in natural resource management: Does representativeness matter? Sociological Spectrum, 25.

Mason, S. G., Fragkias, M. (2018). Metropolitan planning organizations and climate change action. Urban Climate. 25.

McArdle, A. (2016). Local green initiatives: What local governance can contribute to environmental defenses against the onslaughts of climate change. In SYMPOSIUM: Global Challenges and Local Solutions: The Role of Municipalities in the Fight Against Climate Change. Fordham Environmental Law Review. 28:1

McCabe, B.J. (2013). Are homeowners better citizens? Homeownership and community participation in the United States. Social Forces, 91.

McPherson, E. G., Simpson, J. R., Peper, P. J., Gardner, S. L., Vargas, K. E., and Xiao, Q. (2007). Northeast community tree guide: benefits, costs, and strategic planting. General Technical Report PSW-GTR-202. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

McGrath, M. (2018). Five things we have learned from the IPCC report. BBC News. Retrieved from https://www.bbc.com/news/science-environment-45784892

Meyer, R. (2018). How to understand the UN's dire new climate report. The Atlantic. Retrieved from https://www.theatlantic.com/science/archive/2018/10/how-to-understand-the-uns-dire-new-climate-report/572356/

Nanaki, E. A., and Koroneos, C. J. (2016). Climate change mitigation and deployment of electric vehicles in urban areas. Renewable Energy. 99.

New York State Department of Environmental Conservation (NYSDEC). (2018). Community action on climate change: Climate smart communities, a network of leaders. https://www.dec.ny.gov/energy/76483.html

New York State Department of Environmental Conservation (NYSDEC): New York State Climate Smart Communities. (2015). New York community and regional greenhouse gas inventory guidance: Methods and data sources for community-wide (geospatial) GHG emissions inventories. Version 1.0.

Nolon, J. R. (2009). The Land Use Stabilization Wedge strategy: Shifting ground to mitigate climate change. William & Mary Environmental Law and Policy Review. 34 (1).

Nolon, J. R. (2012). Land use for energy conservation and sustainable development. a new path toward climate change mitigation. Journal of Land Use and Environmental Law. 27 (2).

Outka, U. (2016). Cities and the low-carbon grid. Environmental Law, 46:1. Lewis and Clark Law School.

Race, B. (2018). Climate change and cities: what we need to do. Forbes. Retrieved from https://www.forbes.com/sites/uhenergy/2018/10/15/climate-change-and-cities-what-we-need-to-do/#47cc4a9f28f6

Resource Systems Group, Inc. (2005). New Paltz Transportation and Land Use Project: Phase A Report. Prepared for the Town and Village of New Paltz and the New York State Department of Transportation, Region 8

Resource Systems Group, Inc. (2006a). New Paltz Transportation and Land Use Project: Phase B Report. Prepared for the Town and Village of New Paltz and the New York State Department of Transportation, Region 8

Resource Systems Group, Inc. (2006b). New Paltz Transportation and Land Use Project: Phase C Report. Prepared for the Town and Village of New Paltz and the New York State Department of Transportation, Region 8

Revi, A., Satterthwaite, D.E., Aragón-Durand, F., Corfee-Morlot, J., Kiunsi, R.B.R., Pelling, M., Roberts, D.C., Solecki, W. (2014). Urban areas. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535-612.

Schuldt, J.P., Rickard, L.N., Yang, Z.J. (2018). Does reduced psychological distance increase climate engagement? On the limits of localizing climate change. Journal of Environmental Psychology, 55.

Stone, B., Vargo, J., Habeeb, D. (2012). Managing climate change in cities: Will climate action plans work? Landscape and Urban Planning. 107.

Vitolo, T., Kallay, J., Whited, M., Malone, E., White, D., Hall, J. (2017). An analysis of municipalization and related utility practices, prepared for the District of Columbia Department of Energy and Environment (DC DOEE). Synapse Energy Economics, Inc.

Wallace-Wells, D. (2019). The uninhabitable earth: Life after warming. Tim Duggan Books.

Ward, B. (2018). The IPCC global warming report spares politicians the worst details: The dangers if governments ignore efforts to limit warming to 1.5C are more grave that the summary makes out. The Guardian. Retrieved from https://www.theguardian.com/commentisfree/2018/oct/08/world-leaders-climate-change-ipcc-report

Wattenbach, M., Redweik, R., Ludtke, S., Kuster, B., Ross, L., Barker, A., Nagel, C. (2015). Uncertainties in city greenhouse gas inventories. Energy Procedia. 76.

While, A., Whitehead, M., (2013). Cities, urbanisation and climate change. Urban Studies. 50(7).

Whitmarsh, L., Seyfang, G., O'Neill, S. (2011). Public engagement with carbon and climate change: To what extent is the public 'carbon capable'? Global Environmental Change, 21.

Whitmarsh, L., Corner, A. (2017). Tools for a new climate conversation: A mixed-methods study of language for public engagement across the political spectrum. Global Environmental Change, 42.

World Bank. (2018). Urban development overview. http://www.worldbank.org/en/topic/urbandevelopment/overview