

Bellefonte Borough

Climate Action Plan



Local Actions and Policies to Reduce Bellefonte's Greenhouse Gas Emissions

Approved by Bellefonte Borough Council

September 21, 2020

[Reference to Public Record]

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This Climate Action Plan was made possible through a grant agreement between the International Council for Local Environmental Initiatives (ICLEI) - Local Governments for Sustainability and the PA Department of Environmental Protection, which was funded by the US Department of Energy State Energy Program. The template was developed by ICLEI – Local Governments for Sustainability, USA and was originally published in April 2018. It was later edited by PA Department of Environmental Protection in December 2019.

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Executive Summary

With seasonal variations and catastrophic natural disasters becoming more intense and frequent, climate change threatens the health, safety, and overall well-being of communities across the globe. The Commonwealth of Pennsylvania and Bellefonte are no exception. Bellefonte recognizes a growing need to address its own contribution to climate change, as well as adapt to the impacts that will occur and be exacerbated, absent local greenhouse gas reduction. This Climate Action Plan includes an inventory of Bellefonte's greenhouse gas emissions (GHGs) from community-wide activities, establishes an emissions reduction target, and outlines feasible actions to achieve that target. In addition, the Plan identifies ways in which GHG reduction actions can further Bellefonte's ability to adapt to climate change impacts. While this plan is not focused on adaptation, it ensures that GHG measures are not counteractive to Bellefonte's future resilience and will hopefully be a catalyst for developing a robust strategy towards that end.

Bellefonte's first GHG inventory illustrated the potential for significant emissions reductions in the energy and transportation sectors. Total emissions are projected to slightly increase with the borough's population growth rate unless aggressive action is taken. The actions introduced in this plan include policies and programs related to residential, commercial, and industrial buildings, renewable energy production, waste reduction, water and wastewater management, transportation, and adaptation to climate risks.

This Climate Action Plan is influenced by the goals set in the Commonwealth of Pennsylvania's 2018 Climate Action Plan. A future goal is to achieve 80% emissions reduction by 2050 compared to 2005 values, which may be estimated using the 2017 GHG inventory and known population growth rate. The actions set forth in this plan, when modeled, fall short of this statewide goal, and as with the Pennsylvania state plan will require further actions to be introduced when feasible.

1. Introduction

Climate change is the greatest environmental challenge of the 21st century, with overwhelming evidence in the past decade. It poses a serious threat not just to Bellefonte's natural resources, but also to our jobs and our health. Climate action also presents huge opportunities for creating a healthier, safer, and more equitable zero-carbon world. Bellefonte has an unparalleled opportunity to make changes in ways that create jobs and benefit all residents. Scientists expect that with the current trends in fossil fuel use, Americans may see more intense heat waves, droughts, rainstorms, floods, wildfires and landslides in the future. These impacts could drag down our economy, stress our natural resources and worsen inequities facing many Americans. Action is required at all levels, and local governments have a unique role to play in building low-carbon communities. In Pennsylvania, temperatures have increased by more than 1.8°F since the early 20th century and are expected to increase by an additional 5.4°F by 2050. Similarly, annual precipitation in Pennsylvania has increased by approximately 10% since the early 20th century and is expected to increase by another 8% by 2050, with a 14% increase during the winter season (Shortle et al. 2015).

These impacts are caused by the accumulation of greenhouse gas (GHG) such as carbon dioxide (CO₂) and methane (CH₄) in the atmosphere, primarily resulting from burning fossil fuels and land use changes. Although the natural greenhouse effect is needed to keep the earth warm, a human enhanced greenhouse effect with the rapid accumulation of GHG in the atmosphere leads to too much heat and radiation being trapped. Carbon emissions from human activities have continued to rise in recent decades, reaching the highest rates in human history between 2000 and 2010 (Intergovernmental Panel on Climate Change (IPCC), 2014). About half of all carbon dioxide emitted between 1750 and 2010 occurred in the last 40 years. The energy, industry and transportation sectors have dominated the rise in emissions. In Pennsylvania, the sectors responsible for the most GHG emissions are industrial at 31%, electricity production at 30%, and transportation at 23% (Pennsylvania Department of Environmental Protection (PA DEP), 2019). With the current trajectory of population growth, urbanization, and reliance on personal vehicles, emissions will only continue to rise. Given the critical impacts of climate change on humanity, the time to act to reduce GHG and our carbon footprint is now.

In addition to national and state efforts to make systemic changes that will reduce global emissions, local governments can play a powerful role in addressing climate change. The design of American communities—how we use our land, how we design our buildings, how we get around—greatly impacts the amount of energy we use and the volume of GHG emissions we produce. It is critical that communities like Bellefonte demonstrate that it is possible to dramatically reduce GHG emissions while creating more vibrant and prosperous places to live and do business.

Statewide Climate Action

In 2008, the Pennsylvania Climate Change Act was passed, and requires the Department of Environmental Protection (DEP) to (1) develop an inventory of GHG emissions and update it annually; (2) administer a Climate Change Advisory Committee; (3) set up a voluntary registry of GHG emissions; and (4) prepare a Climate Change Action Plan and Climate Impacts Assessment, both to be updated once every three years. The most recent Climate Impacts Assessment was updated in 2015, and the most recent Climate Action Plan, as well as greenhouse gas inventory, were released in 2019. These documents offer information and guidance for local climate action planning in the Commonwealth. The Climate Impacts Assessment provides a scientific basis for potential statewide impacts of global climate change, which can be used alongside available local data to inform community adaptation efforts. The PA Climate Action Plan summarizes statewide greenhouse gas emissions, sets an emissions reduction target, and describes potential mitigation and adaptation actions for residents and businesses, as well as local and state government. The reduction targets are 26% by 2025 and 80% by 2050 from 2005 levels, consistent with an executive order signed by Governor Wolf in 2019 (PA DEP, 2019).

To ensure consistency with the PA Climate Action Plan, Bellefonte's reduction targets meet the statewide targets. In addition, many of the statewide actions were incorporated into this plan, which is described further in Chapter 4: *Taking Action*.

Purpose and Scope of the Climate Action Plan

Bellefonte is joining an increasing number of local governments committed to addressing climate change at the local level. Along with a cohort of 19 other jurisdictions in the Commonwealth of Pennsylvania, Bellefonte began the climate action planning process in 2019. College students were matched with staff from each jurisdiction and were trained by ICLEI USA on each component of the climate action planning process. They worked together to develop individual climate action plans. ICLEI's technical guidance was enabled via a grant from US Department of Energy State Energy Program through the PA Department of Environmental Protection.

Bellefonte Borough recognizes the risk that climate change poses to its residents and businesses, and is acting now to reduce the GHG emissions of both its government operations and the community at-large through the innovative programs laid out in this Climate Action Plan. Furthermore, it is recognized that Bellefonte needs to address existing climate risks such as extreme heat and increased flooding and adapt its systems and infrastructure to new conditions. This Climate Action Plan takes advantage of common sense approaches and cutting-edge policies that our local government is uniquely positioned to implement – actions that can reduce energy use and waste, create local jobs, improve air quality, preserve our local landscape and history, reduce risk to people and property, and in many other ways benefit Bellefonte for years to come.

Purpose

By creating a clear course of action so that everyone has a role in creating and achieving climate and sustainability goals, our Climate Action Plan drives and coordinates local efforts toward a reduction in GHG emissions of 80% percent below 2005 emission levels by 2050.

The Climate Action Plan is a framework for the development and implementation of actions that reduce Bellefonte's GHG emissions. The Plan provides guiding objectives and actions to realize Bellefonte's GHG reduction goal.

In addition to addressing mitigation concerns, the Climate Action Plan considers the vulnerability of Bellefonte to hazards that are and will continue to be exacerbated by climate change. The plan prioritizes GHG reduction measures that support climate adaptation and does not propose any actions that are maladaptive to foreseen climate change impacts.

Scope

This Plan covers objectives and actions for reducing GHG emissions resulting from local government and community-wide activities within Bellefonte. It addresses the major sources of emissions in Bellefonte and sets forth objectives and actions in the following 7 sectors that both Bellefonte and community members can implement together to reduce greenhouse gas emissions:

- Commercial and Industrial Buildings
- Residential Buildings
- Energy Production
- Waste Management
- Water & Wastewater Management

- Transportation
 - Local Food

The Plan creates a framework to document, coordinate, measure, and adapt efforts moving forward. In addition to listing actions, the Plan discusses how to feasibly implement the Plan via timelines, financing, and assignment of responsibilities to departments, staff, or community partners where known. Future efforts will help determine the costs and feasibility of this framework.

Planning Process

While Bellefonte has already begun to reduce greenhouse gas emissions and climate risk through a variety of actions, this plan is a critical component of a comprehensive approach to reduce Bellefonte Borough's emissions. The planning process was based on the following overarching framework, developed by ICLEI – Local Governments for Sustainability, USA (ICLEI), and known as the Five Milestones for Climate Mitigation.

