DOYLESTOWN TOWNSHIP
PRESERVING THE PAST. EMBRACING THE FUTURE.

CLIMATE ACTION PLAN

Produced by the Doylestown Township Environmental Advisory Council

ADOPTED JUNE 17, 2025

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Executive Summary

Climate change, sometimes referred to as global warming, is the challenge for our time, affecting every living thing on our planet. The overwhelming consensus of scientific thought is that human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Many people think climate change mainly means warmer temperatures, but temperature rise is only the beginning of the story. Because the Earth is a system, where everything is connected, changes in one area can influence changes in all others.

The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity. We already see some of these effects in Bucks County, with hotter summers, warmer, wetter winters, severe storms with flooding, and periods of drought. These changes have direct effects on human health, infrastructure and economic activity. We must accelerate the transition away from fossil fuels, methane release and destructive land management. The actions we take today will affect the health and sustainability of the world we leave to our children.

A transition away from the carbon-based economy holds the promise of many direct benefits and desirable co-benefits. These include 1) the slowing of global climate change and its consequences; 2) reduced pollution of all types and improvements in human health; 3) costs savings, as renewable energy is increasingly the most cost effective option; 4) increased employment as we build out the clean energy economy; 5) improved social equity locally and globally; 6) greater resilience as renewable energy is inherently more scalable and allows for greater distribution of production capacity; 7) improved quality of life.

The Doylestown Board of Supervisors unanimously adopted a resolution on March 17, 2020, that set out goals for renewable energy consistent with the Sierra Club “Ready for 100” initiative. The goals are as follows:

- 100% renewable electricity by 2035
- 100% renewable energy for all uses by 2050

This climate action plan is a follow-up to that resolution.

In order to gauge the task to be performed to reduce greenhouse gas "GHG" emissions in the Township, and to monitor future progress, an initial assessment of the level of carbon emissions within Doylestown Township was performed. This work was done with the assistance of staff and students at Penn State University and the Pennsylvania Department of Environmental Protection. As expected, the economic sectors that create the largest amount of GHG emissions in the township are transportation, followed by residential energy use and commercial energy use. Solid waste, water, wastewater and land use also contribute a small fraction of GHG emissions.

Following the baseline assessments, modeling was performed to assess the impact of various energy efficiency and energy transition strategies. An important consideration in modeling these strategies was the limitations of the authority of small municipalities. Local actions are necessary and important, and they have desirable co-benefits, but local actions alone are inadequate to achieve the desired goals. Thus, we propose a framework consisting of three categories of action, including 1) *political advocacy* to county, state and federal government for necessary policy and legislation; 2) *education* for residents and business owners to encourage local energy transition; and 3) *direct action* by the Township wherever possible. These categories of action are further broken down by sector.

Specific recommendations include the following:

- **Advocate** through political channels to the County, State and, where appropriate, the Federal government for 21st century building codes; legislation enabling community solar development and/or community choice aggregation; and 'greening of the grid' though a modernized electricity grid with decentralized power generation coming from renewable and nuclear sources.

- **Educate** township staff, residents and businesses about the range of individual actions that are available, effective and cost effective, including home energy efficiency, electric vehicles, residential solar and residential land management. We will also identify grants and other funding sources that are available at the township level.

- **Legislate** and adopt at the township level, within its authority and budget, policies that move the energy transition forward. These may include ordinances that enable desirable actions and behaviors such as updated zoning laws and installation of public EV chargers, as well as specific choices by the township itself which demonstrate how change can occur such as purchasing electric vehicles where feasible, installing municipal solar, improving management of township properties and installing walking and biking paths.

- **Monitor** progress periodically to measure changes against the stated goals. The energy transition we need is urgent, but slow. We need to remain attentive to the goals over time.

THE CHALLENGE

Climate change, sometimes referred to as global warming, is the challenge for our time, affecting every living thing on our planet. Although the current state of the issue reflects the cumulative effect of decades of human activity, we now understand that the current path is unsustainable and potentially catastrophic. Quoted below is how the United Nations describes the issue on their website:

"*Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.*

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases.

Climate scientists have showed that humans are responsible for virtually all global heating over the last 200 years. Human activities like the ones mentioned above are causing greenhouse gases that are warming the world faster than at any time in at least the last two thousand years.

The average temperature of the Earth's surface is now about 1.2°C warmer than it was in the late 1800s (before the industrial revolution) and warmer than at any time in the last 100,000 years. The last decade (2011-2020) was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850.

Many people think climate change mainly means warmer temperatures. But temperature rise is only the beginning of the story. Because the Earth is a system, where everything is connected, changes in one area can influence changes in all others.

The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.

Climate change can affect our health, ability to grow food, housing, safety and work. Some of us are already more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. In the future, the number of people displaced by weather-related events is expected to rise.

In a series of UN reports, thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5°C would help us avoid the worst climate impacts and maintain a livable climate. Yet policies currently in place point to a 3°C temperature rise by the end of the century.

The emissions that cause climate change come from every part of the world and affect everyone, but some countries produce much more than others. The seven biggest emitters alone (China, the United States of America, India, the European Union, Indonesia, the Russian Federation, and Brazil) accounted for about half of all global greenhouse gas emissions in 2020.

Everyone must take climate action, but people and countries creating more of the problem have a greater responsibility to act first."

What can we expect to happen in Southeast Pennsylvania?

Although global Climate Change is a worldwide problem, the US National Climate Assessment has made specific predictions and action plans for the US, as well as assessments for 10 separate regions of the US. Pennsylvania is in the Northeast Region. The US National Climate assessment predicts less distinct seasons, shorter winters and hotter summers, and increased intensity of precipitation. All of this will adversely affect agriculture, forestry and tourism; rising sea levels and ocean acidification affecting coastal recreation and commerce; more rapid breakdown of infrastructure like roads, bridges and dams; and negative impacts on human health due to heat, flooding and disease.[US GCRP Fourth National Report Ch 18 Executive Summary]

Climate Changes

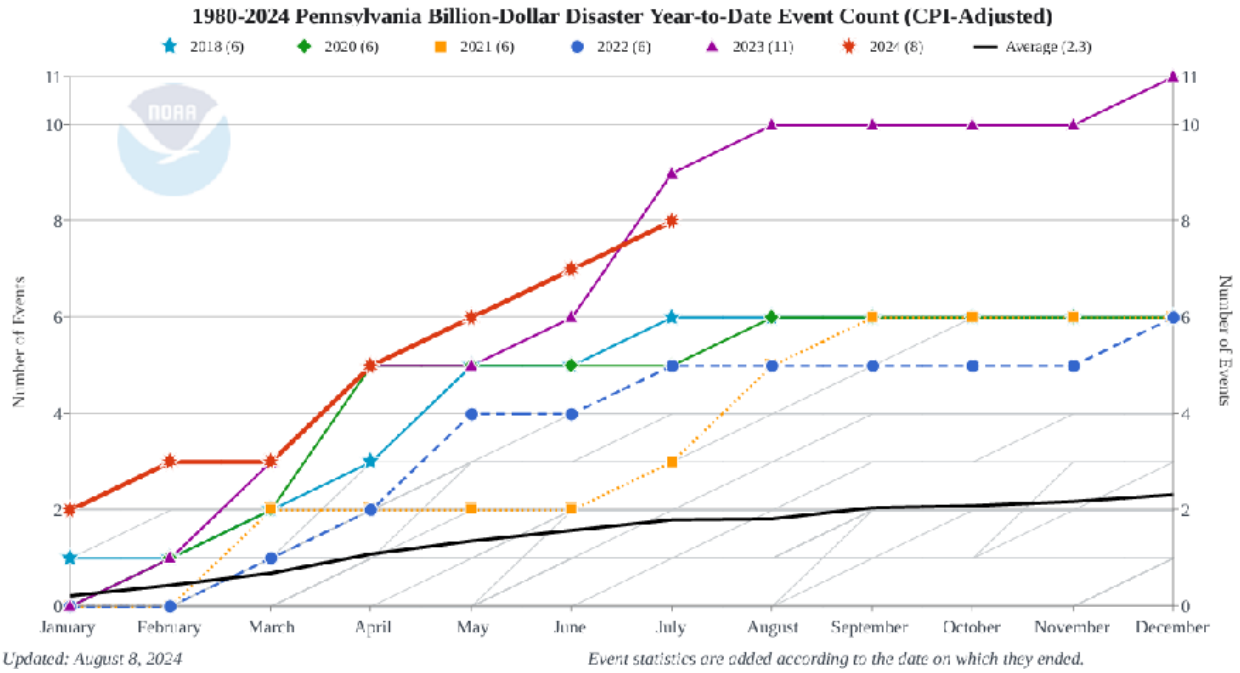
The major climate impact in our region is expected to be shorter winters, hotter summers with increased total precipitation and increased intensity of precipitation, especially in winter and spring. These trends are already in effect. The number of days with temperatures over 90° F are increasing. In 1960, there were, on average 15 days per year over 90° F in Philadelphia. In 2017, the average number was 22 days per year. By 2040, we can expect around 35 days per year over 90° F. Likewise, extreme rainfall is increasing, as shown by the massive flooding along the Mississippi and other parts of the central US. 2018 was also the rainiest year ever recorded in NJ, with more than 64 inches of rain recorded, compared to an annual average of about 45 inches per year. Doylestown has an average annual rainfall of 48 inches per year; in 2018 the total rainfall was 61 inches. In July 2023 there was fatal flash flooding along the Delaware River which killed 7 members of a single family; 5 people killed in Bucks County flooding, with 2 children still missing (Inquirer.com). Given all the streams and rivers within the township, damaging floods will increase, and low-lying areas will become permanently wet. In addition, there has been a dramatic increase in tornadoes in the Bucks County region. Across the Philadelphia/Delaware/South Jersey area for the 4 years 2014 to 2018, there were 6 tornadoes; for the four-year period of 2019 to 2023 there were 64 events! Philadelphia tornadoes: Number has increased by 1,000 percent across region | FOX 29 Philadelphia)

