City of Pittsburgh

CLIMATE ACTION PLAN

Version 3.0

1. **Decarbonize the electricity grid**
    - Increase integration of smart technology
    - District scale energy
    - Increase local renewable energy generation
2. **Improve building operations**
    - Increase energy efficiency
    - Shrink peak energy loads
    - Reduce residential energy burdens
3. **Change how people get around**
    - Reduce vehicle miles traveled
    - Improve pedestrian and bicycle infrastructure
    - Prioritize transit oriented development
    - Electrification
4. **Use less and waste less**
    - Pursue circular economy
    - Reduce food waste
    - Increase diversion rates
5. **Focus locally**
    - Increase local food production
    - Improve community cohesion and urban design
    - Generate local renewable energy
    - Grow local businesses

ACKNOWLEDGEMENTS

Thank you to the following organizations for their contributions to the Climate Action Plan

-ACCESS
-Airport Corridor Transportation Association
-Action Housing
-AgRecycle
-Allegheny County Sanitary Authority
-Allegheny CleanWays
-Allegheny Conference
-Allegheny County
-Allegheny County Conservation District
-Allegheny County Economic Development
-Allegheny Land Trust
-American Geophysical Union
-American Health Care Group, LLC
-Aquion Energy
-Aramark
-Avison Young
-Bike Pittsburgh
-BiodiverCity
-BNY Mellon
-Brazen Kitchen
-Bridgeway Capital
-BuroHappold
- Carnegie Mellon University
-Carnegie Mellon Traffic21
-Carnegie Mellon University School of Art
-Carnegie Museum of Natural History
-Castriota Metals & Recycling
-Chatham University
-CJL Engineering
-Committee for Accessible Transportation (CAT)
-Conservation Consultants Inc
-Construction Junction
-Covestro
-Delta Development Group
-Direct Energy
-Duquesne Light Company
-Duquesne University
-Duquesne University's Center for Environmental Research and Education
-Dylamato's Market
-East End Food Co-op
-Eat n Park
-Eaton Corporation
-EcoCraft Homes
-EIS Solar
-EnerNoc
-Ethos Collaborative
-Eutectics
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-EvolveEA
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-Hillman Foundation
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-IMG Midstream
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-Itron Inc.
-Just Harvest
-Michael Baker International
-Mitsubishi Electric Power Products
-Mount Washington Community Development Corporation
-NAIOP
-National Academy of Sciences
-National Energy Technology Laboratory
-National Renewable Energy Laboratory
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-Oakland Transportation Management Association
-Oakland Planning and Development Corporation
-Oxford Development
-Port Authority of Allegheny County
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-Pittsburgh Community Reinvestment Group
-Pittsburgh Penn State Extension
- Pennsylvania Department of Transportation
-PennFuture
-Pennsylvania Environmental Council
-Peoples Natural Gas
-Phipps Conservatory
-Pittsburgh Downtown Partnership
-Pittsburgh Food Policy Council
-Pittsburgh Parking Authority
-Pittsburgh Parks Conservancy
-Pittsburgh Pirates
-Pittsburgh Water and Sewer Authority
-Pittsburghers for Public Transit
-PNC
-Port Authority of Allegheny County
-Pennsylvania Resources Council

-Putting Down Roots
-Pittsburgh Botanical Garden
-RAND Corporation
-Regional Industrial Development Corporation
-Richard King Mellon Foundation
-Riverlife
-Rye Development
-Science & Engineering Ambassadors Program
-Shadyside Worms
-Solarize Allegheny
-Southwestern Pennsylvania Commission
-Sports & Exhibition Authority
-Steel City Soils
-Sustainable Pittsburgh
-The Heinz Endowments
-Thriving Earth Exchange
-Tree Pittsburgh
-University of Pittsburgh
-University of Pittsburgh Medical Center
-Urban Redevelopment Authority
-Urban Land Institute
-Walnut Capital
-Waste Management
-Western Pennsylvania Conservancy
-Westinghouse Electric Company
-Women for a Healthy Environment
-Zipcar
-412 Food Rescue

Letter from the Mayor

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EXECUTIVE SUMMARY

Climate change is a major threat to communities around the world. Potential consequences of climate change include an increase in extreme weather events, higher rates of infectious diseases and heat-related illnesses, the possible shortage of food and basic goods and an increase in public expenditures to mitigate these effects. The City of Pittsburgh has long recognized that wide-ranging action must be taken in order to mitigate the effects of climate change on both local and global communities.

As a result, on February 9, 2007, the City of Pittsburgh signed the U.S. Mayors Climate Protection Agreement, pledging to implement local climate change mitigation solutions that would save taxpayer dollars and reduce long-term energy use.

Pittsburgh's Green Government Task Force (GGTF) was charged with developing the first ever Pittsburgh Climate Action Plan, adopted by the City as a guiding document in July 2008, providing an outline of specific strategies for achieving greenhouse gas emissions reductions.

In 2012, the *Pittsburgh Climate Action Plan 2.0* was created to review and revise the greenhouse gas emissions reduction efforts of government, businesses, institutions of higher education, and Pittsburgh residents, proposing new measures that could be implemented in order meet a greenhouse gas reduction target of 20% below 2003 levels by 2023.

In 2017, it is clear that expedited measures must be taken to help mitigate the local effects of global climate change. Building on the successes of the previous versions, *Pittsburgh Climate Action Plan, Version 3.0* has been created to track progress made via the first two plans and propose new measures to counteract the adverse effects of climate change. This document aligns with Mayor William Peduto's climate goals signed in 2015 at the Paris Accords, where he was one of the 12 mayors representing the United States. In June 2017, Mayor Peduto also joined 175 other U.S. mayors in signing an Executive Order[1] to pledge efforts to meet the "1.5 degrees Celsius target" as set forth by the Paris Agreement.

The Pittsburgh Climate Action Plan 3.0 takes a renewed approach toward climate change mitigation, presenting action plans and strategies around six key areas; Energy Generation & Distribution, Buildings & End Use Efficiency, Transportation & Land Use, Waste & Resource Recovery, Food & Agriculture, and Urban Ecosystems.

While each area has specific goals and actions, there is significant overlap across action areas, helping create a more holistic plan that provides opportunities for the greater impact through coordination across sectors. Of the six focus areas, the overlapping actions naturally create two action clusters; energy and ecosystems.

[1] http://apps.pittsburghpa.gov/mayorpeduto/Climate_exec_order_06.02.17_(1).pdf

Many strategies related to energy sources and energy usage are presented throughout the first three chapters, Energy Generation & Distribution, Buildings, and Transportation & Land Use. The two main goals in these chapters are improved energy efficiency and increased fuel shift. In order to reach these ambitious goals, projects must address both goals. For example, when shifting to electric vehicles, carbon-free charging sources must also be implemented.