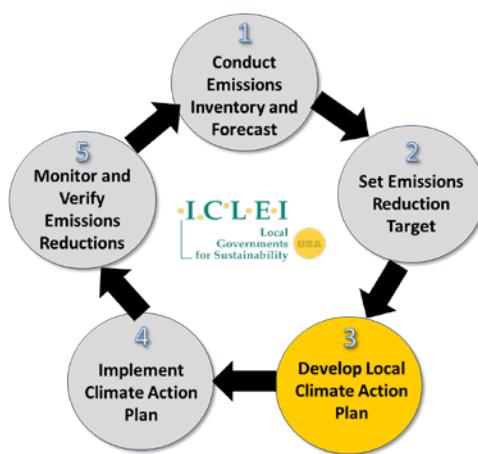


Figure 1: Five Milestones for Climate Mitigation

As indicated by the figure above, climate action planning is a continuing cycle and does not stop with the development of this document. However, this Climate Action Plan represents Bellefonte's first planning cycle, including the completion of the first three milestones:

Milestone 1: Chapter 3 summarizes the emissions inventory and forecast

Milestone 2: Chapter 4 sets reduction targets

Milestone 3: Chapters 5-12 outline objectives and actions

Chapter 13 also describes the initial steps of milestones 4 and 5, monitoring and implementation.

Planning Team and Stakeholders

The planning team consisted of Bellefonte Borough government representatives, county government representatives, concerned Bellefonte residents, and a student from Drexel University. The members of the planning team are listed below:

- Joanne Tosti-Vasey, Bellefonte Borough Council President
- Don Holderman, Assistant Borough Manager
- Raymond Stolinas Jr., Centre County Planning Director
- Madeleine Pelchat, Masters student at Drexel University
- Gay Dunne, Bellefonte Borough representative
- Kevin Abbott, Bellefonte resident and Business owner

The team met through conference call several times between February and May of 2020. Meetings were used to discuss the results of the GHG inventory, potential target emissions reduction goals, climate adaptation strategies, and community input.

Social Equity

Climate equity was a core component of the planning process and will continue to be through implementation. Climate Equity ensures the just distribution of the benefits of climate protection efforts and alleviates unequal burdens created by climate change. Implementation of this concept requires intentional policies and projects that simultaneously address the effects of and the systems that perpetuate both climate change and inequity. Under the status quo, however, not everyone is given the opportunity to participate and benefit.

Communities of color and low-income populations have historically been under-served by programs and investments and under-represented in decision-making, including for the development and implementation of climate policy. These exclusionary processes maintain or exacerbate disparities in public health; food, energy, and housing security; air and water quality; economic prosperity, and overall quality of life. These inequities primarily stem from ongoing institutional racial bias and historical discriminatory practices that have resulted in the inequitable distribution of resources and limited access to opportunities.

Climate change is likely to amplify the impacts of these existing inequities. The Waterfront District and much of the South Ward near the top of S. Allegheny Street –have been identified as low to moderate income areas of the borough by the US Census Bureau. Low to moderate income people as well as people of color,

immigrants, and the unhoused do live here and are also dispersed elsewhere in town. These individuals as well as outdoor workers, the very young, and the elderly also disproportionately bear the economic burdens of climate change impacts. In addition, the many economic and health benefits of carbon reduction investments are not often shared equitably across the borough.

In an attempt to ensure an equitable climate action plan considering these potential inequities, Bellefonte had a community-driven process, which is described in the following section.

Community-Driven Planning Process

Bellefonte's community-driven process included the following steps:

- Developed a survey covering actions related to residential and municipal energy usage, transportation, stormwater management, and locally sourced food.
- Sent the survey in the mail to members of the community and posted a Google Forms link to online community pages.
- Held a focus group over Zoom to elaborate on survey responses and provided additional feedback.
- Compiled community responses and used the feedback to directly influence actions outlined in the plan.
- Additional processes will include public meetings and ongoing meetings with stakeholders once the plan is accepted to further define steps and programs moving forward.

Community Survey Responses and Implications

A survey was sent out to 75 randomly selected residents of the borough and it was also posted on the Bellefonte Borough website for people to download, fill out and return. Over 50% of the selected residents and 5 to 10 downloaded surveys were completed and returned. The survey responses clearly demonstrated the community's desire for local action on climate change. There were eleven people who filled out the surveys who agreed to participate in the focus group (eight were able to actually participate) to further flesh out the responses in the written survey.

The survey and focus group found that residents are passionate about renewable energy and interested to learn more about how to make the switch easily and cost-effectively in their homes. Inspired by this interest, the plan strives to assist in making this switch and to research the potential of local generation.

Weatherization of homes was another popular strategy for energy saving with almost 80% of responders actively interested in weatherizing their homes. Thus, this plan intends to meet the needs of residents to weatherize their home easily and cost-effectively

The survey found the current public transportation infrastructure to be unpopular. Many in the community felt their daily needs required a car, as opposed to walking, biking, or taking available public transportation. Actions in this plan will address the public transportation issues and provide more beneficial alternatives.

Many responders noticed flooding as an increasing issue in the public areas of Bellefonte. Actions in this plan will adapt to increased flooding from climate change using various stormwater management strategies. By dealing with stormwater infrastructure, the community will also help address the extreme weather effects within the borough.

Almost 90% of the community responders were passionate about increasing access to locally sourced food options and food sustainability. This plan addresses this desire, although the emissions reductions associated with these actions will not directly influence the greenhouse gas inventory, as food and food waste were not considered in our review.

Bellefonte intends to provide community workshops on the topics discussed in the survey to assist residents in making sustainable life changes.

Vision Statements and Objectives

1. Make Bellefonte a leader in clean and local energy that comes from the sun, wind, or other innovative renewable technologies.
2. Transform our buildings into high-performing places to live, work, learn, and play.
3. Ensure the benefits of climate action are equitably distributed and empower historically underserved populations to participate in the process of transitioning to a carbon-free community.
4. Transform Bellefonte into a community where people walk, bike, take mass transit, or carpool for most trips in a safe, accessible, and affordable transportation network.
5. Aggressively transition toward a clean, carbon-free transportation system that improves health and livability for the Bellefonte community.
6. Become a leader in sustainable, smart transportation through innovative partnerships, policies, programs, and technology.
7. Understand potential climate-related risks and mitigate these risks while preparing our community for chronic and extreme weather events.

The Climate Action Plan offers a robust set of objectives and actions that will address the climate hazard vulnerabilities and aim for an 80% reduction in GHG emissions by 2050. Each action and objective was

created and reviewed by a group of stakeholders who considered technology limitations, funding constraints, public support, feasibility of implementation, environmental justice considerations, and other barriers.

Bellefonte established the following targets to maintain a vibrant, healthy, and safe community for future generations, while improving the quality of life for those who live here today. The groups who will be measuring and collecting the data determine if these goals are achieved are listed in the specific plan by topic area later in this report.:.

By 2025

- Bellefonte will create an Environmental Advisory Review Board
- Bellefonte will install solar energy on municipal buildings such that 50% of energy is renewably sourced
- Bellefonte will switch to 100% LED lighting in all municipal buildings and public spaces and educate residents on the advantages of LED lighting
- Bellefonte will upgrade the building codes with energy efficiency guidelines for new construction and rental properties in both the commercial and residential districts.
- Bellefonte will install one electric vehicle (EV) charging unit each for EV police and public works vehicles.
- Bellefonte will double the amount of bike racks in the commercial district from 2020 values
- Bellefonte will work with CATA to increase CATA-GO service and provide a downtown loop trolley system
- Bellefonte will create a community garden in an underutilized area
- Bellefonte will establish a year-round indoor farmers market

By 2035

- 50% of Bellefonte's electricity mix will be renewable
- 25% of homes and businesses will have solar panels or will purchase solar or wind energy through a variety of alternatives for access to these forms of alternative energy, including but not limited to self-purchase, roof-top rentals, community alternative energy production, and utility company alternative energy production.
- 50% of homes using coal or oil-fired heating will convert to electricity with preference for renewable
- Increase annual number of households reached by low-income weatherization programs by 30%

- Bellefonte will incentivize Leadership in Energy & Environmental Design (LEED) certification and/or enforce net-zero building codes for new buildings –
- 10% of parking spaces will have EV charging
- 3 police cars and 25% of public works vehicles will be EV
- 20% of Bellefonte's commuters will carpool, 3% will bike, 9% each will walk, use public transit, and telecommute to work respectively
- Miles of bike lane per resident in low-income neighborhoods is equal to that in higher-income neighborhoods
- 50% of new sidewalk projects will be completed with 75% being permeable
- 20% of jobs in transit construction and renewable energy installation are provided to residents of low-income neighborhoods, or groups that face employment challenges.
- At least 30% of housing units within $\frac{1}{4}$ mile of high-frequency transit are designated affordable
- A food outlet selling fresh produce is located within a 15 minute walk of every resident
- An emergency cooling center is located within a 10 minute walk for the most vulnerable residents (based on age, income and other factors)

50% of necessary public stormwater management projects will be completed and residents provided with abatement programs for their homes By 2050

- 80% of Bellefonte's electricity mix will be renewable
- 50% of homes and businesses will have solar panels or will purchase solar or wind energy
- 100% of heating fuel derived from fossil-fuels (oil, natural gas and propane) will be switched to a low-carbon fuel source and/or electric heat
- 70% of Bellefonte's households and businesses will participate in smart grid meter programs
- 90% of Bellefonte's existing buildings will complete energy-efficiency improvements
- 50% of Bellefonte's tenants will participate in a green lease program
- 25% of parking spaces will have EV charging
- 80% of residential vehicles will be electric
- 100% of police vehicles and 50% of public works vehicles will be electric with sufficient charging stations

- 25% of Bellefonte's commuters will carpool, 5% will bike, and 15% will walk, use public transit, and telecommute to work respectively
- 100% of public transportation will be carbon free
- All of Bellefonte will have sidewalks with 75% of projects since 2020 made from permeable materials
- 100% of suggested stormwater management projects from 2020 assessment will be completed
- 10% of residents will have abatement runoff solutions on their property

2. Co-Benefits of Climate Action

Greenhouse gas reduction and climate resilience are not the only beneficial outcomes of climate action plans. The following outcomes are referred to as “co-benefits,” and they illustrate how taking action on climate change results in a more prosperous community.