Infrastructure

Infrastructure will be negatively impacted by climate change. Aging infrastructure will fail more quickly due to stress from heat and flooding. Existing flood plain maps will become outdated, and some ordinances and regulations may need to be revised to adapt (e.g., for storm sewers and spillways, retention basins, construction sites and riparian buffers). Some low-lying areas may become unusable, and some residents may need to relocate. Power outages will also increase, and more resilient electric infrastructure will be needed.

Economic Impact

Climate change is predicted to cause large declines in economic growth [https://www.nature.com/articles/s41586-018-0071-9] over the course of this century; a temperature increase of 2.5-3.0°C is expected to result in a 15-25% decrease in GDP by 2100. In addition, billion-dollar weather disasters are increasing in frequency [NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2019) https://www.ncdc.noaa.gov/billions/]; in 2023 in Pennsylvania, there were 11 separate billion-dollar weather events. Locally, we can anticipate loss of economic activity due to power outages, flooding with occasional closure of business and schools, loss of agriculture and loss of tourist activity. In addition, tax rolls may be reduced as some damage-prone properties are devalued or relocated.



Human Health

Human health is also at risk, with much of the expected costs of global climate change being related to increased healthcare costs. Direct effects on health are related to extreme weather events with injuries, illness and stress, affecting mental health (including increased substance abuse); heat stress and drought, especially affecting vulnerable populations such as the elderly and the poor; and water-borne illness following floods. The spread of insect-borne disease like West Nile Virus, Zika Virus, Yellow Fever, encephalitis and many others will increase in frequency. Many of these diseases are transmitted by mosquitoes or ticks; as the climate gets warmer, the habitat for tropical mosquitoes moves north, and there are more days of mosquito activity. Since 1970, the number of mosquito 'danger days' has increased from 148 to 162, an increase of 14 days. This trend will continue as summers become longer.

Quality of Life

Beyond the expected economic and health-related effects of global climate change, quality of life will be affected as well. Recreation along rivers and beaches will be disrupted due to extreme weather events, erosion and damage. Forests and recreation areas with trees will be stressed due to the spread of invasive insects and other pathogens. Extreme heat will make summertime outdoor activities and exercise more dangerous and uncomfortable. Skiing will disappear from the Poconos by the end of the century.

As illustrated in many of the above examples, individual actions, while laudable and essential, will be insufficient to the task of addressing climate change given the scale of the issue and the country-level and industrial sources of GHGs being emitted. Collective action, including government at all levels, will be needed to tackle the challenge of climate change. Time is of the essence, and committing now to a course of action to reduce carbon emissions to zero by 2050 is essential.

THE PROMISE

Despite widespread misconceptions about the difficulty and cost of transitioning to a zero-carbon economy, the truth is that virtually all of the technologies necessary to achieve the goals have already been invented. Additionally, some of the solutions are already the lowest cost in the market, and others are well on their way to cost competitiveness. For example, the International Energy Agency ("IEA") famously proclaimed in 2020 that "Solar power is now the cheapest electricity in history." Other enabling technologies, such as battery electric vehicles, are more expensive to purchase in the U.S. (but very competitive on a life-cycle basis), while EV's in China are already cheaper than their internal combustion equivalent. With continued investment in clean technologies, prices will continue to fall and performance will continue to improve.

The benefits of achieving a net zero-carbon economy also extend well beyond mitigating the potentially catastrophic effects of climate change. They include:

- Improved public health – transitioning to green energy sources will remove major sources of air and water pollution now present in the extraction and use of fossil fuels. Removing fossil fuel heating and cooking in residences and commercial buildings will improve indoor air quality and reduce respiratory illnesses.
- Increased employment – according to the IEA in 2023, "More people work in the energy sector today than in 2019, almost exclusively due to growth in clean energy, which now employs more workers than fossil fuels." While jobs in some of the extractive industries will no doubt be negatively affected, the net is likely to be an increase in total employment and economic activity.
- Improved social equity – the world's poor suffer the most from the effects of climate change – heat, floods, droughts – as well as bear the brunt of the negative impacts of air and water pollution, suffering significantly worse health outcomes and life expectancy. The implementation of green energy solutions promises to improve this historic imbalance.
- Greater resilience – the current model of electricity production and distribution is highly susceptible to interruption and is extremely costly to extend to the world's population that does not have reliable access to electricity. Green energy production is inherently more scalable and allows for greater distribution of production capacity, significantly improving resilience.
- Lower cost – the zero carbon alternatives are already lowest cost in electrical generation, and other areas, such as EVs, are closing in on their carbon-producing competition, even without giving effect to the cost externalities associated with carbon pollution. As technologies mature, zero carbon solutions will save cost over their usable lives.

DOYLESTOWN TOWNSHIP RESPONSE

In recognition of the seriousness of the problem of climate change, Doylestown Township began a project in 2018 to address the issue. The Environmental Advisory Council initially led the effort to develop a plan for the Township. The first enabling action by the Board of Supervisors was a resolution adopted unanimously on March 17, 2020 that set out goals for renewable energy consistent with the Sierra Club "Ready for 100" initiative. The goals are as follows:

- 100% renewable electricity by 2035
- 100% renewable energy for all uses by 2050

This climate action plan is a follow-on to that resolution. It is intended to serve as a blueprint for action by the Township in successfully transitioning to carbon neutrality by 2050, consistent with the resolution adopted and international climate goals. This plan is intended to be specific, actionable, and measurable. Of course, it will also need to be a living document, and adaptation to changing events will be required along the way.