The remaining three chapters; Waste and Resource Recovery, Food & Agriculture, and Urban Ecosystems, follow a similar, overlapping plan. The main idea presented throughout all three chapters is waste reduction and proper resource management.

City Context

Why a Climate Action Plan for Pittsburgh

Pittsburgh has come a long way from the days of smoke darkened skies that were a result of the extensive steel industries. However, as global temperatures continue to rise and the costly impacts of climate change become more prevalent, cities are at the forefront of climate action. Local government has a responsibility to provide for the health, safety, and welfare of residents. The Climate Action Plan provides a road map for reducing Greenhouse Gas Emissions in the City of Pittsburgh while also improving the resilience, health, and overall quality of life for Pittsburgh residents. The Climate Action Plan is designed to serve as a guiding document that will support future decision making in Pittsburgh.

A Picture of Pittsburgh

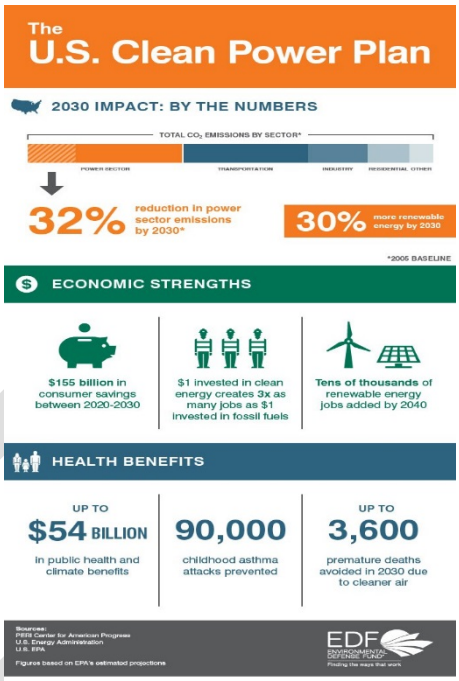
-58.35 sq. miles
- Population: 305,704
- Population density**:** 5,483/sq. mile
-Map of Pittsburgh

How the Action Plan was Developed

The Climate Action Plan 3.0 was a multi-year process which was focused on thoughtful civic engagement. The deliberative civic engagement process included over 400 residents representing 90 organizations from the Pittsburgh business community, non-profit sector, and local, state, and federal government partners. This process allowed the City to adopt pragmatic strategies that account for and expand upon many actions and initiatives already underway.

Clean Power Plan

Through the development process, Pittsburgh also modeled many goals and strategies after the U.S. Clean Power Plan Framework. The Clean Power Plan (CPP) requires the state of Pennsylvania to reduce power sector emissions by 24% below 2012 levels. At a national level, CPP aims to reduce emissions from coal-burning power plants, increase the use of renewable electricity, and improve energy conservation and efficiency. Similar to the CPP, the Pittsburgh Climate Action Plan supports strategies for reducing dependence on coal, encouraging conversion of coal fired powerplants to natural gas, protecting existing carbon free nuclear power, increasing utilization and generation of renewable electricity, and decreasing energy consumption through optimization and efficiency improvements in both the power and transportation sectors.



https://www.edf.org/sites/default/files/Clean-Power-Plan-Infographic.jpg

Pittsburgh's Resilience Challenges

While the Climate Action Plan is designed first and foremost as a carbon mitigation strategy, there is a broad scope of 'co-benefits' that can be achieved through the proposed actions. When putting forth strategies and pathways for deep carbon reductions, these co-benefits were analyzed to assist with action prioritization. Mitigation actions can also help address Pittsburgh's Resilience Challenges and achieve key co-benefits such as improved equity, increased economic development, decreased negative health impacts.

The threats to Pittsburgh's resilience include both chronic stresses—long-term, slow burning issues that overwhelm the capacity of city resources and erode resident wellbeing—and potential acute shocks— sudden, large-scale disasters that disrupt city services and threaten residents from extreme events. While the city's inland geography protects its residents from many of the natural hazards that are expected to occur more frequently in coastal regions, the city's endemic stresses disproportionately affect some of its most vulnerable residents and represent its core resilience challenges. Specifically, Pittsburgh faces significant challenges with social, racial, and economic inequities that have persisted for decades, which have led to unequal access to housing, transportation, employment, and services. Other key stresses affecting vulnerable Pittsburghers include aging infrastructure and poor air and water quality. Potential future shocks include extreme weather, flooding, landslides, and extreme temperatures, among other concerns identified during strategy development. Action on climate change provides a unique opportunity for coordination and collaboration that can address Pittsburgh's most significant stressors.

Alignment with Existing Plans

The measures laid out in this plan aim to reduce carbon emissions but have also been prioritized based on the ability to impact additional shocks and stressors identified within Pittsburgh's OnePGH Resilience Strategy. Actions high on the prioritization list will not only

reduce emissions but will also improve overall resiliency, increase innovation, foster leadership, promote workforce development, introduce economic opportunities and align with the OnePGH Strategy and Pittsburgh's P4 Criteria.

Pittsburgh's Resilience Framework

The Pittsburgh Climate Action Plan is designed to be a subheading of the OnePGH Resilience Strategy. Similarly to the resilience strategy, the Climate Action Plan is also meant to align with the four "p"s of the p4 framework, already adopted by partners across the city to inspire innovative, sustainable, and inclusive action. Priority actions in the Climate Action Plan are able to reduce emissions as well as work collectively to make Pittsburgh a resilient city in terms of its People, Place, Planet, and Performance.

PEOPLE Pittsburgh will empower all residents to contribute to thriving and supportive communities by ensuring that basic needs are met. We will be an inclusive city of innovation that celebrates our diversity, and all residents will have equal access to resources and opportunity.

PLACE Pittsburgh will use land to benefit all residents; to increase social cohesion, connectivity, public and ecological health; and to protect against current and future risks. We will design, scale, and maintain our infrastructure for current and future needs, providing benefits and services to our neighborhoods during times of calm and crisis.

PLANET Pittsburgh will achieve long-term environmental health through wise stewardship, improved use of our resources, and a reduced carbon footprint.