1. Improving Public Health

Climate change mitigation activities, particularly those related to transportation, help to clean the air by reducing vehicle emissions and therefore improve public health. Mitigation activities help to engender a greater degree of choice for Bellefonte’s residents. More transit options combined with transit-oriented development practices make for a more vibrant, livable community with shorter commute times and more opportunities for active transport. This creates more connected and resilient neighborhoods.

Saving Money and Reducing Risk In addition to addressing climate change, measures taken to reduce greenhouse gas emissions have other important benefits. The most obvious of these is the potential for significant cost savings. Many of the measures in this plan pay for themselves quickly by reducing direct costs, such as fuel or energy used, and also indirect costs such as maintenance. For instance, a “right-sized” vehicle fleet is less expensive to purchase and fuel, while also being less costly to maintain. Encouraging energy efficiency, public transit use, building improvements, and other measures will also result in lower energy and water bills for residents and employers as well.

Acting now will also save on runaway costs on climate change, especially in the longer term. These costs range from infrastructure damage in extreme storms and pest control to industry losses, particularly for industries that depend on environmental conditions, such as winter sports.

2. Enhancing Resource Security

A key strategic side benefit of climate change mitigation activities is enhanced energy security through reduction in total demand. This will put less strain on the energy system as a whole as we transition to clean renewable energy. Similarly, demand shifts can help with improving water and food security as well.

Many of the actions identified here to mitigate GHG emissions will also help Bellefonte's government, businesses, and residents to adapt to a changing climate. For example, extreme and prolonged heat waves can put considerable strain on the reliability of energy delivery in peak periods, possibly leading to service disruption during times when cooling is most needed. By increasing efficiency across Bellefonte Borough, such service disruptions are less likely and Bellefonte Borough will be able to better cope with those situations. Similarly, climate actions can secure food and water sources and prevent damage and service disruptions to these systems from extreme weather events.

3. Creating Jobs

Renewable energy is a growing sector of the economy. The U.S. Department of Energy reports that sustainable tourism, green construction, and urban agriculture can provide job opportunities that didn't exist in the past. These climate protection measures can spur business and job growth during the design, manufacture, and installation of energy efficient technologies, which presents a particular opportunity to reinvest in the local economy and generate green jobs within Bellefonte. Downtown Bellefonte, Inc. can and will be brought into the discussion to assist in creating this opportunity going forward.

4. Fostering Social Equity

Social equity and justice are major concerns for addressing climate change, and thus were established as core values behind this plan. Equity is when all individuals have access to the opportunities necessary to satisfy their essential needs, advance their well-being and achieve their full potential. Environmental justice ensures fair treatment and meaningful involvement in the development of laws, policies and regulations and the identification of issues impacting vulnerable communities. As discussed in Chapter 1, Bellefonte's community-driven planning process generated solutions that will both address climate change and ensure a better quality of life for lower income people and people of color living in our community.

3. Bellefonte's GHG Emissions

Since the early 1990s, U.S. cities have developed community-wide and local government operations greenhouse gas (GHG) inventories based on accounting protocols created by ICLEI. Known as the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions and the Local Government Operations Protocol, these standards created a credible and defensible methodology which accelerated the number of inventories created and provides consistency within and across U.S. communities. In 2014, ICLEI partnered with the World Resources Institute and C40 Climate Leadership Group to create the Global Protocol for Community Scale GHG Emissions, which allows communities around the world to compare their emissions footprint.

Bellefonte used the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions as a guide in developing the following greenhouse gas inventory.

Through the completion of a local emissions study, or “greenhouse gas inventory,” our Bellefonte has determined emissions levels for the community as a whole. Community-wide emissions represent the sum total of emissions produced within Bellefonte limits as well as emissions resulting from electricity use within the jurisdiction, even if said electricity is generated elsewhere. In this way, the community-wide figures represent all emissions for which the community is responsible.

Bellefonte Community-Wide GHG Emissions

The following figure breaks down community-wide emissions in Bellefonte. Note that emissions from the Bellefonte's operations are embedded within the community-wide totals. For example, emissions from government buildings are included in the “Commercial” sector and emissions from Bellefonte fleet vehicles are included in the “Transportation” figure above. Government operations are therefore a subset of total community emissions.

CO₂e By Category

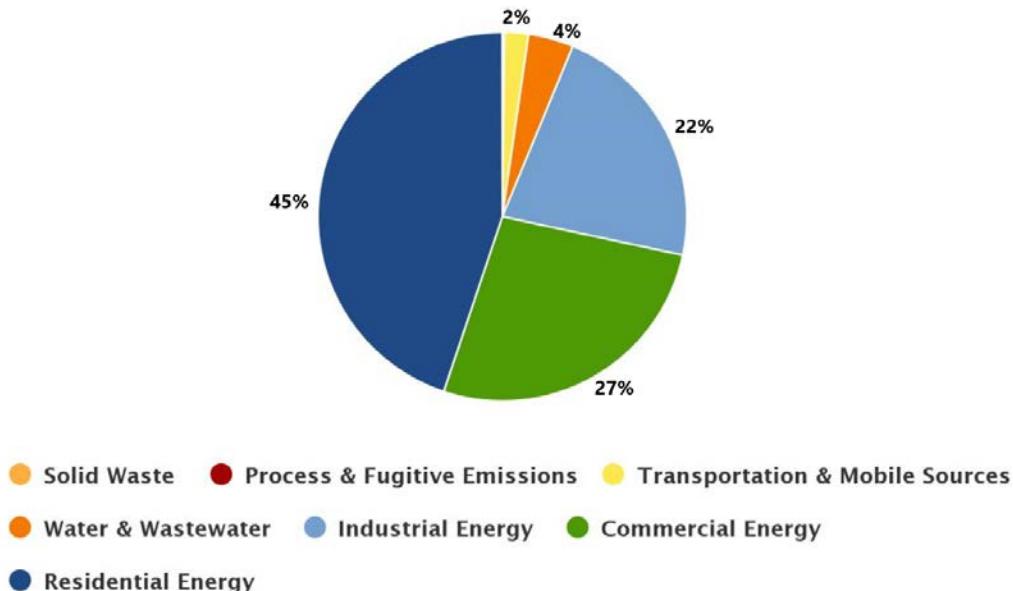


Figure 2: Bellefonte Community-Wide GHG Emissions in 2017

Forecasting Bellefonte's GHG Emissions

Bellefonte has also completed an emissions forecast based on projections of current data and expected future trends. This emissions forecast is the “Original” forecast (also known as a “Business As Usual” forecast), a scenario estimating future emissions levels if no further local action (i.e. projects within this Climate Action Plan) were to take place. The forecast indicates that, if we do not take action, GHG emissions will continue to increase.

Projected Growth in GHG Emissions

Figure 3 shows the projected growth in GHG emissions in Bellefonte from 2017 to 2050. For complete information regarding the emissions inventory and forecast, including methodology and supporting data, please reference Appendix I.

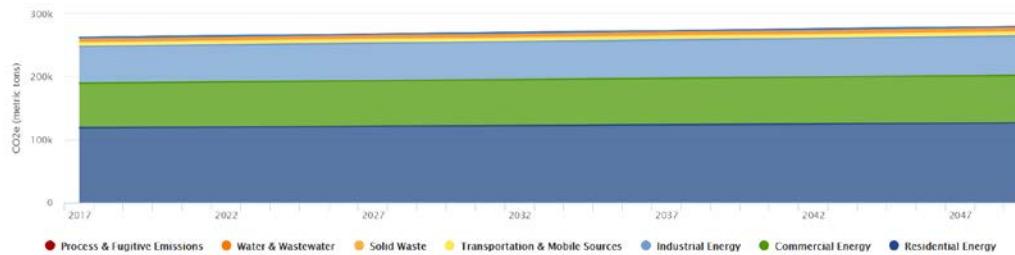


Figure 3: Projected Growth in GHG Emissions from 2017 to 2050

Bellefonte's GHG Reduction Target

Bellefonte has set targets to reduce its emissions to 80% percent below 2005 levels by 2050. At this point, we do not have emission figures for 2005 – the target starting date set by Pennsylvania. We do have data back to 2017 and will need to find a way to obtain the 2005 data after this plan is accepted to find what our starting point truly is.

Figure 4 compares the reduction target with the business-as-usual forecast. The combination of measures that Bellefonte has already implemented, are currently planned, and are presented through this Climate Action Plan are designed to achieve the 2050 targets. Reductions in 2050 rely on the best information currently available pertaining to population forecasts, future changes to building codes, and vehicle fuel efficiency standards among other information.