While this report was in process, the Township has already begun a number of initiatives in support of this Climate Action Plan. Among these actions are the following items of note:

- Adjusted the parking ordinance to provide for EV chargers
- Committed to the purchase of its first EV to replace an IC administrative vehicle
- Equipped its new community center with electric instead of gas appliances and designed the building to be "solar ready' in its roof construction
- Adopted a "lights out" resolution
- Commissioned a study of a ground-mounted solar array to supply some or all of the Township administration's electricity demand

DOYLESTOWN TOWNSHIP PROFILE

Doylestown Township is a predominantly suburban municipality in the central part of Bucks County. Bucks County is one of the collar counties surrounding the major urban center of Philadelphia. Doylestown Township is independent of Doylestown Borough, but the communities are closely intertwined, as the Township surrounds the Borough on three sides. The basic demographics of Doylestown Township, per the U.S. Census Bureau July 2022 estimate, are as follows:

- Population – 17,941
- Households – 6,203
- Race – 89.6% white
- College educated – 57.7%
- Older than 65 years – 22.6%
- Poverty rate – 3.9%

Compared to national and Pennsylvania averages, Doylestown Township is relatively older, whiter, more affluent and better educated. It is also more suburban, with a high proportion of single-family homes on larger lots, although the adjacent Borough is denser and more urban. Doylestown Township is also relatively stable from a population perspective, with very little population growth over the last decade.

The commercial sector within the township is predominately light industry, largely encompassing retail (shopping centers), health care, car dealerships, and office buildings. The largest single landowner is Del Val University.

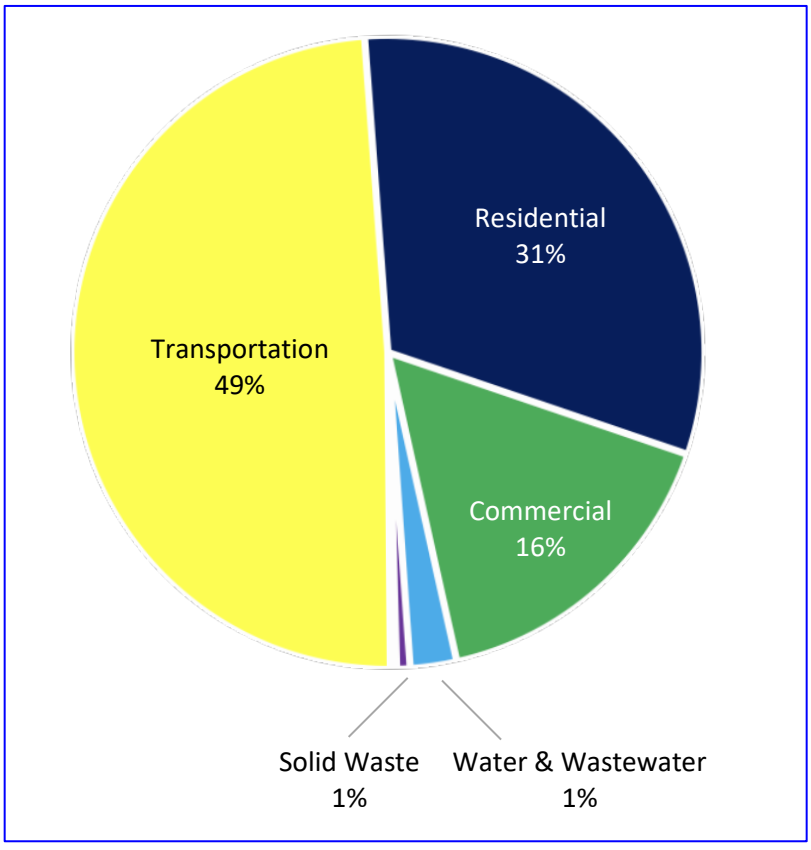
(https://datausa.io/profile/geo/doylestown-pa)

Since transportation in the US accounts for roughly 30% of overall greenhouse gas pollution, it's worth considering vehicle ownership and use in the Township. The majority of households own two or more vehicles and drive alone (72.6%), and commute for an average of 26 minutes a day. There are approximately 6,000 vehicles in the Township, and "a typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year" according to the EPA. Transportation in the Township is responsible for approximately 28,000 metric tons of CO2 per year.

All of these characteristics will need to be considered in defining a set of action plans that can be successfully implemented within our community.

BASELINE

In order to gauge the task to be performed to reduce GHG emissions in the Township, and to monitor future progress, an initial assessment of the level of carbon emissions within Doylestown Township was performed. This work was done with the assistance of staff and students at Penn State University and the Pennsylvania Department of Environmental Protection, using a tool provided by ICLEI – Local Governments for Sustainability (ICLEI, originally International Council for Local Environmental Initiatives). The results of that initial assessment are shown on the following graph:



The primary contributions to the greenhouse gas emissions in the Township are as follows:

- **Transportation** – By far the largest contributor to greenhouse gas emissions in the Township, the transportation sector is principally related to passenger car and light truck operation. Other minor contributors are heavy trucks and light aircraft. There is a modest amount of off-road carbon pollution contribution, primarily related to gas-powered lawn and garden equipment.

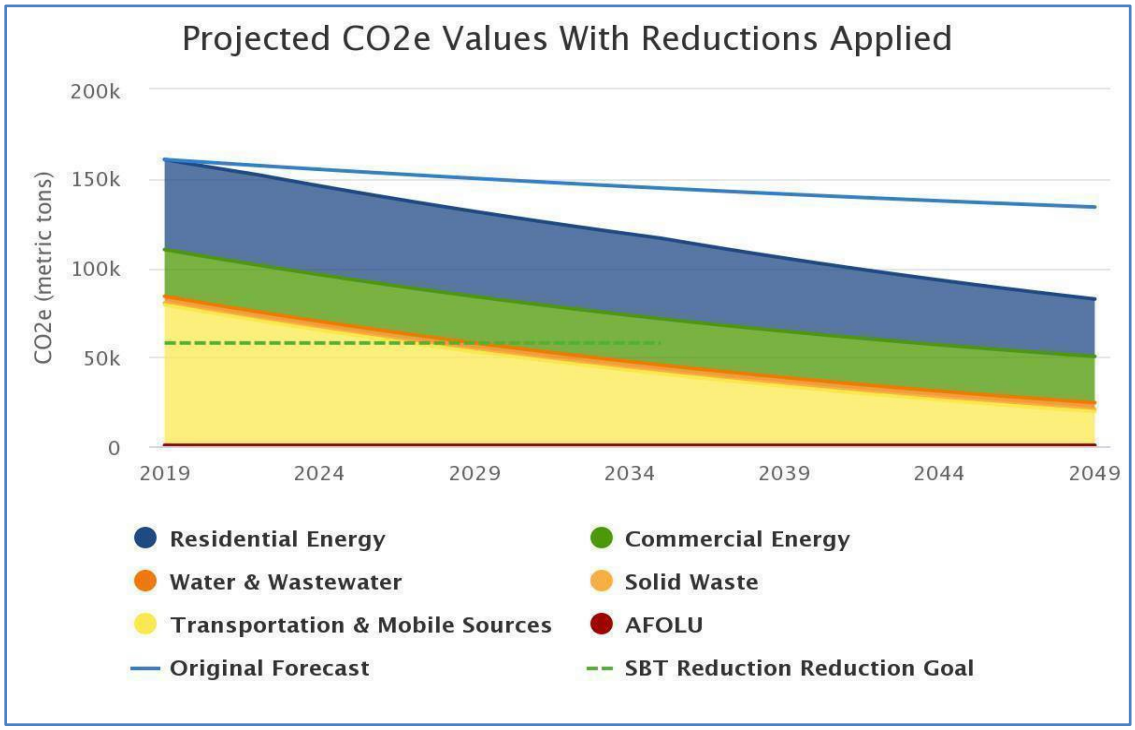
- **Residential** – The residential sector is the second largest source of greenhouse gas emissions. This relates to the various fossil fuels used for home heating – oil, natural gas and propane – along with residential electricity use. The township is fortunate that the electricity supplied by the grid has a large nuclear component, so is less carbon intensive than in the U.S. as a whole. However, this also represents a risk to the forward forecast, as those nuclear facilities are old, and may well be replaced by other sources, including fossil fuels, over the forecast period.
- **Commercial** – The commercial sector constitutes the third largest greenhouse gas source. The commercial sector in the township is principally office and shopping centers, with essentially no heavy industry. The commercial sector also benefits from the nuclear component of electricity production, and is subject to the same risk of substitution of fossil fuel sources.
- **Solid Waste and Water and Wastewater** – Both of these constitute relatively minor contributions to the greenhouse gas emissions of the Township.
- **Agriculture and Land use** – The agricultural sector is a fairly small contributor in the Township, and is composed primarily of the agricultural activities of Del Val University. Residential and Township land use (i.e., lawns, gardens and parks) contributes a very small fraction of overall GHG emissions, but improvements in this sector, especially increasing tree cover, will have important co-benefits for the natural environment and human quality of life.