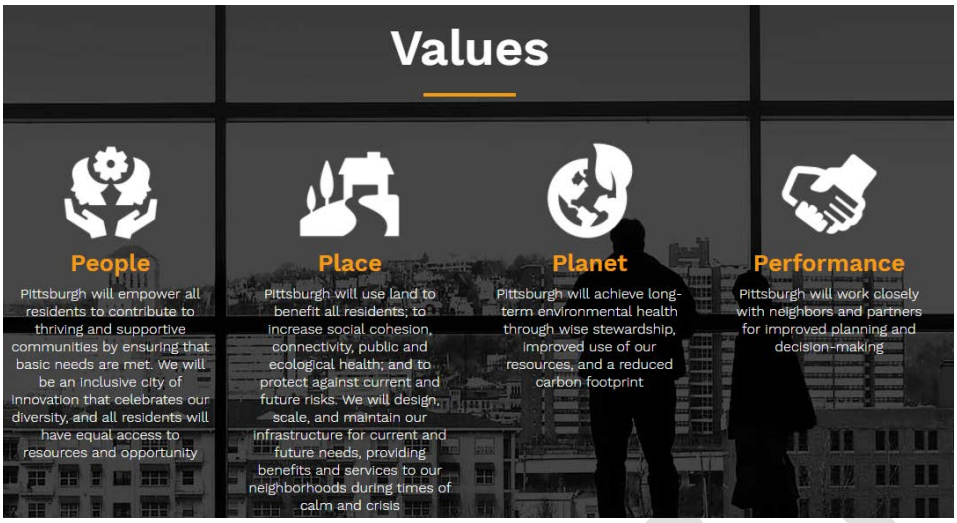
PERFORMANCE Pittsburgh will work closely with neighbors and partners for improved planning and decision-making.

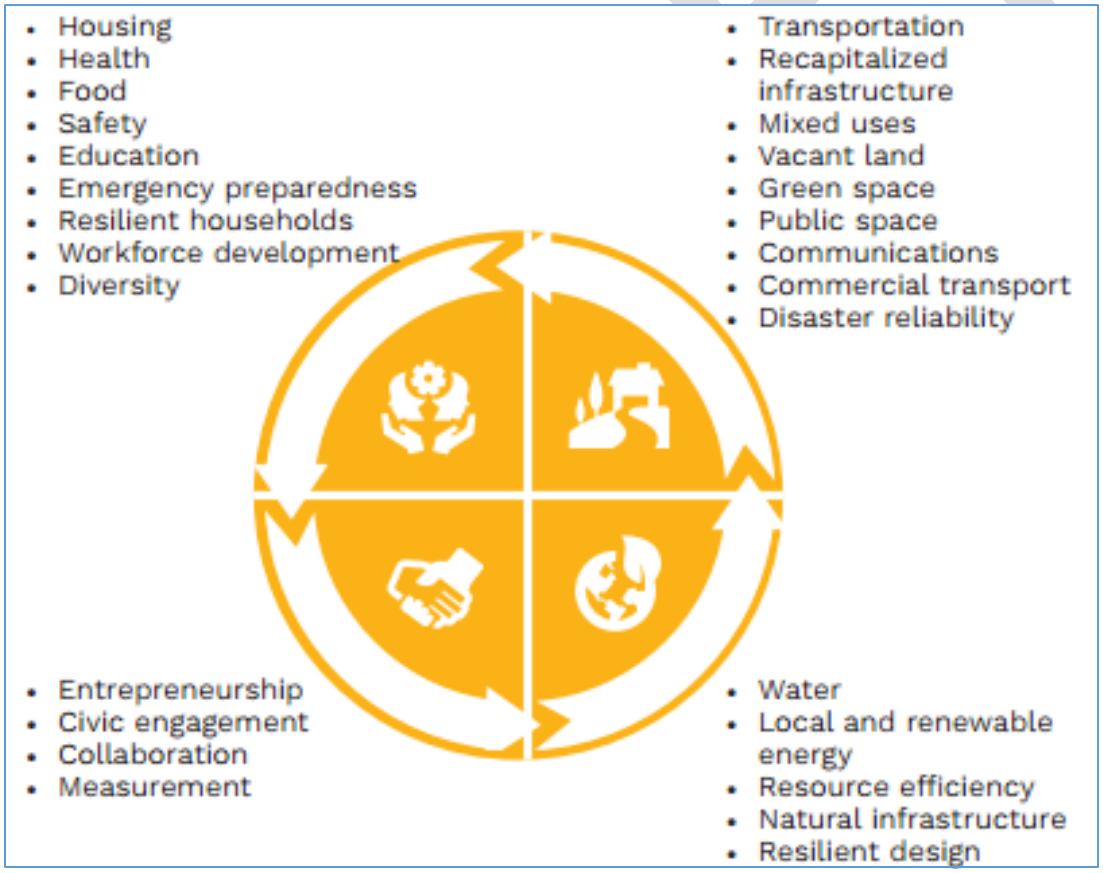
OnePGH

OnePGH is the strategy for Pittsburgh to thrive in the 21st century as a city of engaged, empowered, and coordinated neighbors. Pittsburgh will be resilient when our city is livable for all residents. OnePGH establishes a bold vision for the city, buildings on recent successes and a wealth of community assets, while directly confronting the complex challenges that we all continue to face.

p4 Initiative

The p4 initiative is based on a central unifying framework: People, Planet, Place, and Performance. Launched in 2015 to create a new sustainable, innovative, and inclusive model for development and design, p4 aims to establish Pittsburgh as a "city of the future." In the past couple of decades, Pittsburgh has not only recovered, but transformed dramatically since the steel industry's collapse. This transformation will continue through a major new wave of development, representing approximately 500 acres across the urban core. This development potential and the manner in which it is guided, will influence Pittsburgh's built and natural environments, and communities for generations to come.


Values
People
Pittsburgh will empower all residents to contribute to thriving and supportive communities by ensuring that basic needs are met. We will be an inclusive city of innovation that celebrates our diversity, and all residents will have equal access to resources and opportunity
Place
Pittsburgh will use land to benefit all residents; to increase social cohesion, connectivity, public and ecological health; and to protect against current and future risks. We will design, scale, and maintain our infrastructure for current and future needs, providing benefits and services to our neighborhoods during times of calm and crisis
Planet
Pittsburgh will achieve long-term environmental health through wise stewardship, improved use of our resources, and a reduced carbon footprint
Performance
Pittsburgh will work closely with neighbors and partners for improved planning and decision-making


Housing
Health
Food
Safety
Education
Emergency preparedness
Resilient households
Workforce development
Diversity
Transportation
Recapitalized infrastructure
Mixed uses
Vacant land
Green space
Public space
Communications
Commercial transport
Disaster reliability
Entrepreneurship
Civic engagement
Collaboration
Measurement
Water
Local and renewable energy
Resource efficiency
Natural infrastructure
Resilient design

Climate Action Plan Implementation

The Division of Sustainability and Resilience, as a part of the Department of City Planning, will serve as the lead office for implementation of the Climate Action Plan. The Division of Sustainability and Resilience will support a series of implementation steps through the next year to facilitate the effective rollout and adoption of the Climate Action Plan across sectors and stakeholders. As implementation progresses, there are a number of levers, such as policy intervention, funding and budget allocations, community engagement, data analysis, and partnership coordination, that can be activated to optimize the success of the Climate Action Plan.