Bellefonte's reduction target is consistent with the statewide target of 26% reduction by 2025 and 80% by 2050 from 2005 levels, although the planning forecast shows a need for further action to meet this goal (see Appendix I for these calculations).

Bellefonte Borough Climate Action Plan

The summary table below identifies the sectors within Bellefonte Borough Climate Action Plan, the number of actions within each sector, and the contribution of each sector toward the GHG reduction goal. Each sector has a dedicated section within this document where objectives and specific actions (both new and those already employed) are described.

While the local government cannot address climate change by itself, government policies and practices can dramatically reduce greenhouse gas emissions from a range of sources and help prepare Bellefonte for the anticipated impacts of climate change. In addition, Bellefonte Borough will assist residents and businesses in their endeavors to reduce emissions through programs explained in this Plan. By working together,

Bellefonte can not only do its part toward achieving a stable climate - we can reap the benefits of healthier air, lower costs for utilities and services, improved transportation and accessibility, a more vibrant local economy, and many other positive side effects of reducing our carbon footprint.

Bellefonte Climate Action Plan Summary Table – Sectors

Sector	Description	Number of Distinct Actions	Anticipated MTCO2e Reduction by 2050	Percentage of Total Reduction at 2050
Commercial / Industrial Buildings	Policies and programs to reduce commercial and municipal sector energy use.	5	~23,900	17%
Residential Buildings	Policies and programs to reduce residential sector energy use.	9	~25,400	19%
Energy Production	Policies and programs to promote local small-scale renewables.	7	~829500	61%
Waste, Composting and Recycling	Policies and programs to reduce solid waste generation.	3	<100	1%
Water and Wastewater Management	Policies and programs to reduce energy associated with water and wastewater treatment.	2	<100	1%
Transportation	Policies and programs to reduce on-road vehicle miles traveled and promote electric or low emission vehicles.	10	~3,900	3%

*MTCO2e (Metric tons of CO₂ equivalent)

The Impact on Emissions

The figure below depicts historic GHG emissions, forecasted growth in emissions, and target emissions from 2020 to 2050. The color wedges represent the projected reductions in emissions based on local programs.

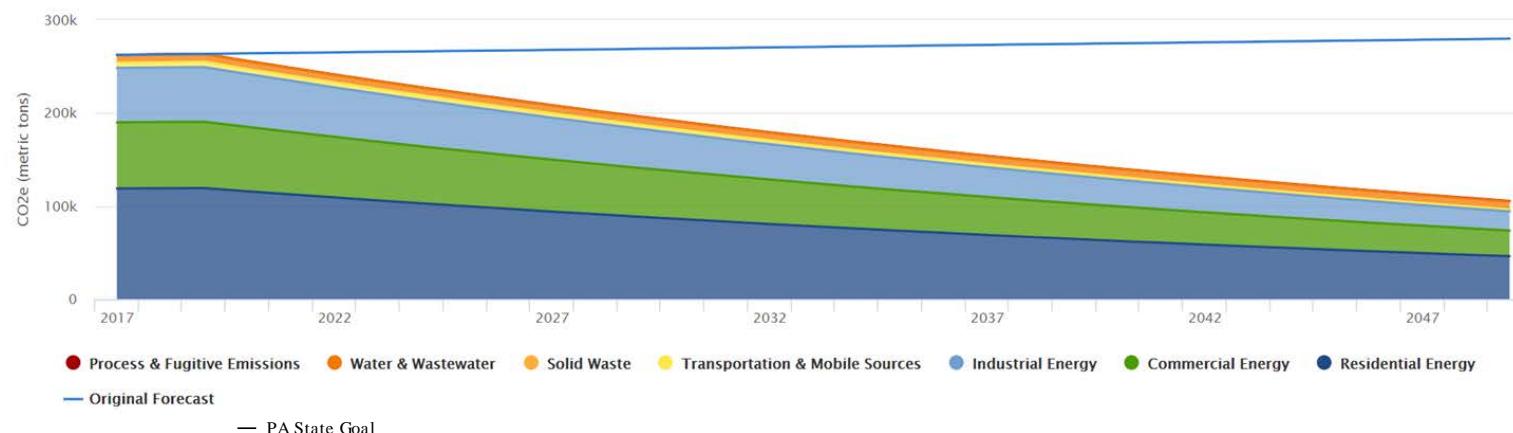


Figure 4: Visualizing GHG Reductions

4. Taking Action

In the following chapters, a series of objectives with supporting actions are explored for each emissions sector. An “Objective” is a goal, end result, or target, and an “Action” is a means of realizing the objective. Each sector draws on the actions of the local government, residents, and businesses, although some areas may be largely one or the other.

Emissions Reduction Potential

Calculating expected emissions reductions for each objective and action requires making assumptions about degree of implementation, technology, and individual behavioral changes several years into the future. The uncertainty associated with these assumptions makes it difficult to assign exact reduction totals to each objective or action. To address this uncertainty and provide a simple but useful reference for reduction potential, a series of symbols and percentage ranges has been devised to represent the emission reductions associated with each objective and its actions:

Symbol	GHG Reduction Potential
	Small Impact
	Moderate Impact
	Significant Impact

Specific implementation assumptions and GHG reduction estimates are listed in the Appendix.

Evaluating Co-Benefits

In addition to measuring the GHG reduction potential, each objective and action is also evaluated for other benefits such as public health, equity and justice, jobs and prosperity, and environmental conservation. The symbols below will indicate which co-benefits a measure will generate.

Symbol	Co- Benefit
	Supports jobs and economic prosperity by reducing cost over time
	Advances social equity



Fosters resource security



Improves public health and local environmental quality

Supporting Actions

Certain actions might be supportive of more than one objective within the same or another sector. These cross-cutting actions will be indicated in the “Supporting Actions” column for each objective.

New and Existing Actions

This Climate Action Plan includes a combination of existing policies and programs as well as new ideas based on best practices from around the country. Whether an action is new or existing is noted in the action heading.

Consistency with Statewide Climate Action Plan

The Commonwealth of Pennsylvania’s 2018 Climate Action Plan includes many actions that are meant to be implemented by local governments as well as on the state-level. This Climate Action Plan incorporates as many of those actions as possible and appropriate. The tables in the following chapters will indicate whether an action is adapted from the statewide plan.

Climate Adaptation

Some of the proposed actions reduce risk to climate hazards as well as greenhouse gas emissions, which is explicitly identified in the “Reduces Climate Risks” column. This Plan does not propose any actions that would foreseeably increase the community’s risk to climate hazards, but some actions are more directly supportive of climate adaptation than others. The “Climate Adaptation” chapter describes climate hazards and related actions in more detail.

5. Commercial Buildings

Energy consumed in commercial buildings and industrial processes account for approximately 50% of Bellefonte's total GHG emissions. Improving the efficiency of our commercial building stock and reducing the energy intensity of the local industrial sector will contribute significantly to achieving Bellefonte's greenhouse gas reduction target. This chapter focuses on opportunities to retrofit existing commercial and industrial buildings and to ensure that future activities in these sectors are compatible with our community's climate protection goals.

Objective	Supporting Actions	Co- Benefits	Reduction Potential
CB 1 – Retrofit existing commercial, municipal, and industrial buildings	RB 1, EP 1		
CB 2 – Ensure new commercial, municipal, and industrial construction is built to maximize energy efficiency	CB 1, RB 2		

Objective CB 1 – Existing Commercial, Municipal and Industrial Buildings

Retrofit existing commercial, municipal, and industrial buildings to achieve a 35% reduction in energy use by 2050



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
CB- 1A	Partner with local utility companies to ensure commercial properties maximize use of energy efficiency rebate programs	N	Y	Y		Community, Utility, and Public Works Dept	Number of program users
CB- 1B	Partner with utilities to offer on-bill financing for commercial energy efficiency retrofit projects	N	N	Y		Utility, Public Works & Finance Dept	Number of projects
CB- 1C	Upgrade all municipal building equipment and lighting to highest standards of energy efficiency	E	N	Y		Public Works Dept	Number of upgrades

Objective CB 2 – New Commercial, Municipal, and Industrial Buildings

Ensure new commercial, municipal, and industrial construction is built to maximize energy efficiency



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
CB- 2A	Continually upgrade building codes with latest standards in	E	Y	Y		Codes Enforcement	Upgrade of code

energy efficiency or higher			Dept
	Community, Codes Enforcement, Bldgs & Finance	Dept	Number of certified projects
CB-2B Incentivize EnergyStar and/or LEED certification for new construction	N	Y	Y



6. Residential Buildings

Energy consumed in residential buildings accounts for over 45% of Bellefonte's total GHG emissions. Improving the efficiency of our residential building stock will contribute significantly to achieving Bellefonte's greenhouse gas reduction target, while saving residents money on utility bills and reducing the need for new infrastructure. This chapter focuses on opportunities to retrofit existing residential buildings, increase the quality of new construction, and to ensure that future activities in these sectors are compatible with our community's climate protection goals.