MODELING PROJECTED OUTCOMES

As part of our analysis, we modeled the future path of greenhouse gas emissions in the Township given that we follow through on key elements of this proposed plan. Included in our analysis are various exogenous factors – things going on in the wider environment – that will have an impact in the Township. While the Township and its residents don't have direct control over the exogenous factors previously mentioned, there are many actions the Township the EAC and citizens can take to positively influence these factors. The intent here is to quantify the gap between the Township's renewable energy goals to the goal that we will reasonably need to address in our action plans. The exogenous factors that we modeled were as follows:

- Fuel economy standards for cars and light trucks
- Probable penetration of EVs as a percentage of the car and light truck fleet
- Installation of residential solar in the Township
- Penetration of residential heat pumps
- Effect of residential energy education
- Installation of solar in commercial sector

The net effect of these exogenous factors is shown on the following graph:



The model clearly shows significant improvement in carbon emissions compared to the baseline as we enact this plan, but it also shows a significant gap to the goal of reducing net carbon to zero by 2050. The challenge is to adopt and execute actions that can address this gap.

ACTION PLANS

Although Doylestown Township has committed to trying to reach specific GHG reduction targets, the reality is that municipalities like Doylestown have very limited authority and resources to make the kind of changes necessary to impact these exogenous factors. The actions necessary, (including large scale switches to renewable energy and improvements in energy efficient through modern building codes) are largely the responsibility of the state and federal governments.

The actions proposed below recognize those limitations. The framework we suggest is to consider three categories of action, including 1) *political advocacy* to county, state and federal government for necessary policy and legislation; 2) *education* for residents and business owners to encourage local energy transition; and 3) *direct action* by the Township wherever possible for policies, ordinances and strategic partnerships which allow for greater efficiency and faster transition away from fossil fuels for the Township facilities, and facilitate the same for residents. Please note that the use of "we" herein refers to the Township Supervisors, and by extension, those working for the Township.

It is important to note that many of the actions proposed have important *co-benefits*. This means that in addition to reducing GHG emissions, the proposed actions have other beneficial effects, and in some cases these co-benefits are quite substantial. For example, energy conservation will reduce energy costs and reduce other types of fossil fuel pollution; transition to electric lawn equipment will reduce noise pollution; and planting trees provides cooling shade, animal habitat and reduces soil erosion.

The actions proposed below are aimed primarily at climate change *mitigation*, i.e. slowing down GHG emissions to reduce the rate of climate change. Another important aspect of climate change planning is climate change *adaptation*, i.e. modifying infrastructure and related policies to adapt to the inevitable effects on our community of excessive heat, flooding, storms, fires and human health. This document does not specifically address climate change adaptation.

Transportation – On-road

Top-level drivers

- **Cars and light trucks** – In Doylestown Township, fossil fuel use in cars and light trucks is the largest contributor to greenhouse gas emissions in this category. Key to addressing this is the rapid adoption of EVs to replace Internal Combustion Engine (ICE) gas and diesel vehicles, with recharging provided by green sources. Long shot answers might be hydrogen fuel cell vehicles, although those come with substantial infrastructure issues.

- **Medium and heavy trucks** – Although not as large as cars and light trucks, this is a growth area as online purchasing with parcel delivery takes an increasing share of retail sales. Essentially none of this is domiciled in the Township, but trips in the township are increasing. Major fleets have begun transitioning to hydrogen and battery powered vehicles, which is key to addressing the carbon emissions in this category, as long as the sources of refueling are carbon neutral.
- **Bus fleets** – The largest component in this category are the school bus fleets that operate in the Township. Electric busses for school use are already available, and EVs are ideal in this low-mileage, long dwell time application.
- **Construction equipment** – Constituted of highly specialized and expensive equipment, this is a difficult area to address.

Impediments

- **Size and scale** – The small size and low density of the Township make some of the strategies employed by larger municipalities not feasible. For example, mass transit is inapplicable to the Township, with most of the population commuting to locations outside of the Township for work. Any mass transit solutions to reducing passenger car and truck miles traveled would have to come at a county level or higher.
- **Landlord/tenant problem** – Although the Township is largely composed of single-family homes, renters are currently at a disadvantage in considering conversion to EV ownership. Most multi-family units in the Township do not currently feature facilities for EV charging, and the incentives for landlords to invest in such equipment are weak. With a limited public charging network in the Township, conversion to EVs by renters is daunting.

Action Plans

- **Exogenous**
    - **Federal and state incentives** – Key to continued EV adoption will be federal and state incentives, as the Township is too small to offer meaningful incentives for the purchase of EVs. We will advocate for the continuation of EV incentives until the economics of EVs are superior to IC-powered vehicles.
    - **CAFE standards** – Federal and state Corporate Average Fuel Economy "CAFE" standards will continue to play a role in encouraging the manufacture of EVs. We will advocate for continued improvement in CAFE standards to facilitate the transition to EVs.
    - **Infrastructure funds** – Recent legislation has made various pools of federal and state investment available. This is particularly vital in addressing the charging network in the U.S. We will actively look for opportunities to deploy the available funds effectively to quickly address infrastructure needs in the Township.

- **Building codes** – The township does not control building codes, as the state has only granted limited authority in that area. Building code adjustments are urgently needed to ensure provisioning for EV chargers in all new construction. We will advocate for the state to adopt building codes with those provisions, or for the state to allow municipalities to amend their own building codes to affect that inclusion.
- **Bus fleets** – The primary bus fleet within the Township is that of the school district, a separate governmental entity. We will work to persuade the school district to adopt EV busses as soon as possible, or for the state to require such a conversion. We can also enable this transition by educating school administrators on the federal incentives and grants available. We will also advocate for adoption of zero carbon technologies for the county and regional transit systems.
- **Heavy vehicles** – Not all heavy vehicles yet have viable non-carbon alternatives. We will monitor technological improvements in this area, and advocate for conversions as they become available.

- **Community**
  - **Education** – Lack of familiarity and misconceptions play a large role in inhibiting purchase of EVs. We will work through various channels to help educate the community about the actual experience of owning/driving EVs, give people hands-on opportunities to interact with EVs, and help to overcome the misconceptions that are holding back widespread adoption. The EAC should lead this activity.
  - **Partner with vocational education** – The conversion to an EV-centric transportation system will create numerous opportunities for employment of skilled labor. We will partner with local education institutions and State and local Workforce Development agencies sources to expand the pool of technicians that will be needed.
  - **Partner with local landlords** – We will engage with local landlords – both multi-family residential and commercial – to expand the availability of local charging stations. We will serve as a resource guide to available funding, and educate them about the potential revenue stream represented by EV charging.
- **Municipal**
  - **Ordinance changes** – Both the Zoning and Subdivision ordinances will be adjusted to require the provision of EV charging at shopping centers and multi-family residential developments.
  - **EV charger deployment** – The Township will add EV chargers at appropriate Township owned or leased sites, subject to budgetary limitations, giving effect to federal and state incentives.
  - **Walking and bike paths** – The Township has an existing network of 31 miles of walking and bike paths. We will continue to develop his network, including enhanced connections to adjoining municipalities where possible.
  - **Congestion mitigation** – The Township will utilize various strategies, including traffic circles and traffic light timing, to minimize congestion and attendant pollution.

- **Idling Restrictions** – The Township will consider imposing limitations on idling of heavy vehicles to both limit carbon and other pollution and to encourage the transition to zero-carbon alternatives.