Sustainability and Resilience Commission

In order to fully recognize all of the actions and initiatives laid out in the Climate Action Plan, serious effort will be required on behalf of the City and its many stakeholders. The first action needed to begin implementing the Climate Action Plan is the creation of a Sustainability and Resilience Commission. Currently, the City has an existing Sustainability Commission comprised of representatives from varying City Departments whose main focus has been to make City operations more sustainable. The proposed Sustainability and Resilience Commission would be an amendment to the existing commission. Expanding the Commission to include members from the nonprofit, education, utility, and corporate sectors will allow for greater impact and coordination amount stakeholders. Once established, the updated commission will oversee the implementation of the Climate Action Plan as well as the tracking of progress towards goals. This commission will ensure that the CAP 3.0 is implemented in a way which benefits all Pittsburghers.

Institution Engagement

The City of Pittsburgh will not be able to achieve these ambitions goals without the ongoing support and engagement from all parties, especially the large institutions such as hospitals and universities that operate within the city. The institutions have the opportunity to make significant impacts across all sectors. Additionally, the expertise and research capacity of the institution has proven to be invaluable to the climate action process. Expanding upon these existing partnerships will help foster innovation and expedite the 2030 Goals.

Community Engagement

Community engagement and grass roots action is a vital aspect of successful climate initiatives. Organizations such as the Citizens Climate Lobby, Climate Realities Leadership Corp, and the Sierra Club work to engage community members in climate related issues and policy decisions. These organizations will play an important role in educating the public and encouraging action at the neighborhood and household levels.

Pittsburgh Climate Action Plan 4.0

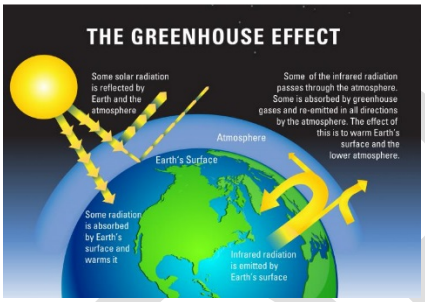
This Climate Action Plan provides a holistic approach to reducing Pittsburgh's impact to climate change and improving the overall resilience of the city and its residents. This plan provides

pathways for emission reduction and is designed to be a guiding document for the City of Pittsburgh and relevant partners. It is meant to be a living document that evolves as actions progress. Additionally, this Climate Action Plan is designed to be a 5 year plan. As technology improves and policies change, an updated CAP can be written. Actions started as a result of this plan and the associated data to be collected will inform the next iteration of the Pittsburgh Climate Action Plan.

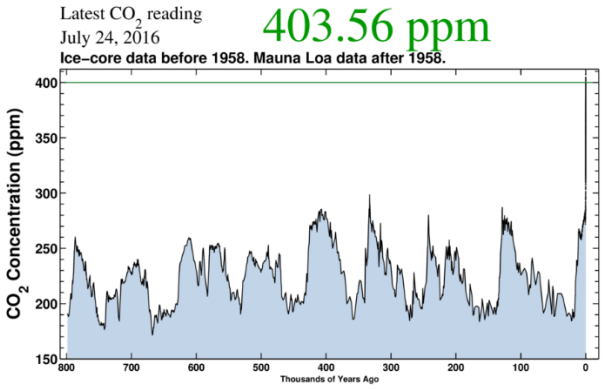
Introduction

In 2016, Earth's surface temperatures were the warmest since modern recordkeeping began in 1880, according to independent analyses conducted by National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA)[2]. Earth's average surface temperature has risen approximately 2.0 degrees Fahrenheit (1.1 degrees Celsius) since the start of the industrial revolution in the late 1700's, a change driven largely by increased activities releasing carbon dioxide and other human-made emissions into the atmosphere. Most of the warming occurred in the past 35 years, with 16 of the 17 warmest years on record occurring since 2001.

Climate Change



Greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4) and ozone (O_3) in the atmosphere, absorb some of the infrared radiation (heat) emitted by Earth's surface, which keeps our planet livable. Without the greenhouse effect, Earth's average temperature would be near 0 degrees Fahrenheit, rather than the 20th century average of 57.1 degrees F.



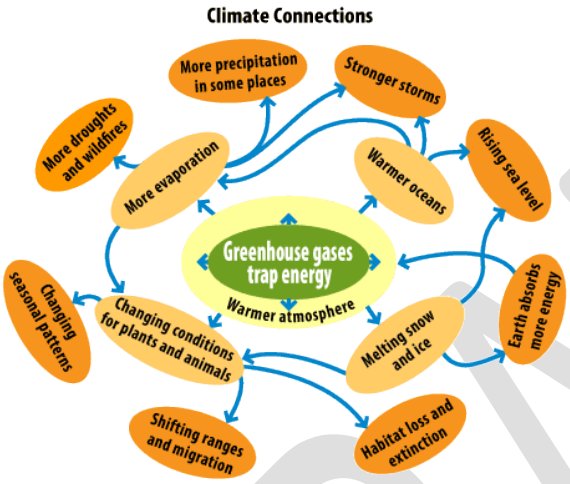
However, human activities such as burning fossil fuels and destroying forests have increased the amount of GHGs in the atmosphere over the last 100 years. This is disturbing the optimum levels of GHGs, amounting to increased

[2] https://www.nasa.gov/press-release/nasa-noaa-data-show-2016-warmest-year-on-record-globally

heating. As the emissions increase, more heat is trapped, leading to numerous changes in Earth's natural processes.

For over 800,000 years the atmospheric concentration of carbon dioxide has fluctuated but has not exceeded 300 parts per million (ppm). Currently, the levels hover above 400 ppm.
The dramatic increase in GHGs in the atmosphere has already led to a 1.5°F (0.85°C) increase in global average surface temperature from 1880 to 2015.