Objective	Supporting Actions	Benefits	Reduction Potential
RB 1 – Retrofit existing residential buildings and homes	[X]	   	
RB 2 – Ensure new residential buildings and homes are built to maximize energy efficiency	[X]	   	
RB 3 – Educate residents on best energy efficiency practices	[X]	  	

Objective RB 1 – Existing Residential Buildings

Retrofit existing residential buildings and homes to achieve a 35% reduction in energy use by 2050



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
RB- 1A	Double the number of homes weatherized through existing programs per year	E	N	Y		Community and Public Works Dept	Number of homes weatherized
RB- 1B	Offer financing vehicle to residential sector for energy retrofits	N	N	Y		Community, Local Banks, Bldgs & Finance Dept	Financing program finalized
RB- 1C	Increase residential uptake of utility incentives for energy efficiency	N	N	Y		Community, Utilities, Public Works Dept	Number of residents participating

Objective RB 2 – New Residential Buildings

Ensure new residential buildings and homes are built to maximize energy efficiency



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
RB- 2A	Improve building codes to exceed minimum efficiency requirements	N	Y	Y		Building Codes Enforcement Dept	Code updated
RB- 2B	Incentivize EnergyStar and/or LEED certification for new construction and rental properties	N	Y	Y		Bldg Codes Enforcements & Finance Dept	Number of certified projects

Objective RB 3 – Community Energy Efficiency Education

Educate residents on best energy efficiency practices



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
RB- 3A	Host energy efficiency workshops open to the public	N	Y			Community, Borough Council	Code updated
RB- 3B	Share energy efficiency education resources on all local government websites and social media	N	Y			Borough Council	Number of certified projects

7. Energy Production

Broadly speaking, the use of fossil fuels for energy (including electricity, heating, transportation, and other uses) is the single largest contributor to greenhouse gas emissions and climate change. Fossil fuels still supply a considerable share of energy for electricity, heating, transportation, and other energy-producing uses. Emissions from fossil fuel combustion for energy, including transportation, represent over 95% of the community's total GHG emissions. Energy Production is a cross-cutting sector in that nearly all activities that take place in the community require energy of some sort. While West Penn Power is working hard to increase the percentage of electricity generated through renewable sources, opportunities also exist for citizens and Bellefonte's local government to produce small-scale renewable energy or fuels, offsetting the need for fossil fuels. This sector is limited to energy production exclusively – objectives and actions that focus on end use energy efficiency are included in other sectors. The programs and projects within this sector are designed to spur local government and community investment in renewable energy sources including those that produce electricity, heat, and mobile fuels.

Objective	Supporting Actions	Benefits	Reduction Potential
EP 1 – Enhance support to residents for installing small-scale renewable energy systems or purchasing renewable energy	CB 1, RB 1	 	
EP 2 – Supply at least 50% of Bellefonte local government electricity demand via local renewable generation	CB 1		
EP 3 – Transition residents from heating fuels to electricity	[X]	   	

Objective EP 1 – Small-Scale Renewable Energy Systems

Enhance support to residents for installing small-scale renewable energy systems



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
EP- 1A	Encourage community partners to finance and install renewable systems on large-scale private facilities	N	Y			Community, Economic Dev Committee	Number of partners
EP- 1B	Establish a program to offer renewable energy system financing to small commercial properties	N	Y			Community, Local Bank, Bldgs, Finance, Legal Depts, Utility Experts	Program establishment
EP- 1C	Establish a program to offer solar power system financing for residential properties	N	Y			Community, Local Bank, Bldgs, Finance, Legal Depts, Utility Experts	Number of residential solar systems
EP - 1D	Provide information on and encourage voluntary renewable energy purchase through utility on all local government websites and social media	N	Y			Community, Council	Availability of renewable energy information

Objective EP 2 – Local Renewable Generation for Bellefonte

Supply at least 50% of Bellefonte local government electricity demand via local renewable generation



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
EP-2A	Install renewable energy systems on Bellefonte-owned facilities and property such that 20% of total energy demand of local government buildings is met.	N	Y			PW Dept, RE contractors	Number of RE systems installed; percentage of energy demand met
EP- 2B	Execute renewable power purchase agreement for 30% of total electricity demand of local government buildings	N	Y			PW Dept, Utility	Establishment of RE power purchase

Objective EP 3 – Transition from Heating Fuels

Transition residents from heating fuels to electricity



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
EP-3A	Establish a program to offer financing for switching from heating fuels to electric heating in residential buildings	N	Y			Community, Local Banks, Finance & Legal Dpts.	Number of electric heating systems installed

8. Waste, Composting, & Recycling

Bellefonte's solid waste is disposed of, primarily, at Greentree Landfill. Emissions from decaying putrescible material directly contribute approximately 1% of Bellefonte's total GHG emissions and contribute to emissions in the Transportation sector via hauling of waste to and from facilities. Additionally, embodied energy within the items that we throw away might be harnessed through reuse and recycling of materials. It is in Bellefonte's long-term interest to reduce waste at its source, expand recycling facilities, reduce food waste, and enable re-use of materials. This chapter focuses on opportunities to reduce waste, reuse materials, and recycle what cannot be reused.

Objective	Supporting Actions	Benefits	Reduction Potential
WR 1 – Reduce solid waste generation by at least 15% by 2050	CB 1, RB 1		

Objective WR 1 – Reduce Solid Waste

Reduce solid waste generation by at least 15% by 2050



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
WR- 1A	Establish “Building Materials Reuse Warehouse” for community construction and demolition use.	N	N			Solid Waste, PW,	Establishment of warehouse
WR - 1B	Include food waste in residential composting program	N	N			PW	Introduction of food waste in composting program
WR - 1C	Provide community workshops on composting, recycling, and low-waste lifestyle changes	N	N			Council	Number of workshops held

9. Water & Wastewater Management

This sector does not include the methane collection system; please refer to Energy Production sector for this project.

Objective	Supporting Actions	Benefits	Reduction Potential
WW 1 – Upgrade the energy efficiency of water delivery and treatment systems by at least 15% by 2050	CB 1, RB 1		

Objective WW 1 – Energy Efficiency

Upgrade the energy efficiency of water delivery and treatment systems by at least 15% by 2050



Action Number	Action	New (N) or Existing (E)	State wide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
WW - 1A	Upgrade the mechanical and electrical systems at Water and Wastewater Facilities	E	Y	Y		PW Dept	Number of systems upgraded
WW- 1B	Participate in West Penn Power energy efficiency incentive programs to upgrade pump efficiency	N	N	Y		PW Dept, Utility Com.	Program participation

10. Transportation

Emissions from transportation is a common sight to nearly everyone in Bellefonte. Besides emitting greenhouse gases, transportation fossil fuels also produce a host of criteria air pollutants when combusted, reducing local air quality and affecting our health. Transportation accounts for approximately 2% of Bellefonte's total GHG emissions. This contribution is underestimated, however, as data was only available for in-boundary travel, and did not count commutes outside of Bellefonte. Thus, action on this sector should be significant. This chapter focuses on programs and policies to reduce emissions from transportation and includes design-oriented approaches as well as expansion of alternate modes such as walking, biking, or public transportation to and from the most common destinations in Bellefonte.

Objective	Supporting Actions	Benefits	Reduction Potential
TR 1 – Reduce vehicle miles traveled by single-occupancy vehicles by 40% by 2050	CB 1, RB 1		
TR 2 – Electrify all municipal fleet and buses by 2050	CB 1		
TR 3 – Encourage the transition to residential electric vehicles	WR 1, WW 1		

Objective TR 1 – Reduce single-occupancy vehicles

Reduce vehicle miles traveled by single-occupancy vehicles by 40% by 2050



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
TR- 1A	Expand CATA-GO service	E	N	Y		CATA	Number of riders
TR- 1B	Incorporate designated carpool parking requirements into the development code	N	N			CATA Ride n Share, Public Works	Number of parking spaces
TR- 1C	Convert major corridors in downtown Bellefonte into complete streets (i.e., roadways with bike paths and side walks)	N	N	Y		Penn Dot, Council, Public Works	Number of complete streets
TR- 1D	Encourage compact development and increase accessibility to necessities	N	N			Developers, Zoning, Planning Commission, BAIDA, DBI	Increased walkability access
TR- 1E	Construct permeable sidewalks in locations inaccessible to pedestrians	N	N	Y		Council, Community, Planning Commission	Number of projects

Objective TR 2 – Electrify municipal fleet and public transportation

Electrify all municipal fleet and buses by 2050



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
TR- 2A	Provide electric vehicle charging stations for all police and 50% of public works vehicles	N	N		  	Police, Public Works, Finance, Council, State Grants	Number of charging station
TR- 2B	Transition to 100% electric vehicle police fleet and 50% electric vehicle public works and administrative fleet	N	N		  	Police, Public Works, Finance, Council, State Grants	Number of EVs
TR- 2C	Transition to 100% electric public transportation vehicles	N	Y		  	CATA-	Number of EV public routes

Objective TR 3 – Residential Electric Vehicles

Encourage the transition to residential electric vehicles



Action Number	Action	New (N) or Existing (E)	Statewide CAP Action	Reduces Climate Risk	Co-Benefits	Lead Actor	Metric
TR- 3A	Provide electric vehicle charging at 25% of public parking spaces	N (in process)	N		  	Council, Public Works, Finance, State Grants-	Number of public EV charging stations
TR- 3B	Hold workshops and provide educational material on EV financing on all local government websites and social media	N	N		  	Council, Pittsburgh Green Cities, Drive Electric PA, banks, State & Federal Rebate programs	Accessibility of information

11. Climate Adaptation

This section provides a high-level assessment of potential climate impacts and highlights those greenhouse gas reduction actions that support adaptation for each type of hazard. While Bellefonte does not currently have the capacity to complete a more robust climate vulnerability assessment and adaptation action, the following analysis was completed to educate the public on local impacts and inform future efforts.