Transportation – off-road

Top-level drivers

- **Lawn and garden** – In Doylestown Township, the principal source of carbon emissions in the off-road transportation category is from fuel used for lawn and garden maintenance. With a largely suburban environment, the Township has a lot of area planted in lawns, with attendant lawn maintenance. Key to addressing this is to reduce the area planted in lawns, and to supplant gas-powered lawn maintenance equipment with battery-powered equipment, which is available in essentially all categories.
- **Agricultural** – This component is a minor contributor, as agriculture is not prominent in the Township. Battery-powered agricultural equipment is starting to become available, but is not a complete substitute for gas/diesel in all categories.

Impediments

- **Landlord/tenant problem** – Although the Township is dominated by single family homes, the rental segment represents a challenge in this area. There is little incentive for landlords to convert lawns to other types of landscaping that utilize less mechanical maintenance, or to convert away from gas-powered equipment, as most lawn maintenance is done by third-party contractors. Some of these landlords are also not located in the Township, and may be more difficult to interact with.
- **HOAs** – Home Owner Associations are present in some of the larger developments within the Township. Like landlords, HOAs have different incentives, and may be more difficult to convert, both in terms of land use and lawn maintenance, which is also likely to be outsourced.
- **Lawn care industry** – The lawn care industry in the Township is characterized by a multiplicity of small firms. These firms have a large investment in gas-powered lawn equipment and the infrastructure to support it. Their conversion to battery-powered equipment and the related infrastructure may take some time.

Action plans

- **Exogenous**
  - **Lawn equipment** – The transition to battery-powered lawn equipment is already well underway. Spurred by California's law, passed in 2021, banning the sale of gas-powered lawn equipment in that state after July 1, 2024, manufacturers have begun to offer an ever-expanding number of battery-powered products. Since then, other municipalities have followed suit for a variety of reasons – reducing pollution, reducing greenhouse gases, and, most of all, reducing noise. In some categories, battery-powered models already lead in sales at the consumer level. Product offerings are now available in every category, and solutions are available for most commercial applications, including large-scale users such as golf courses. Particularly promising are autonomous electric mowers that may revolutionize the residential market.
- **Community**
  - **Citizen Education** – Educating the public will be our primary approach to addressing the climate impact of lawn care. We will take a two-pronged approach – both to reduce the amount of residential acreage that is devoted to lawn and to switch from the use of gas-powered equipment to battery electric.
    - With regard to replacing lawns, we will focus on the advantages of planting native plant materials in lieu of lawns:
      - Reduced water and chemical requirements
      - Reduced time and money in maintenance
      - Improved habitat for wildlife, birds and insects
    - We will encourage the transition to electric lawn equipment by partnering with equipment retailers to provide opportunities for the public to see and test the battery-powered offerings that are now available, dispelling myths about the need for gas-powered models. We will also stress the ease of use and lack of required maintenance of battery-powered units.

- **Municipal**
  - **Reduction in lawn coverage**
    - **Ordinances** – the Township will explore adjustments to ordinances to encourage use of landscaping other than lawns. This could include modifying the subdivision ordinance to provide for different land use other than lawns in new developments. Other possible avenues could include a tree ordinance (where not in conflict with enabling legislation regarding solar and wind energy) and the initiation or modification of water use/pricing ordinances.
    - **Financial incentives** – the Township will explore the use of financial incentives for the replacement of existing lawn area with native plants or other non-lawn landscaping.
    - **Naturalization of Township-owned property** – the Township will complete the naturalization of Township-owned parcels that are not designated as parks, replacing lawn with native plants. This will both serve as an example for the public, and reduce labor associated with mowing.
  - **Electrification of lawn care equipment**
    - **Ordinances** – the Township will modify the existing noise ordinance to discourage/eliminate the use of gas-powered lawn equipment in the Township after a date certain.
    - **Financial incentives** – the Township will explore the use of financial incentives for the replacement of existing gas-powered lawn care equipment with battery-powered equipment. The Township will also maintain a database of state incentives available to professional lawn care services for the purchase or financing of battery-powered equipment.
    - **Contractor qualification** – the Township will explore providing some recognition or qualification program for lawn care contractors who have converted exclusively to battery-powered lawn care equipment.
    - **Replacement of Township-owned equipment** – the Township will set goals for the replacement of Township-owned gas/diesel-powered lawn equipment with battery-powered equipment and for the conversion by contractors utilized by the Township.

Residential

Top-level drivers

- **Heating and cooling** – Residential heating and cooling is the largest driver of greenhouse gas emissions in the building sector, representing over half of residential energy use. Some of this is direct in the form of the use of fossil fuels – oil, natural gas or propane – for heating, and some is indirect in terms of the grid electricity generated from fossil fuels used in heating and cooling. Replacing fossil fuels in home heating and providing carbon-

free electricity for heating and cooling will be essential to reaching net-zero in carbon emissions from the residential sector.

- **Appliances and mechanicals** – Water heaters, cooktops, ovens, clothes dryers and refrigerators all contribute to residential energy use, and may directly or indirectly contribute to greenhouse gases. Replacement of fossil fuel appliances for cooking, water heating and clothes drying will be necessary to achieve our carbon reduction the goals.
- **Lighting and electronics** – While smaller contributors, the population of these devices has increased over the years.
- **Building envelope** – The fundamentals of building design play a major role in the energy efficiency of the structure. Insulation, window efficiency, building tightness, siting and other architectural considerations, and the management of fresh air through heat exchangers can have a profound influence on heating and cooling demand of a residential building. Unfortunately, it is difficult and expensive to retrofit existing structures with these features. It is highly desirable to design these features into new construction.
- **Construction materials** – The selection of materials can have a significant effect on the embedded greenhouse gas impact of new construction.

Impediments

- **Landlord/tenant problem** – Although Doylestown Township has a higher percentage of single-family homes than average, the segment of renters and residents of congregate living facilities cannot exercise control over the energy efficiency of their domicile, and landlords do not necessarily have an incentive to make capital improvements to reduce energy use or switch away from fossil fuels due to mismatched incentives.
- **Residential construction** – There is relatively little new development in the Township, so changes to new construction will have only a modest impact on the future greenhouse gas emissions. Additionally, under state law, the Township cannot adopt more progressive building codes to reduce the energy demand of new construction.

Action plans

- **Exogenous**
    - **Building codes** – Residential buildings last decades if not centuries. Thus, any buildings built now will definitionally still be in existence in 2050 and will still be contributing to greenhouse gas emissions if built to current building codes and not retrofitted. Therefore, it is highly important to improve building codes to greatly reduce the energy footprint of residential buildings, and to move away from fossil fuels for heating, cooking and water heating. Nothing about this requires new technology, as buildings with these characteristics have been built around the world for over 30 years. Since the Township is not allowed by state law to promulgate building codes, we will advocate for the state to adopt building codes with those

provisions, or for the state to allow municipalities to amend their own building codes to effect those features.

- **Carbon-free electricity** – Recognizing that residential buildings will need to be converted from using fossil fuels to being powered by electricity in order to reduce greenhouse gas emissions, it is essential that buildings be supplied with carbon-free electricity in order to meet the 2050 target. This could be accomplished with on-site solar, but not in all buildings. Roughly one quarter of existing homes are suitable for solar generation, with the rest not having appropriate siting, roof compatibility problems, or tree cover. Additionally, the landlord/tenant problem prevents renters from taking advantage of on-site solar in most cases. Therefore, we will advocate for the following legislation at the state level:
- **Community solar** – There are currently community solar projects in 39 states, with 22 states having policies in place supporting community solar. The Commonwealth of Pennsylvania currently prohibits community solar. As community solar could open up the benefits of solar power to homeowners with homes that are unsuitable for on-site solar and to renters, we will advocate for the law to be changed to allow/encourage community solar and/or community choice aggregation.
- **Greening the electric grid** – Absent a transition of the electricity grid to renewable generation, the residential sector cannot reasonably be made carbon neutral. We will advocate for law and regulatory changes at the state level to achieve carbon-free electricity from the grid by 2050.