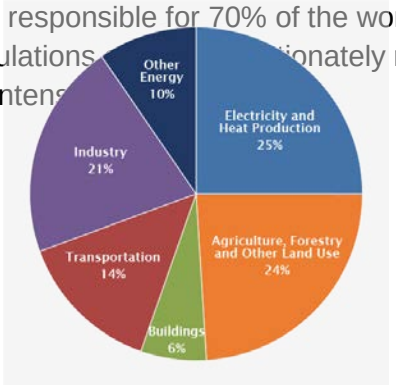
Climate Change Consequences

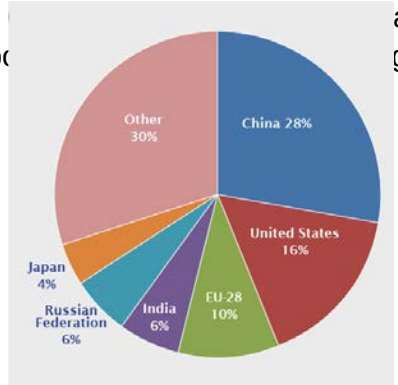


Earth is a resilient planet with many complex interconnected systems that work to keep the planet in balance. However, global warming has already changed climates by altering evaporation and precipitation patterns, melting snow and ice and warming the ocean. This has caused heat waves, droughts, extreme storms, wildfires, hurricanes and tornadoes of varying severity across several regions of the world. If carbon emitting activities continue at the same rate, the planet could see an 8.1°F (4.5°C) increase over preindustrial temperatures by 2100. This could result in the extinction of 16% of the species on Earth.

Global Sources of Emissions

The majority of human-caused GHG emissions are due to burning fossil fuels like coal, natural gas, gasoline and diesel for electricity, heat and transportation. However, it is important to recognize that almost 24% of global emissions are due to deforestation, industrial agriculture and the impact of other land uses. China, the United States, the European Union, Russia and Japan are responsible for 70% of the world's ations with relatively small populations tionately resp gely driven by resource inten



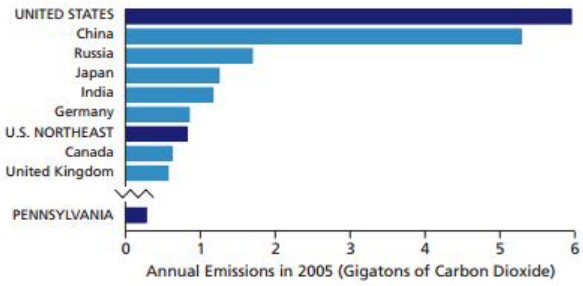


The Paris Agreement

In December 2015, global leaders from 195 countries met in France for the 21st Conference of Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC). The mission of COP21 was to "achieve a legally binding and universal agreement on climate, with the aim of keeping global warming below 2°C." Prior to the conference, 185 countries submitted an Intended Nationally Determined Contributions (INDC) that outlined their strategies and goals for reducing their carbon emissions as a basis for negotiation. However, these INDCs put the world on track for 2.7 to 3.7°C increase, surpassing the COP21 2°C goal. Meanwhile, leading climate scientist James Hansen published a paper outlining the dangers of feedback loops caused at 2°C. Vulnerable countries, such as low-lying island nations- the Maldives, the Marshall Islands and the Seychelles, have long called for a 1.5°C ceiling.

On December 12, 2015, the Paris Agreement was adopted by consensus, and the treaty has been signed by 179 parties and ratified by 20. Article 2.1 says parties agree to "Hold[ing] the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change."
However, even if all emissions ceased tomorrow, GHGs already in the atmosphere would still trigger an additional 0.6°C rise above the current 1.1°C, causing a 1.7°C increase overall. Therefore, immediate action is needed to minimize emissions as soon as possible, and also sequester atmospheric carbon in large quantities.

Climate change in Pennsylvania

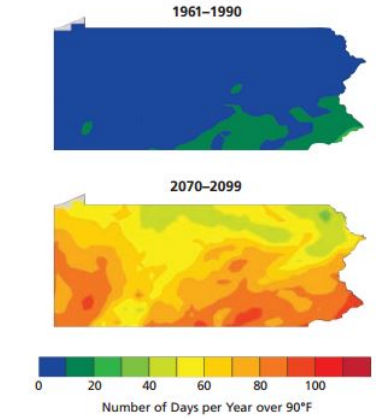


Pennsylvania's emissions are high enough to compare with some of the largest nations in the world. The Energy Information Administration (EIA) conducted a study in 2005 and found that, when compared globally, Pennsylvania's emissions were high enough to rank as world's twenty-second largest emitter of CO_2. For comparison, Pennsylvania's emissions are higher than those of the states of New York and Wyoming combined, and the per capita emissions are more than double those of New York State.

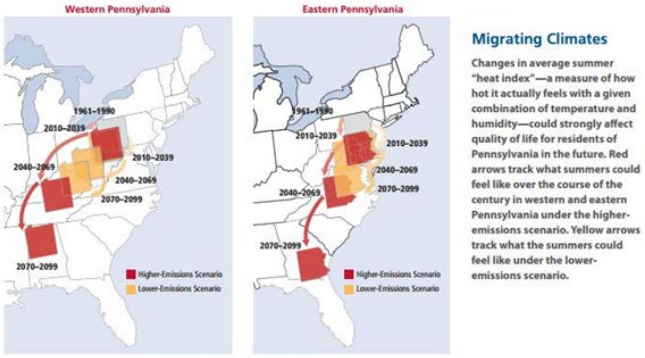
Increased Temperatures

In addition to being a significant contributor to climate change, Pennsylvania is also projected to see significant impacts as a result of climate change. By the end of the century, Pennsylvania is

projected to experience a dramatic increase in the number of extremely hot days. The regions to experience the greatest warming will be in the southwest and southeast.

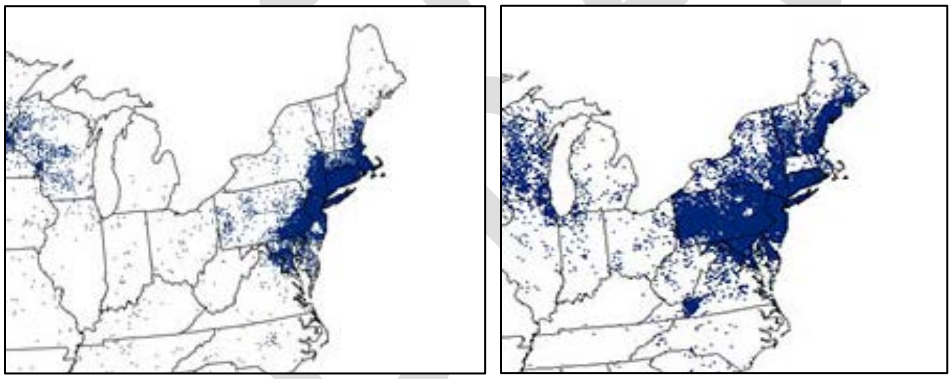


Statewide, Pennsylvania is projected to experience dramatic increases in the number of extremely hot days over the coming century, especially under the higher-emissions scenario. The greatest warming will be in the southwest and southeast regions, where daytime temperatures by late century (2070–2099) could hover over 90°F for nearly the entire summer.