Anticipated Climate Impacts

Over the last 110 years, the Commonwealth of Pennsylvania has experienced a long-term warming of more than 1.8°F, as well as an increasing number of wet months. The warming and wetting trend is expected to continue at an accelerated rate, especially if the world continues on its current path of greenhouse gas emissions. Under this scenario, Pennsylvania will be about 5.4°F warmer than it was at the end of the 20th century, and the annual precipitation will increase about 8%. While the likelihood of meteorological drought is projected to decrease, months with above-average precipitation will continue to rise. These changes will have a variety of ecological, economic, and social impacts on the Commonwealth, particularly related to agriculture, energy, forests, human health, outdoor recreation, water, wetlands and aquatic ecosystems, and coastal resources (Shortle et al. 2015).

Bellefonte is likely to experience increased extreme temperatures and flooding from increased precipitation and extreme weather events.

Bellefonte used U.S. Climate Explorer and Temperate to identify likely changes from today through 2050. The following sections discuss the top climate hazards according to those projections. For more information about the science behind climate change, see Appendix II: Climate Change Science.

Rising Temperatures & Heat

The following graph indicates that average daily temperatures have been increasing and will continue to rise through 2099, which could impact agriculture, public health, and other sectors of the community.

This graph is from U.S. Climate Explorer.



Figure 5: Average Daily Temperature in Bellefonte Between 1950-2099

Increased Precipitation & Flooding

The following graph indicates that the number of days each year that experience more than 3 inches of precipitation have been increasing and will continue to rise through 2099, which could impact infrastructure, public health, and other sectors of the community.

This graph is from U.S. Climate Explorer.

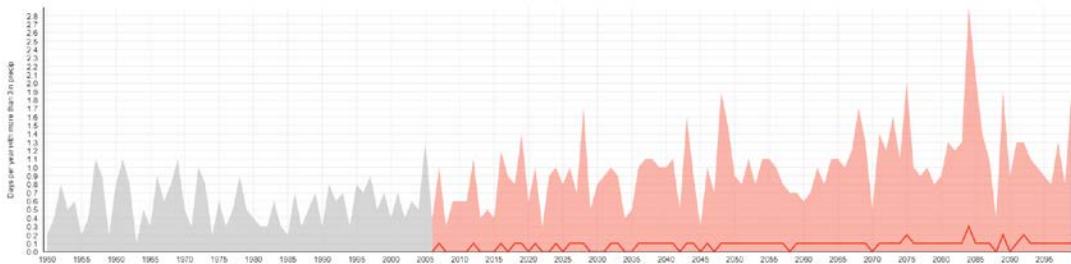


Figure 6: Number of Days per Year in Bellefonte with >3" of Precipitation Between 1950-2099

Adaptive Greenhouse Gas Reduction Measures

Some greenhouse gas reduction measures also reduce risk to climate hazards. The following are a few of many examples of how these outcomes can be related to one another:

- Actions that improve energy efficiency and distribute renewable energy can (1) reduce pressure on the grid when there is higher energy demand for heating and air conditioning during extreme heat events, and (2) increase energy independence for households and businesses, as opposed to complete reliance on centralized power infrastructure that could fail during a catastrophic event.

These types of actions include, but are not limited to:

- Energy-efficient building design for new construction, and retrofits for existing buildings (e.g. weatherization)
- Smart grid technologies
- Microgrids
- Actions that reduce impervious surfaces can reduce the potential for flooding by retaining stormwater in place. These types of actions include, but are not limited to:
 - Expanding or restoring green space
 - Installing green roofs, rain gardens, bioswales, pervious pavers, and other green infrastructure (as well as requiring them for future development)
- Installing green roofs and planting trees adjacent to buildings can regulate indoor temperatures during extreme heat events
- Expanding and protecting alternative transportation routes (bicycle, pedestrian, bus, and rail) provides network redundancies and alternative routes for emergency evacuation

The following table identifies specific greenhouse gas reduction actions from the previous chapters that have the potential to reduce risk from climate hazards, and which hazards they address.

Action	Extreme Temperatures	Flooding	Seasonal Variations	Emergency Evacuation
CB- 1A	X		X	
CB- 1B	X		X	
CB- 1C	X		X	
CB- 2A	X		X	
CB- 2B	X		X	
RB- 1A	X		X	
RB- 1B	X		X	
RB- 1C	X		X	
RB- 2A	X		X	
RB- 2B	X		X	
WW- 1A	X		X	
WW- 1B	X		X	
TR- 1A				X
TR- 1C				X
TR- 1E		X		

12. Monitoring Plan

Starting in January 2021, Bellefonte will engage with community members, businesses, institutions, and other stakeholders through a Climate Action Planning Task Force to prepare for any prerequisite or additional actions needed to begin Plan implementation.

These prerequisite actions include:

- Creating citizen advisory groups for programs that require considerable community engagement.
- Gathering bids for contracted services and equipment.
- Making necessary changes to local policies or existing programs, including staffing.

Establishing a monitoring process enables Bellefonte to track the impacts of the actions included in the plan and compare estimated impacts to what is actually achieved in terms of energy savings, renewable energy production, and GHG emissions reduction. Assessing the implementation status of the actions will allow determination of whether the action is performing well and to identify corrective measures. This process is also an opportunity to understand barriers to implementation and identify best practices or new opportunities in moving forward.

The table below describes the components of the monitoring reports. Action reports are to occur every two years and will only include status updates on the overall action, the mitigation action plan, and the adaptation action plan. The full monitoring report will occur every 5 years and in addition to the components in the action report, will include an updated community and municipal GHG inventory. This will help Bellefonte track its GHG emissions reduction progress. With the approval of this Climate Action Plan in 2020 the first monitoring action report will be due in 2022 and the first full monitoring report with the updated GHG inventories will be due in 2030. Ideally, the most recent GHG inventories should be no more than four years old.

Monitoring Report Component	Action Reporting	Full Reporting
Overall Action: Reporting any changes to initial action as well as updated information on human and financial resources	Yes	Yes

GHG Emissions Inventories:

Provide updated energy consumption and GHG emissions data for the reporting year	No	Yes
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Climate Action Measures:

Report the implementation status (completed, in progress, on hold) of key actions and update their impacts	Yes	Yes
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13. References

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Appendix I: Methodology

Greenhouse Gas Inventory Methodology and Results

The GHG inventory was compiled using ICLEI's ClearPath Inventorying Tool. The data collection and input process are outlined for each sector in the following section. The inventory was completed using 2017 data, the most recently available data for all required sectors.

Residential Energy Usage

Residential energy usage was divided into three categories: electricity, natural gas, and heating fuels. Data for Bellefonte's electricity mix was taken from the EPA's Emissions & Generation Resource Integrated Database (eGRID), using the GHG emissions data set for RCFW. Electricity activity data was provided by West Penn Power, Bellefonte's power utility. Natural gas activity data was provided by Columbia Gas, Bellefonte's natural gas utility. Heating fuel activity data, identified mainly as Distillate Fuel Oil No. 2, was estimated using county level data from the Energy Information Administration and borough level usage from the latest American Community Survey. The following graphic was produced by ClearPath based on the above described data entry, demonstrating the CO₂ equivalent GHG emissions associated with these actions.

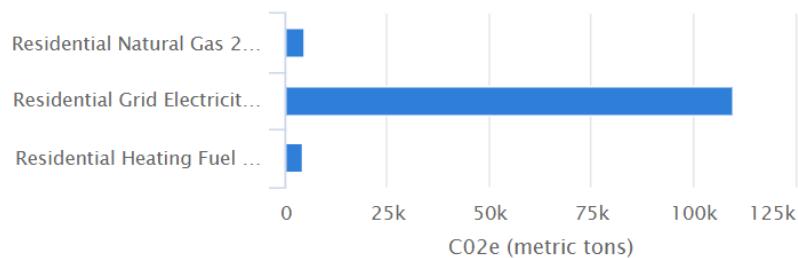


Figure 7: CO₂e associated with Bellefonte's residential energy usage in 2017

Commercial Energy Usage

Bellefonte's commercial energy usage was divided into two categories: electricity and natural gas. The electricity mix used in the factor set was the same as for residential electricity. Electricity and natural gas activity data were provided by West Penn Power and Columbia Gas respectively. The following graphic was

produced by ClearPath based on the above described data entry, demonstrating the CO₂ equivalent GHG emissions associated with these actions.