- **Community**
  - **Education**
    - Most of the residences that will exist in 2050 are already in use today. Therefore, most of the residential housing stock in the Township will need to be retrofitted with energy features that allow the transition to carbon neutrality. The opportune time for such retrofits to occur will be as existing appliances and mechanicals wear out and need to be replaced. We will mount an education campaign focused on both homeowners and suppliers so that energy-wise choices can be made to accomplish the following:
      - Replacing fossil fuel heating equipment with electric heat pumps.
      - Replacing existing a/c units with heat pumps in anticipation of future furnace replacements.
      - Replacement of gas stoves/cooktops with electric, preferably induction.
      - Replacement of gas/oil fired water heaters with electric, preferably heat pump, units.

- **Audits**
  - We will encourage the use of energy audits to identify opportunities to improve the energy characteristics of existing residential buildings, to include the following:
    - Improved insulation to reduce heating and cooling losses
    - High performance window and door replacement
    - Strategies to increase building tightness to prevent conditioned air loss
    - Use of ERVs or HRVs to manage heating/cooling losses of fresh air exchange
- **Incentives**
  - We will establish an online resource of available incentives to help building owners transition to energy efficient mechanicals and appliances.

- **Municipal**
  - **Ordinances** – The Township will modify its zoning and development ordinances to enable and encourage building with advanced energy management features. The Township will also modify its lighting ordinance to require systems in new construction that provide outdoor lighting on demand rather than continuously, such as timers and/or motion sensors. This will both save energy as well as have a positive impact on wildlife.
  - **Incentives** – The Township will consider providing incentives for energy audits and for improvements in existing residential structures.

Commercial

Top-level drivers

- **Industry focus** – In the Township, the commercial sector is comprised primarily of office buildings, shopping centers, car dealerships, and health care facilities. The offices and shopping centers are structured as corporate landlords and commercial tenants, with energy use dominated by lighting and HVAC, with some contribution of tenant-specific demand such as restaurant cooking facilities and market refrigeration.
- **Heating and cooling** – The commercial sector traditionally has not incorporated many advanced energy features with the exception of building control systems. Commercial HVAC has not moved aggressively to increase energy efficiency or to minimize fossil fuel use.
- **Lighting** – Commercial properties have a larger lighting component to their energy demand, particularly with parking lot lighting. Car dealers, in particular, have both high intensity and long duration exterior lighting.
- **Building envelope** – Typical commercial construction has not put much emphasis on minimizing the energy footprint of buildings, concentrating instead on speed and low cost.

Impediments

- **Landlord/tenant problem** – Similar to the residential sector, the mismatch of incentives commercial properties, suppresses investment in energy efficiency measures. Large corporate tenants may also have standardized specifications and contracts that do not allow for creative ways to share the costs/benefits of energy efficiency investments.

Action plans

- **Exogenous**
  - **Building codes** – Similar to residential construction, building in energy efficiency features when a building is built is far more cost effective and efficient than retrofitting buildings after the fact. We will advocate for the state to adopt building codes with those provisions, or for the state to allow municipalities to amend their own building codes to affect those features.
  - **Community solar –** Similar to the residential sector, community solar could open up the benefits of solar power to tenants in commercial office and shopping center buildings that otherwise would be unlikely to adopt solar power. We will advocate for the law to be changed to allow/encourage community solar.
  - **Greening the grid –** Absent a transition of the electricity grid to renewable generation, the commercial sector cannot reasonably be made carbon neutral. We will advocate for law and regulatory changes at the state level to achieve carbon-free electricity from the grid by 2050.
  - **State-level financing facility –** We will act as a resource for commercial owners to access state-level financing facilities that support green energy and energy-efficiency projects and will advocate for their continuation and expansion.
- **Community**
  - **Business Education** – As in the residential sector, most of the commercial buildings in the Township will need to be retrofitted with energy features that allow the transition to carbon neutrality. The opportune time for such retrofits to occur will be as mechanicals wear out and need to be replaced or when significant refurbishment takes place. We will mount an education campaign focused on building owners/developers so that energy-wise choices can be made to accomplish the following:

    - Replacing fossil fuel heating equipment with electric heat pumps.
    - Replacing existing a/c units with heat pumps in anticipation of future furnace replacements.
    - Replacement of gas/oil fired water heaters with electric, preferably heat pump, units.
    - Improving building envelopes, particularly with regard to insulation.
    - Adoption of green roof/cool roof technology.
  - **Financial incentives** – We will act as a resource to commercial owners/tenants to help them to avail themselves of available financial incentives for the adoption of energy efficient and non-fossil fuel building systems.

- **Municipal**
  - **Ordinances** – The Township will modify its zoning and development ordinances to enable and encourage building with advanced energy features.
  - **Development** – Where legally permissible, the Township will take advantage of requests for development and redevelopment approval to encourage the adoption of energy efficient and non-fossil fuel building systems.
  - **Incentives** – The Township will consider providing incentives for energy audits and for improvements in existing commercial structures.
  - **Energy** – The Township will adopt energy best practices for all municipal building projects.
  - **Building Retrofits** – The Township will retrofit existing buildings to comport with the energy goals by 2050. These will principally be done as existing systems require replacement, and will provide a payback over the life of the system for any differential in cost. This will include:
    - Heat pump heating and hot water
    - Advanced building controls
  - **Solar electric** – The Township will develop a solar electric facility to partially or fully supply the electricity needs of the municipal facilities or will participate in a shared solar facility.

Water/Wastewater

Top-level drivers

- **Water/Wastewater Treatment & Processing –** Both the delivery of water and the processing of wastewater contribute to the release of greenhouse gasses. In the Township, the municipal water system relies on wells and pumps to deliver water to households. The energy to run these pumps is potentially a source of greenhouse gas

emissions. On the wastewater side, the Township does not operate its own treatment facility, instead relying on the Bucks County Water and Sewer Authority, a regional agency, which has facilities outside the Township. Those facilities generate greenhouse gases from the energy needed to pump wastewater throughout the system, as well as generating methane, a potent greenhouse gas, directly in the treatment process. Additionally, 2,255 Township properties have on-site wells and septic systems. These systems require some amount of energy to run, as well as generate methane.

Impediments

- **Private systems** – The high level of on-site well and septic systems, which are only lightly regulated, makes any plan to reduce greenhouse gasses in this sector difficult.
- **Ownership** – The scale of the Township does not make operating its own wastewater treatment facility cost effective. Thus, it relies on an outside agency for wastewater treatment that it has limited influence over.

Action plans

- **Exogenous**
  - **Industry trends** – Appliance and plumbing manufacturers have made significant strides in reducing the water demands of common household tasks such as washing clothes and dishes, showering and flushing toilets. As these water-saving devices proliferate, less demand will be placed on the wastewater treatment facilities, whether private or municipal.
  - **Energy efficiency** – The Bucks County Water and Sewer Authority has made strides in reducing energy use. We will advocate for continued improvements in energy efficiency and utilization of green energy sources, as well as implementation of methane, nitrous oxide and carbon dioxide reduction or capture strategies.
  - **Greening the grid** – Absent a transition of the electricity grid to renewable generation, the water and wastewater sector cannot reasonably be made carbon neutral. We will advocate for law and regulatory changes at the state level to achieve carbon-free electricity from the grid by 2050.

- **Community**
  - **Education** – Our educational focus in the community will be on reducing water and wastewater demand by providing information on the following:
    - **Plumbing and appliances** – We will seek to influence consumer behavior in the selection of the highest water efficiency units in clothes washers, dishwashers, toilets and shower heads. We will also engage with local retailers to emphasize the value of these units. We will also serve as a resource for financial incentives available for the selection of water-saving appliances and fixtures.
    - **Rain barrels and cisterns** – We will educate the community about the benefits and use of rain barrels and cisterns for the collection of rainwater for use on landscaping, reducing the use of municipal or well water.
- **Municipal**
  - **Private systems** – The existence of a high proportion of on-site wells and septic limits the effectiveness of county and local improvements in municipal water and wastewater systems. Thus, we will work to convert private systems to municipal water and sewer, both to reduce carbon emissions and to better control pollution from wastewater.
    - We will engage with the community to develop a long-term plan for extension of the existing water and sewer systems and the conversion of private systems.
    - We will consider providing financial incentives and/or financing to encourage conversion from private systems to the municipal system.