Although Pittsburgh is an inland city that is sheltered from many 'typical' consequences of climate change such as sea level rise and extreme hurricanes, Pittsburgh has seen numerous climate related impacts in recent year.

<u>Increase in Lyme Disease</u>



Lyme's disease cases in 2001 vs 2016

The incidences of Lyme disease in the US continue to rise rapidly, especially in the Northeast and Great Lakes regions. If left untreated, Lyme disease can cause severe and debilitating health symptoms. According to the CDC, Pennsylvania had the highest number of Lyme disease cases in the nation for 3 straight years, with many of the highest numbers occurring in western PA. Lyme disease infections usually occur most frequently in the spring and fall due to increased tick activity. Deer ticks that transmit the disease are dormant during the winter, but become active when the temperature rises above freezing. Warmer weather and milder winters mean that the ticks become active earlier and remain active for a longer period of time, allowing the disease to become more widespread.

Washington Boulevard Flooding

In August 2011, two storms hit the Pittsburgh area, dropping 3-4 inches of rain in one day, with 2.1 inches coming in a single hour during the evening rush hour. The storm water overwhelmed the area's drainage system and caused manhole covers to pop off the road. Four people were killed when flash floods swamped cars and water quickly rose up to 9 feet in some areas along Washington Boulevard near the Allegheny River. Overall, 18 vehicles were stranded. The boulevard is in the basin of a large watershed and it gets runoff from surrounding neighborhoods. As the climate changes, heavy rain events and extreme flooding will continue to occur more frequently.

Air Quality Impacts

Pittsburgh first rose to prominence through fossil fuel extraction and carbon-intensive industries, thus establishing its legacy as the 'Steel City'. Coal was mined from Pittsburgh's hillsides, and then burned to forge steel. For several decades, the city was polluted with smoke and particulate matter that choked out the sky and required streetlights to be lit during the day. Along with being the "City that Built America" Pittsburgh earned the nickname "Hell with the Lid Off" due to the extreme air pollution created by the steel industry.

Pittsburgh has made great improvements in air quality since the height of the steel industry, including enacting the nation's first Clean Air Act. However, the American Lung Association still ranks Pittsburgh the eighth worst of more than 200 metropolitan areas in the nation for long-term (annual) soot pollution; the 14th worst for short-term or daily soot pollution, and the 29th worst for ozone, the main precursor for unhealthy smog. Air quality has significant health implications in our region. A recent study, conducted by Dr. Deborah Gentile of the Pediatric Alliance, showed that while the national average for pediatric asthma is about 8%, nearly 23% of children in the Pittsburgh region have been diagnosed with asthma. In Southwestern Pennsylvania, there is an estimated 1500 additional deaths each year that can be attributed to air poor quality. As Pittsburgh strives to reduce GHG emissions, there must also be a focus on improved air quality and related human health benefits.

Pittsburgh: Carbon Legacy to Climate Leadership

Existing Climate Commitments

For years, Pittsburgh has shown a commitment to taking action on climate change. Programs such as the Sustainable Pittsburgh Challenge (formerly the Green Workplace Challenge) and

the 2030 District are a direct result of the efforts of previous climate action plans and the Pittsburgh Climate Initiative. The first two Climate Action Plans also led to the creation and eventual expansion of the City's Office of Sustainability. As a result of many years of dedication, Pittsburgh has also signed on to a number of national and international climate agreements and e. Thes hnical assistance, city to city c er g, and burnish track progress.

We Are Still In

We Are Still In is the broadest cross-section of the U.S. economy ever assembled in pursuit of climate action. Over 2,500 leaders strong and growing, We Are Still In shows the world that leaders from across America's state houses, city halls, board rooms, and college campuses stand by the Paris Agreement and are committed to meeting its goals.

Global Covenant of Mayors for Climate and Energy

The Global Covenant of Mayors for Climate & Energy is an international alliance of cities and local governments with a shared long-term vision of promoting and supporting voluntary action to combat climate change and move to a low emission, resilient society

ICLEI

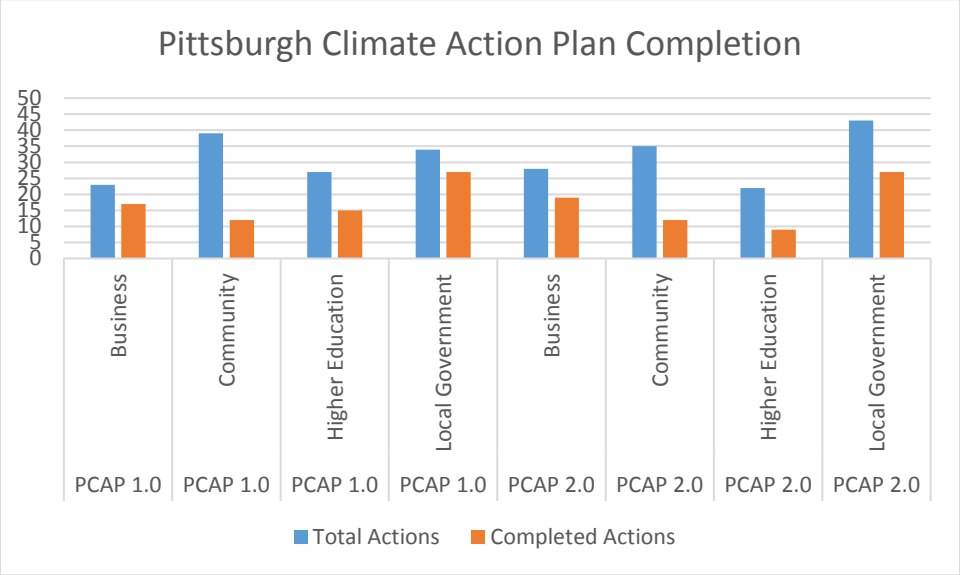
ICLEI – Local Governments for Sustainability is the leading global network of more than 1,500 cities, towns and regions committed to building a sustainable future. ICLEI provides technical consulting, training and information services to build capacity, share knowledge and support local government in the implementation of sustainable development at the local level. Their basic premise is that locally designed and driven initiatives can provide an effective and cost-efficient way to achieve local, national and global sustainability objectives.

Under 2 Coalition

The Under2 MOU is a commitment by sub-national governments to reduce their greenhouse gas (GHG) emissions towards net-zero by 2050. Central to this is the public commitment by all signatories to reduce their GHG emissions by 80-95% on 1990 levels, or to 2 metric tons of carbon dioxide-equivalent per capita, by 2050. Every government faces different challenges on this journey, and the Under2 Coalition provides a global forum that supports Under2 signatories in developing bold, impactful strategies and aligning on a trajectory consistent with 2050 carbon neutrality.