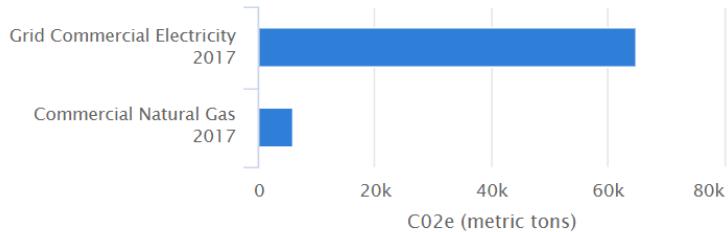


Figure 8: CO₂e associated with Bellefonte's commercial energy usage in 2017

Industrial Energy Usage

Only electricity data was provided for Bellefonte's industrial energy usage. The electricity mix used in the factor set was the same as for residential and commercial electricity. Electricity activity data was provided by West Penn Power. ClearPath calculated approximately 58,500 metric tons of CO₂ equivalent emissions associated with this action.

Transportation

Bellefonte's transportation was divided into four categories: passenger and freight diesel, and passenger and freight gasoline usage. Although rail does run through the borough, activity data was not made available by the North Shore Railroad Company. Daily Vehicle Miles Traveled within the boundaries of Bellefonte was provided by the PA Department of Transportation. The percentage breakdown of vehicle type was approximated using state level data provided by ICLEI. Transportation emissions associated with Bellefonte are assumed to be significantly higher, as in-boundary data was used, which does not account for the travel outside of Bellefonte that originates or ends in the borough. Future inventories should prioritize determination of associated travel outside the boundaries. The following graphic was produced by ClearPath based on the above described data entry, demonstrating the CO₂ equivalent GHG emissions associated with these actions.

CO₂e By Record

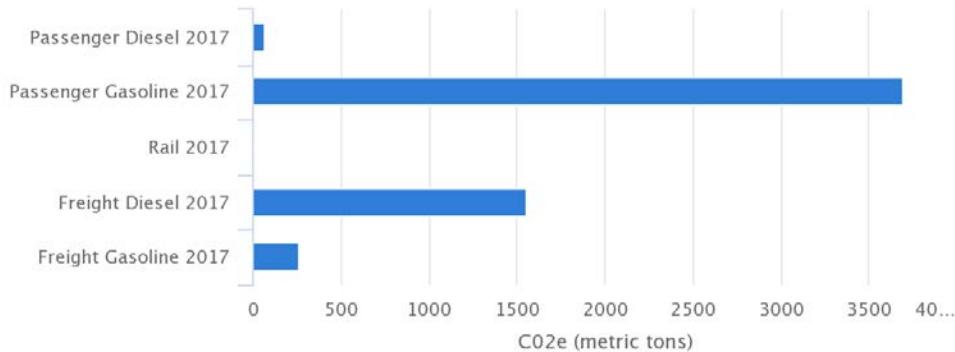


Figure 9: CO₂e associated with Bellefonte's transportation usage in 2017

Solid Waste

The percentage breakdown of materials found in municipal solid waste was provided as state level data by ICLEI. The Centre County Recycling and Refuse Authority (CCRRA) provided information on yearly total waste landfilled from Bellefonte in tons. The CCRRA also informed that Greentree Landfill uses methane capture and cleans and reuses it for vehicle fuel. ClearPath calculated over 200 metric tons of CO₂e emissions associated with Bellefonte's solid waste generation in 2017.

Water and Wastewater

Information on potable water distribution and wastewater treatment energy usage was available to Bellefonte directly. Only electricity is used for water extraction, treatment, and distribution. Natural gas and electricity data were provided for wastewater treatment. The wastewater facility does use nitrification in the treatment process. The following graphic was produced by ClearPath based on the above described data entry, demonstrating the CO₂ equivalent GHG emissions associated with these actions.

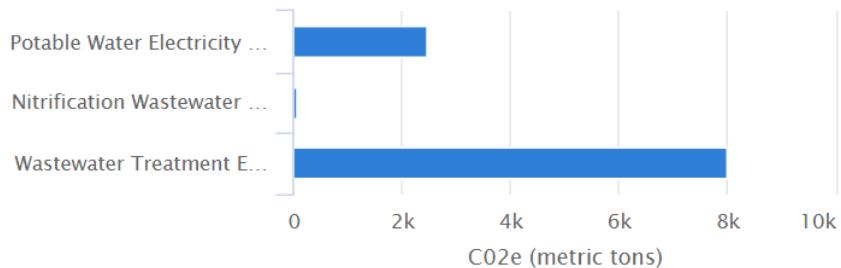


Figure 10: CO2e associated with Bellefonte’s water and wastewater processes in 2017

Fugitive Emissions

Fugitive emissions from natural gas distribution were also calculated using ClearPath. Using activity data provided by Columbia Gas, and an assumed leakage rate of 0.3%, from the Environmental Defense Fund’s Natural Gas Leakage Rate Modeling Tool, ClearPath calculated fugitive CO2e emissions of 262 metric tons for 2017.

Forecasting

Future emissions forecasting was completed using ClearPath’s Forecasting Tool. A population growth rate of 0.2% was assumed for 2020-2050. The carbon intensity factor was assumed to remain constant, as Pennsylvania does not have future goals for their Renewable Energy Portfolio set. Thus, a slight increase in emissions is expected in Bellefonte over the next three decades, unless the growth rate or carbon intensity factors described in these assumptions change.

Reduction Calculations

ClearPath’s Planning tool was used to determine reduction potential for various reduction strategies in this plan. The table below divides the reduction strategies input into the emissions forecast, provides the emission reduction between 2020 and 2050 values when the strategy is applied, and categorizes it into one of the sectors outlined in this plan. This breakdown was used to calculate Bellefonte Borough Climate Action Plan Summary Table.

Action Number	Associated ClearPath Reduction Strategies	Reduction Potential (CO2e metric tons)
CB- 1, CB- 2	Commercial Electricity and Natural Gas Reduction	~23,900
RB- 1, RB- 2	Weatherization, Residential Electricity and Natural Gas Reduction	~25,400
EP- 1, EP- 2, EP- 3	Residential and Commercial Renewable Energy Mix Increase, Transition from Heating Fuels	~82,900
WR- 1	Waste Education, Composting	<100
WW- 1	Commercial Electricity and Natural Gas Reduction	<100
TR- 1, TR- 3	Reduced VMT, Increased Public Transit	~1,600
TR- 2	Electric Vehicles	~2,300

Appendix II: Climate Change Science

The Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report affirms that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" (IPCC, 2014, p. 151). Researchers have made progress in their understanding of how the Earth's climate is changing in space and time through improvements and extensions of numerous datasets and data analyses, broader geographical coverage, better understanding of uncertainties and a wider variety of measurements (IPCC, 2014). These refinements expand upon the findings of previous IPCC Assessments – today, observational evidence from all continents and most oceans shows that "regional changes in temperature have had discernible impacts on physical and biological systems" (IPCC, 2014, p. 151).

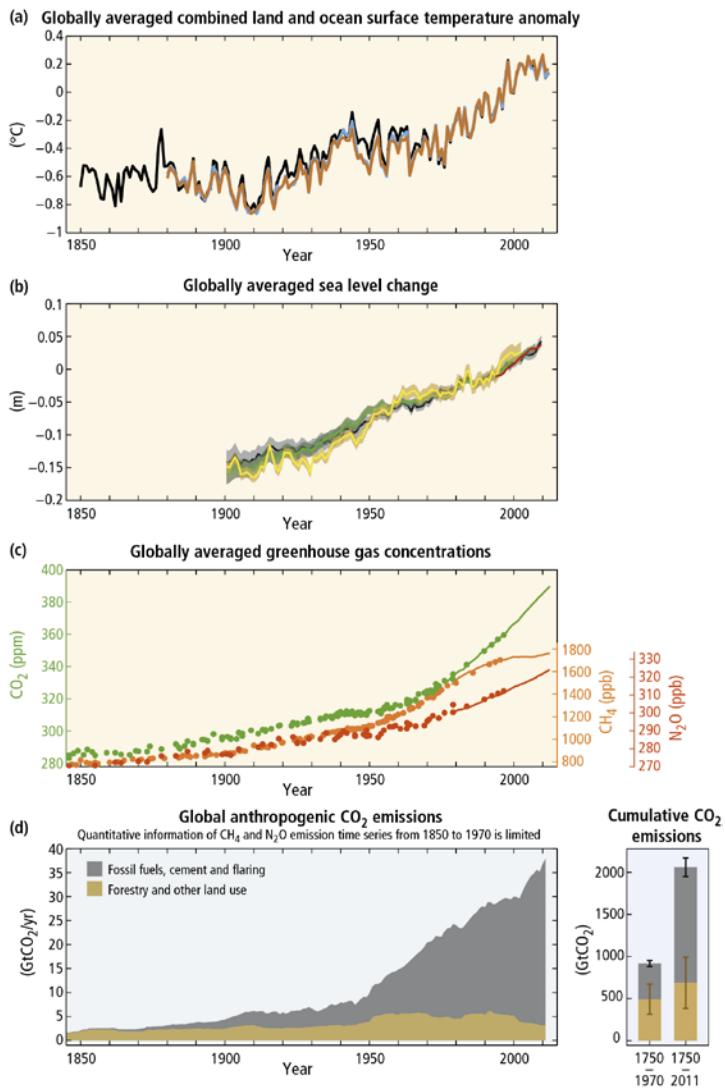


Figure 1 Observations and other indicators of a changing global climate system

The Fifth Assessment also asserts that “it is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations and other anthropogenic forcings together. Globally, economic and population growth continued to be the most important drivers of increases in CO₂ emissions from fossil fuel combustion. Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an

increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions" (IPCC, 2014, p. 151).