Solid Waste

Top-level drivers

- **Solid waste** – Solid waste is at the end of a long chain of processes, all of which require energy and create greenhouse gas emissions. At its most basic level, solid waste represents the end of the useful life of an asset that is no longer productive, requiring the application of energy and raw materials to replace. Anything that is done to reduce the volume or velocity of this process serves to reduce the climate impact. The aphorism "reduce, reuse, recycle" concisely captures the fundamental principles of reducing the climate impact of solid waste.

Impediments

- **Consumer preferences** – In our capitalist economy, consumer preferences drive the production of goods and services. As climate impacts are not currently priced into finished products, what economists refer to as externalities, the price signal does not result in change in consumer behavior. For example, the recent consumer preference for fast fashion – cheap but short-lived clothing – rather than higher quality, longer-lived apparel, has greatly increased the amount of fabric waste going into landfills.

- **Private sector distributed collection and processing** – In the Township, the service of waste collection is provided by private companies, utilizing facilities outside of the Township. Under this model, the Township has little influence on either the demand or supply.

Action plans

- **Exogenous**
  - **Responsibility** – Given that many of the processes relating to solid waste occur outside of the Township, most of the large-scale action plans would need to occur at the County, State or Federal level. Nonetheless, we will advocate for actions in the following areas:
  - **Food waste** – Reducing food waste is ranked by Project Drawdown as the third most impactful strategy that can be pursued to reduce greenhouse gas emissions. We will advocate for the following:
    - Standardized, improved labeling laws governing such concepts as “best by” or “sell by” dates.
    - Laws requiring diversion of unsold food in supermarkets to charities or for use as animal feed.
    - Consumer education on reducing household food waste.
  - **Recycling** – With new restrictions from China, and potential restrictions from India, less of the waste stream is being successfully recycled. We will advocate for the following:
    - Consumer education and improved labeling of packaging to more clearly identify the exact recycling status of materials.
    - Requirements on manufacturers to establish recycling strategies for their products as a prerequisite for products to be sold. Europe has pursued this strategy with substantial success.
    - Requirements that biodegradable/compostable materials be substituted for single use plastics.
  - **Methane capture** – Methane is a potent greenhouse gas, and municipal solid waste (MSW) landfills are the third-largest source of human-related methane emissions in the United States. Landfills can be built or retrofitted with systems to capture and use the biogas emissions so that they do not enter the atmosphere. We will advocate for laws or regulations to require this.

- **Composting** – Up to half of the waste that enters landfills is organic waste that could be composted. Not only would large scale composting greatly reduce the land required for landfills, but it would also significantly reduce methane emissions. While the Township may not have the scale to manage its own municipal composting operation, a regional composting facility could be very successful, modeled on successful programs such as those in New York City, San Francisco, Seattle, Boulder, Colorado and Portland, Oregon. We will advocate for the establishment of such a program.

- **Community**
  - **Education** – Our efforts in community education will focus on reducing solid waste in the Township. It will include the following:
    - **Recycling** – We will sharpen the focus on recycling, providing clearer, more specific information on what can be recycled and the benefits from doing so. We will also give attention to dispelling myths about recycling.
    - **Composting** – We will provide residents with specific information on establishing a successful backyard composting program, along with information on equipment sources.
    - **Single use plastics** – As a follow-on to the recent ordinance on single-use plastic bags, we will provide helpful information for residents looking to further reduce the impact of single-use plastics on the environment.
    - **General waste reduction** – We will provide consumer information on reducing waste in food, apparel, and other common household items. We will partner, where possible, with non-profits and companies devoted to the resale, reuse and repurposing of excess goods.
- **Municipal**
  - Despite the fact that the Township does not directly control the transportation of trash or recycling or run landfill facilities, we will explore the following strategies to reduce solid waste:
    - **Municipal trash hauling** – The potential for the Township to provide its own trash-hauling operation or to contract with a single hauler would open up the following avenues to reduce the climate impact of solid waste:
      - Elimination of multiple vendors' fleets servicing the same neighborhoods will reduce greenhouse gas emissions, air pollution, and wear and tear on Township roads.
      - Trash and recycling pricing could be designed to incentivize consumer behavior.
      - Could provide the information for a positive feedback loop. Other municipalities have proven the potential for modifying resident behavior by benchmarking households against averages for their neighbors.

- **Composting** – We will explore setting up and operating a municipal composting facility, or participating in a regional facility. This could ultimately lead to an ordinance requiring household composting.

Agriculture and Land Use

Top-level drivers

- Greenhouse gas emissions from the agricultural sector represent about 10% of total US greenhouse gas emissions. They are related to the following processes:
- **Livestock** – Methane emissions from livestock digestion (known as enteric fermentation) is the largest contributor.
- **Fertilizer** – The second largest contribution is from nitrous oxide, principally related to fertilizer application and manure management.
- **Land Use** – Carbon dioxide released by conversion of land to agricultural use, partially offset by carbon stored in crops, is also a contributor.
- **Residential Lawns** – Virtually all private properties in Doylestown have a mown lawn. Grass does not sequester carbon as woody plants do. Although attractive and relatively easy to maintain, lawns are an ecological desert and net producers of GHGs from mowing, fertilizer and other chemicals and water use.

Impediments

- The Township has very little agriculture within its borders. Actions in this area will have modest impact. Minimizing lawns, mowing and chemical applications will likewise have a modest impact, but is relevant to the Township and will have valuable co-benefits.

Action plans

- **Exogenous**
  - Most of the actions taking place in this sector are occurring outside the Township, and will have very little impact on the Township meeting its goals. The principle actions occurring in the US relate to the following:
  - **Methane reduction** – Feed additives for ruminants, principally cattle, have shown some promise.
  - **Anaerobic digesters** – Although high in initial cost, anaerobic digesters can capture methane emissions from manure decomposition, making biogas available for energy.
  - **Regenerative agriculture** – Comprised of a host of practices such as cover crops, no tillage and diversification of crops planted together, regenerative agriculture can greatly reduce the use of artificial fertilizer, herbicides and pesticides. It is better for soil health and significantly reduces carbon emissions.

- **Transition to electric lawn care equipment**- As noted above, the transition to electric lawn equipment is well underway.

- **Community**
  - **Del Val University –** The only significant player in this sector in the Township is Del Val University. We will partner with them in staying abreast of best practices, and to help them with evaluating opportunities.
  - **Residential** – Residential lawns are ubiquitous in the Township. Best management practices for lawns will involve less mowing without sacrificing tidiness, converting some lawn area to meadow or planting trees to sequester carbon. Education for residents and modification of some ordinances are recommended.
- **Municipal**
  - **Township Land** – The Township has no agricultural land under its control. However, the Township does control a significant amount of park land and open space, and much of this area requires periodic mowing. Some of these areas are suitable for conversion to meadows (as has been done successfully in Central Park) or reforesting. Doylestown Township has approximately 36% tree canopy , and the Township should actively identify open area either within the parks or other Township land (e.g., Lower State Rd) that could be densely planted with trees. This would capture additional carbon and reduce the need for mowing. Continuing to replace non-native plants and lawns with native plant varieties will reduce the need for pesticides, fertilizers and water application, as well as providing the ancillary benefit of increasing habitat for pollinators, birds and other wildlife.

Appendix

Doylestown Township - 2022 ClearPath Inventory Methodologies

Residential Energy

Data was retrieved from Resource 1.