Pittsburgh Climate Action Plans

PCAP 3.0 builds upon the actions and lessons learned from PCAP 1.0 and 2.0.The first two climate action plans were organized into four sectors: Business, Community, Higher Education and Local Government. Within each sector, actions targeted energy, transportation, and waste management as well as education, advocacy, and coordination. Given that many actions focused on greenhouse gas reductions occur over long time frames, some planned activities have not been completed; however, PCAP 1.0 & 2.0 set in motion many important measures.



The first two Pittsburgh Climate Action Plans laid the groundwork for and supported the creation of successful citywide programs like the Green Workplace Challenge and the Pittsburgh 2030 District, which encourage organizations and building owners to implement sustainable practices and measure energy and water conservation.

From 2011-2017 over 250 participating organizations have completed 7,840 measurable actions in the Green Workplace Challenge, saved more than 127 million kWh and prevented 23,283 metric tons of CO2e.

In the Pittsburgh 2030 District, 104 Property Partners managing over 79.2 million square feet across 492 commercial buildings have reduced energy use by 10.7%, water use by 7.4%, and carbon emissions from transportation by 24.2% below baselines. The 2016 energy use reduction of 982 million kBtu is equivalent to 113,540 metric tons of CO2e.

The 12-member Pittsburgh Higher Education Climate Consortium (HECC) has collectively achieved a 20% reduction in carbon emissions since 2003. These reductions came as a result of bold action such as Carnegie Mellon University's purchase of100% renewable electricity and University of Pittsburgh's adoption of the Sustainable Development Goals.

PCAP 1.0 also led to the codification of the City of Pittsburgh's Sustainability Coordinator position, which has since evolved into the City's Division of Sustainability and Resilience, now with five full-time staff members. PCAP 2.0 helped created a Sustainability Coordinator position at Pittsburgh Water and Sewer Authority (PWSA). This is in addition to Sustainability Coordinators at the Sports & Exhibition Authority (SEA) and the Urban Redevelopment Authority (URA).

Building on results from PCAP 1.0 and 2.0, PCAP 3.0 is structured according to emission sources, with a focus on instrumental, measurable actions with assigned stakeholders. Action plans are broken into six categories or chapters;

1) Energy Generation and Distribution
2) Buildings and End Use Efficiency
3) Transportation and Land Use
4) Waste and Resource Reduction
5) Food and Agriculture
6) Urban Ecosystems

This PCAP 3.0 lays out pathways, strategies, and a framework for achieving Pittsburgh's greenhouse gas reduction goals by the year 2030 and beyond, as follows:

Pittsburgh's Greenhouse Gas Emission Reduction Goals (Below on a 2003 Baseline)

- 20% GHG Reduction by 2023
- 50% GHG Reduction by 2030
- 80% GHG Reduction by 2050
- Pursue a future carbon neutral goal

Pittsburgh 2030 Climate Goals

Internal City Operations:

1) 100% renewable electricity use
2) 100% fossil fuel free fleet
3) Divestment from fossil fuels

City of Pittsburgh:

1) 50% energy use reduction
2) 50% water use reduction
3) 50% transportation emission reduction
4) Zero Waste- 100% diversion from landfills

In short, Pittsburgh follows a 0-50-100 goal; zero waste, 50% emissions reduction, and 100% renewable electricity. These broad, ambitious goals allow for innovation and collaboration with a variety of stakeholders.

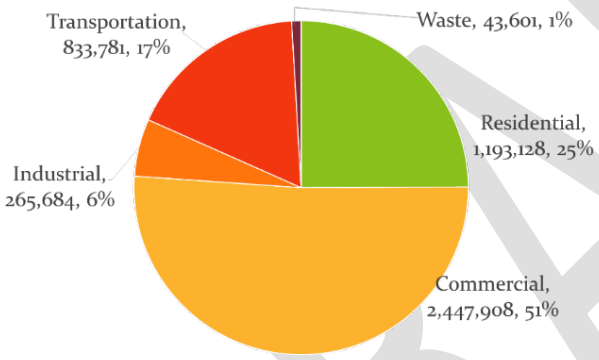
CHAPTER ONE: Measuring Pittsburgh's Impact

Goal: Measure Pittsburgh's climate and ecological impact and report annually

Developing a Greenhouse Gas Inventory is the first step in managing climate change.
The Greenhouse Gas (GHG) Inventory quantifies emissions and analyzes the sources of those emissions. This data informs mitigation strategies and is essential for tracking progress towards future reduction goals. A citywide greenhouse gas inventory, based on 2013 data, was compiled and used to inform the Climate Action Plan 3.0.

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	Indirect GHG emissions occurring as consequences of the use of grid-supplied electricity, heat, steam and/or cooling within city boundary.
Scope 3	All other GHG emissions that occur outside city boundary as a result of activities taking place within the city boundary.

Figure 1: Definition of Scope 1, 2, and 3 GHG Emissions (http://www.ghgprotocol.org/calculationg-tools-faq)

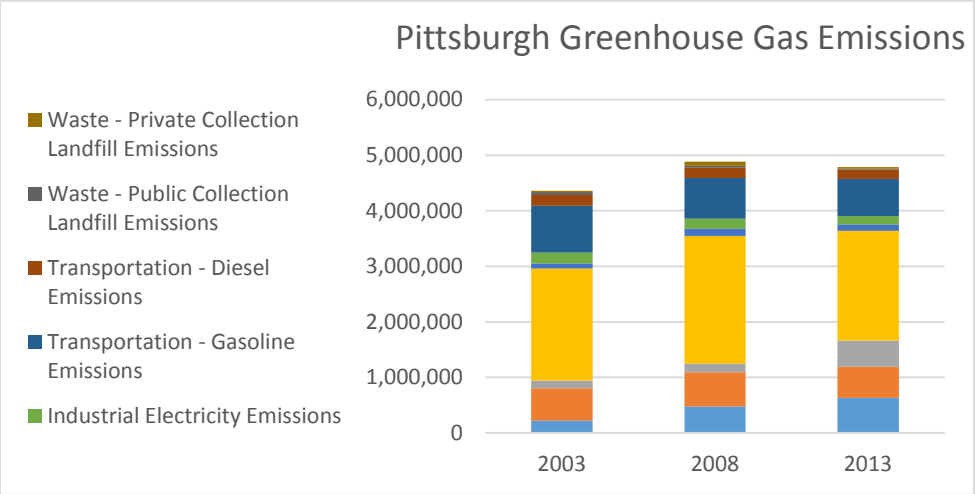


Sector Based Inventory

GHG inventory protocols tend to focus on Scope 1 and Scope 2 emissions, as defined in Table 1, while Scope 3 emissions are more difficult to quantify. Scope 1 emissions come from sources within the city limits, such as gasoline being burned by a vehicle on a city road. Scope 2 emissions occur as a consequence of electricity demand within city limits. Burning of fossil fuels at power plants located outside of Pittsburgh but which satisfy electricity demands within this city are a main contributor to Scope 2 emissions. Scope 3 emissions are other emissions associated with activities that occur within city limits. For example, Pittsburgh residents generate waste, but that waste is hauled to landfills outside of the city. The methane from that waste is therefore part of Pittsburgh scope 3 emissions. Pittsburgh's GHG inventory primarily focuses on Scope 1 and Scope 2 emissions as prescribed in the ICLEI methodology. These emissions are related to data that is more reliable and readily available.