In short, the Earth is already responding to climate change drivers introduced by mankind.

Temperatures and Extreme Events are Increasing Globally

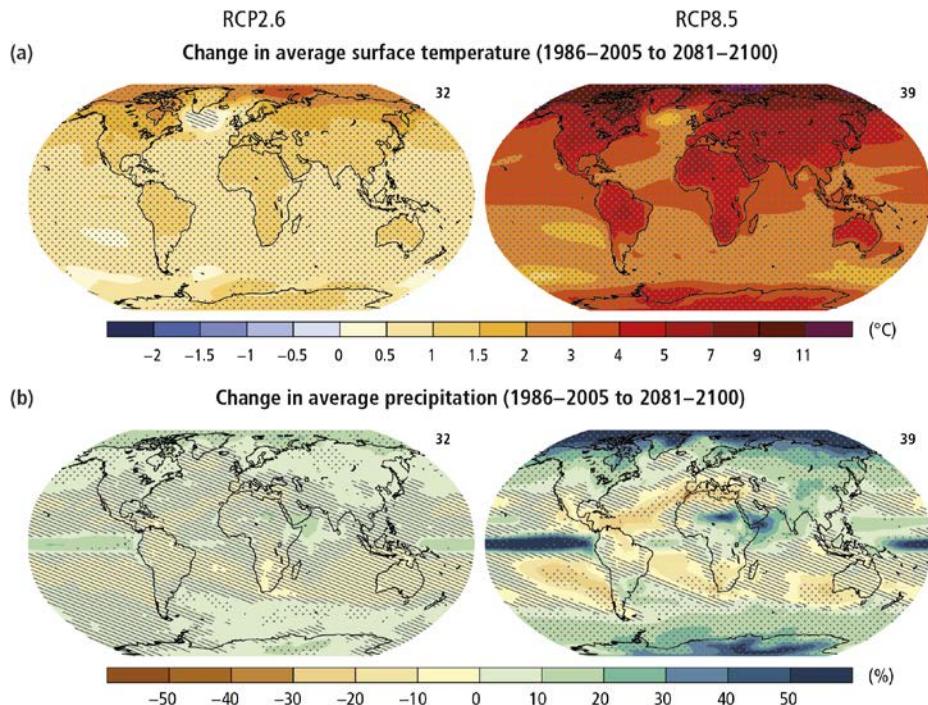


Figure 2 Change in average surface temperature (a) and change in average precipitation (b) based on multi-model mean projections for 2081–2100 relative to 1986–2005 under the RCP2.6 (left) and RCP8.5 (right) scenarios.

Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise. Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions (IPCC, 2014).

Climate Risks

Climate change is projected to undermine food security. Due to projected climate change by the mid-21st century and beyond, global marine species redistribution and marine biodiversity reduction in sensitive regions will challenge the sustained provision of fisheries productivity and other ecosystem services. For wheat, rice and maize in tropical and temperate regions, climate change without adaptation is projected to negatively impact production for local temperature increases of 2°C or more above late 20th century levels, although individual locations may benefit. Global temperature increases of ~4°C or more above late 20th century levels, combined with increasing food demand, would pose large risks to food security globally. Climate change is projected to reduce renewable surface water and groundwater resources in most dry subtropical region, intensifying competition for water among sectors.

Until mid-century, projected climate change will impact human health mainly by exacerbating health problems that already exist. Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low income, as compared to a baseline without climate change. Health impacts include greater likelihood of injury and death due to more intense heat waves and fires, increased risks from foodborne and waterborne diseases and loss of work capacity and reduced labor productivity in vulnerable populations. Risks of undernutrition in poor regions will increase. Risks from vector-borne diseases are projected to generally increase with warming, due to the extension of the infection area and season, despite reductions in some areas that become too hot for disease vectors.

In urban areas climate change is projected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges. These risks are amplified for those lacking essential infrastructure and services or living in exposed areas. Rural areas are expected to experience major impacts on water availability and supply, food security, infrastructure and agricultural incomes, including shifts in the production areas of food and non-food crops around the world.

Climate change is projected to increase displacement of people. Populations that lack the resources for planned migration experience higher exposure to extreme weather events, particularly in developing countries with low income. Climate change can indirectly increase risks of violent conflicts by amplifying well-documented drivers of these conflicts such as poverty and economic shocks (IPCC, 2014).

Greenhouse Gas Emissions Must be Reduced

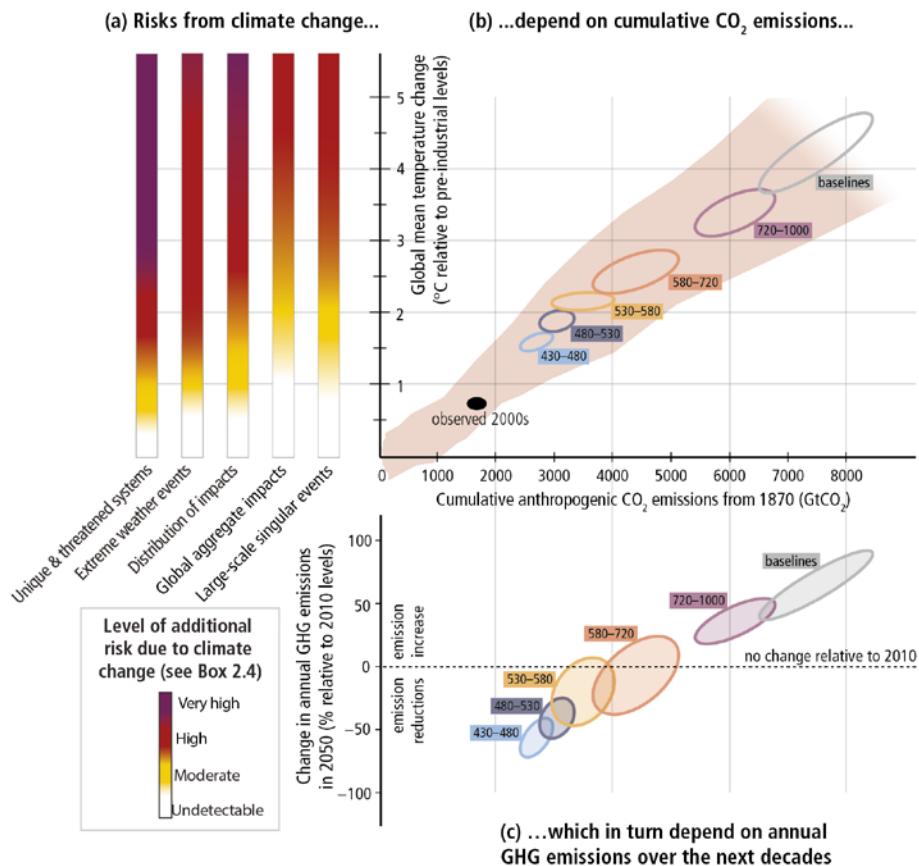


Figure 3 The relationship between risks from climate change, temperature change, cumulative carbon dioxide (CO₂) emissions and changes in annual greenhouse gas (GHG) emissions by 2050.

Limiting risks across Reasons For Concern (a) would imply a limit for cumulative emissions of CO₂ (b) which would constrain annual GHG emissions over the next few decades (c). Panel A reproduces the five Reasons For Concern. Panel b links temperature changes to cumulative CO₂ emissions (in GtCO₂) from 1870. They are based on Coupled Model Intercomparison Project Phase 5 simulations (pink plume) and on a simple climate model (median climate response in 2100), for the baselines and five mitigation scenario categories (six ellipses). Panel C shows the relationship between the cumulative CO₂ emissions (in GtCO₂) of the scenario categories and their associated change in annual GHG emissions by 2050, expressed in percentage change (in

percent GtCO₂-eq per year) relative to 2010. The ellipses correspond to the same scenario categories as in Panel B, and are built with a similar method (IPCC, 2014).

The recent and massive buildup of greenhouse gases in our atmosphere is conceivably even more extraordinary than changes observed thus far regarding temperature, sea level, and snow cover in the Northern hemisphere in that current levels greatly exceed recorded precedent going back much further than the modern temperature record.

Anthropogenic greenhouse gas emissions have increased since the pre-industrial era driven largely by economic and population growth. From 2000 to 2010 emissions were the highest in history. Historical emissions have driven atmospheric concentrations of carbon dioxide, methane and nitrous oxide to levels that are unprecedented in at least the last 800,000 years, leading to an uptake of energy by the climate system (IPCC, 2014).

In response to the problem of climate change, many communities in the United States are taking responsibility for addressing emissions at the local level. Since many of the major sources of greenhouse gas emissions are directly or indirectly controlled through local policies, local governments have a strong role to play in reducing greenhouse gas emissions within their boundaries. Through proactive measures around land use patterns, transportation demand management, energy efficiency, green building, and waste diversion, local governments can dramatically reduce emissions in their communities. In addition, local governments are primarily responsible for the provision of emergency services and the mitigation of natural disaster impacts. While this Plan is designed to reduce overall emissions levels, as the effects of climate change become more common and severe, local government adaptation policies requiring Bellefonte Borough Council approval will be fundamental in preserving the welfare of residents and businesses.