Emissions from Grid Electricity: [Doylestown Township Residential Energy (Grid Electricity)]

- Data was provided in terms of KWh
- All "DOYLESTOWN TWP" data was allocated to the Township, along with half of the general "DOYLESTOWN" data (the other half of which was allocated to the Borough)
- On Sheet 1 (2019 - elec) of Resource 1, data was taken from columns "Residential" and "Residential Heating"
- (390,737.00/2) + 57,151,699.00 + 24,436,691.00 = 81,783,758.5 KWh
- Number of households: 6087 (retrieved from 2020 Census)
- Population: 17971 (retrieved from 2020 Census)
- Data quality: activity data: High
- Data quality: emissions factor: High

Emissions from Stationary Fuel Combustion: [Doylestown Township Residential Energy (Stationary Fuel Combustion - Natural Gas)]

- Data was provided in terms of ccf (converted to therms)
- All "DOYLESTOWN TWP" data was allocated to the Township, along with half of the general "DOYLESTOWN" data (the other half of which was allocated to the Borough)
- On Sheet 2 (2019 - nat gas) of Resource 1, data was taken from columns "Residential" and "Residential Heating"
- 29,919.00 + (21,232.00/2) + 1,743,350.00 = 1,783,885.00 ccf → 18,447.62 therms
- Fuel type: natural gas
- Number of households: 6087 (retrieved from 2020 Census)
- Population: 17971 (retrieved from 2020 Census)
- Data quality: activity data: High
- Data quality: emissions factor: High

Emissions from Stationary Fuel Combustion: [Doylestown Township Residential Energy (Stationary Fuel Combustion - Fuel Oil)]

- Data was retrieved from Resource 2 and the S2504: Census Bureau Table
- Fuel type: Distillate Fuel Oil No. 1

- Calculations were made in spreadsheet labeled "Dtown TWP residential fuel usage estimate oil and gas" → 192,224.5 MMBtus
- Number of households: 6087

Emissions from Stationary Fuel Combustion: [Doylestown Township Residential Energy (Stationary Fuel Combustion - Propane)]

- Data was retrieved from Resource 2 and the S2504: Census Bureau Table
- Fuel type: Distillate Fuel Oil No. 1
- Calculations were made in spreadsheet labeled "Dtown TWP residential fuel usage estimate oil and gas" → 8,237.0 MMBtus
- Number of households: 6087

Commercial Energy

Data was retrieved from Resource 1.

Emissions from Grid Electricity: [Doylestown Township Commercial Energy (Grid Electricity)]

- Data was provided in terms of KWh
- All "DOYLESTOWN TWP" data was allocated to the Township, along with half of the general "DOYLESTOWN" data (the other half of which was allocated to the Borough)
- On Sheet 1 (2019 - elec) of Resource 1, data was taken from columns "Large C&I" and "Small C&I"
- (164,223.00/2) + 38,133,657.00 + 24,364,663.00 = 62,580,431.5 KWh
- Number of households: 6087 (retrieved from 2020 Census)
- Population: 17971 (retrieved from 2020 Census)
- Data quality: activity data: High
- Data quality: emissions factor: High

Emissions from Stationary Fuel Combustion: [Doylestown Township Commercial Energy (Stationary Fuel Combustion)]

- Data was provided in terms of ccf (converted to therms)
- All "DOYLESTOWN TWP" data was allocated to the Township, along with half of the general "DOYLESTOWN" data (the other half of which was allocated to the Borough)
- On Sheet 2 (2019 - nat gas) of Resource 1, data was taken from column "General Service Commercial and Industrial"
- 1,162,188.00 ccf → 12,018.49 therms
- Fuel type: natural gas
- Commercial workforce size: 19,971 people (0.553 employed from census) = 9,937.963
- Population: 17971 (retrieved from 2020 Census)

- Data quality: activity data: High
- Data quality: emissions factor: High

Industrial Energy

It was determined that there would be no input for the industrial energy sector. The provided spreadsheet (mentioned in "Commercial Energy") combined commercial and industrial energy together, and with the small industrial presence in the Township, it was determined that the entirety of the provided calculations would be put towards commercial energy.

Transportation & Mobile Services

Doylestown Township On-Road Transportation

- Calculation method: on-road factor
- VMT location: in-boundary (as Resource 3 already accounted for the difference between in-boundary and out of boundary)
- Travel type: passenger
- Type of VMT or emissions data: in boundary
- Fuel type: Gasoline
- VMT: Column S (VMT/Pop) and row 162: 22.96(17,971) = 412,614.16 Annual VMT
- Previously calculated CO2: Resource 3, Column AG, 209.64 short tons/day → 190.18 metric tons/day (365) → 69,415.7 metric tons
- Previously calculated CH4: Resource 3, Column AH, 31.99 lbs/day → 0.01451 metric tons/day (365) → 5.29615 metric tons
- Previously calculated N2O: Resource 3, Column AI, 8.35 lbs/day → 0.0037875 metric tons/day (365) → 1.3824 metric tons

Doylestown Township Aviation Travel (Within Jurisdiction)

- Data received by Jim, who contacted the Doylestown Airport (within the jurisdiction)
- Aviation type: within jurisdiction
- Flight type: domestic passenger
- Local attribution: 80%, as provided by the manager
- Fuel type: aviation gasoline
- Fuel loading: 0.8(Avgas 74,600 + JetA 83,650) = 126,528 gallons

Doylestown Township Aviation Travel (In/Out of Boundary)

- Aviation type: between jurisdictions
- Flight type: domestic passenger
- Local attribution: 20%, as provided by the manager
- Fuel type: aviation gasoline

- Fuel loading: 0.2(Avgas 74,600 + JetA 83,650) = 31,650 gallons

Doylestown Township Off-Road Transportation

- Data was taken from Resource 4
- Bucks County was filtered
- Only CO2 and CH4 pollutants were filtered
- Sum of CO2 and then CH4 pollutants
- Population ratio of Doylestown Township to Bucks County = (17971/646538) = 0.02779
- 0.02779(CO2 Sum) = 8530.049 tons → 7738.3 metric tons CO2
- 0.02779(CH4 Sum) = 3.96 tons → 3.59 metric tons CH4

Solid Waste

Doylestown Township Solid Waste Generation

- *Emissions calculated outside of ClearPath*
- Ratio of Doylestown Township population to PA population: 17971/13002700 = 0.00138
- Column AF, 2.640 MMCO2e (0.00138) = 3,643.2 metric tons
- Does the receiving landfill have methane collection? No
- Treatment location: outside the jurisdiction

1148.16 CO2e/28 global warming potential = 39.3 metric tons

Water & Wastewater

Doylestown Township Septic Systems

Told to use 2000 systems as an estimate but was not necessary

- Calculation type: population based
- BOD5 load: 0.08
- Population served: 179171

Doylestown Township Wastewater Treatment Energy Use

Emissions calculated outside of ClearPath

Ratio of Doylestown Township population to PA population: 17971/13002700 = 0.00138

Column AF, 1.18 MMCO2e (0.00138) = 1,628.4 metric tons

Treatment location: out of boundary

AFOLU

Doylestown Township AFOLU (Dairy Cows)

- Agricultural process: enteric fermentation
- CO2 emissions from agriculture: 0
- CH4 emissions from agriculture: 16.8
- N2O emissions from agriculture: 0
- Acres cultivated: 100
- Head of livestock: 120 (dairy cows)
    - Other inventories created for:
        - 65 horses

Data Resources

1. https://pennstateoffice365-my.sharepoint.com/:x:/g/personal/cpv5135_psu_edu/ERf1CTYvslpBk7gw62TPiMwBSujAcmplme6BqxlZB3KKuA?e=5BhdDx
    a. Emailed by Brandi Robinson, connected to Melanie Dickersbach at Exelon?
2. Spreadsheet emailed by Jim, “average space heating consumption…” for home heating fuel, 2015
3. https://pennstateoffice365-my.sharepoint.com/:x:/g/personal/cpv5135_psu_edu/EfZX47K6jKNEvDeCTOaW9jsB5JtKiGMnM7GQK9I2X3JXig?e=jWE0Dr
4. Spreadsheet in google drive labeled “nonroad_123.csv”