2013 Greenhouse Gas Inventory

In the 2013 GHG Inventory, included as an appendix to this Climate Action Plan, emissions are categorized by sources and activities in each sector: Residential, Commercial, Industrial, Transportation and Waste



In terms of annual emissions, Pittsburgh saw a 12% increase in emissions from 2003 to 2008, but a decrease of 2% from 2008 to 2013. It is difficult to draw conclusions from Pittsburgh's existing greenhouse gas inventories due to different methods and scopes of consumption data. However, it is clear that Pittsburgh needs to take more ambitious action in order to ensure achievement of the 2030 goals.

Future Inventories

Using data that is nearly 5 years old is not ideal and makes it difficult to demonstrate the impact of recent programs and initiative. In order to truly track progress and align actions with measurable GHG reductions, more up to date, readily available data is needed. Moving forward, one of the first steps in tracking progress is to establish a more consistent process for conducting a greenhouse gas inventory.

With the new resources available to the City of Pittsburgh, through the American Geophysical Union (AGU), and Local Governments for Sustainability (ICLEI) extensive effort was put into standardizing the data collection and analysis process in order to develop the 2013 inventory. With this methodology and strong partnerships with the local utility companies in place, future inventories should be less time intensive and more reliable. This will allow for a yearly GHG Inventory to be compiled.

Several cities are adjusting inventory protocols to account for more scope 3 emissions, such as the carbon and ecological footprints associated with the consumption of products and services within city limits. Pittsburgh also plans to take steps to further understand and track its Scope 3 emissions for the future exercises in GHG inventory management. More information on the 2013 Greenhouse Gas Inventory and the inventory methodology can be found in the ***GHG Report***

CHAPTER TWO: Energy Generation and Distribution

Goal: 50% Emissions Reduction below 2003 levels by 2030

Goal: Power all City facilities with 100% clean electricity by 2030

Objective:

- Reduce natural gas fugitive emissions by 50% by 2030
- Reduce line loss from electricity
- Create a 21st Century energy system and support the utilities of the future
- Install 200 Megawatts of local, clean power by 2030
- Convert 50% of Pittsburgh customers to clean electricity

Strategies:

- Calculate reasonable estimates for annual methane leakage volume
- Calculate reasonable estimates for annual transmission loss for local grid
- Improve gas line leak detection
- Implement a long term infrastructure plan to replace aging natural gas delivery lines and to optimize electricity delivery grids
- Install smart meters to provide better customer data access
- Duquesne Light to install solar microgrid pilot at Woods Run facility
- Support alternative utility ratemaking in Pennsylvania such as decoupling, formula rates, cost-recovery mechanisms, etc.
- Develop and implement Pittsburgh's District Energy Plan
- Create a local Energy Authority to enable community choice aggregation, power purchase agreements, and renewable regulatory approvals
- Support Duquesne Light with the Public Utility Commission (PUC) to install local renewable power generation to meet Pennsylvania's Alternative Energy Portfolio Standards (AEPS) standards for Provider of the Last Resort (POLAR) customers
- Support and allow for community source aggregation and renewable regulatory approvals (Big Opportunity)

Challenges:

- Many regulations and policies regarding energy grids are enacted at the state level
- Aging infrastructure
- Population growth and new development will increase energy demands

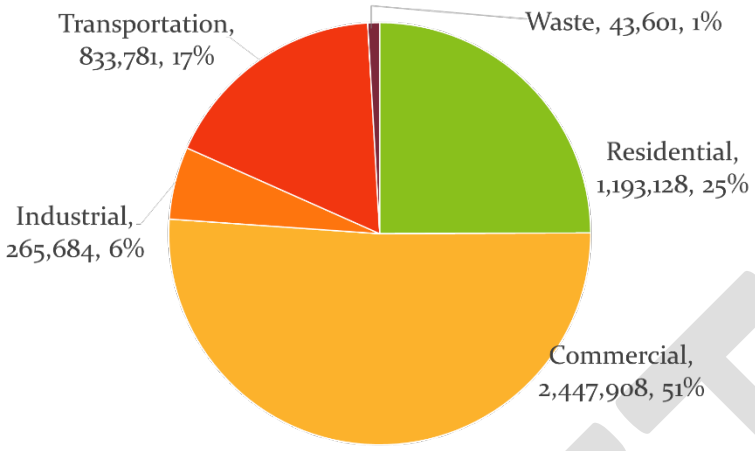
Existing Projects and Previous Work:

- Ecoinnovation District
- District Energy Pittsburgh
- People's Gas Methane Mapping Project
- Duquesne Light Woods Run Microgrid
- NRG Fuel Cell

Energy Champions

- University of Pittsburgh
- Carnegie Mellon University
- National Energy Technology Laboratory
- Green Building Alliance
- People's Gas
- Duquesne Light Company
- Sustainable Pittsburgh

Greenhouse Gas Emissions from Energy Use



Emissions from the built environment dominate Pittsburgh's emission with 99% of emissions coming from energy use. These emissions come from the use of electricity, natural gas, and transportation energy use.

Pittsburgh Electricity

Pittsburgh is served by Duquesne Light Company (DLC), which is an investor-owned electricity distribution company. Duquesne Light does not generate electricity, and Pittsburgh does not have a municipal utility. Within the Duquesne Light service territory, nearly 70% of electrical generation is nuclear or hydroelectric, but given greenhouse gas inventory protocols, Pittsburgh calculates its emissions from electricity using the EPA eGRID emission factors for RFC-West (RFC-W), which includes coal generation in West Virginia, Ohio and Indiana (See eGRID map in Appendix___).

Generators within the Duquesne Light Company Service Territory

Generator	Generation Type	Output (MW)	Percent (%)
Beaver Valley	Nuclear	1831	69.46
Brunot Island	Natural Gas (Peaker)	220	8.34
Cheswick	Coal	578	21.93
Patterson	Hydroelectric	2	0.27
Townsend	Hydroelectric	5	
	Total MW	2636	

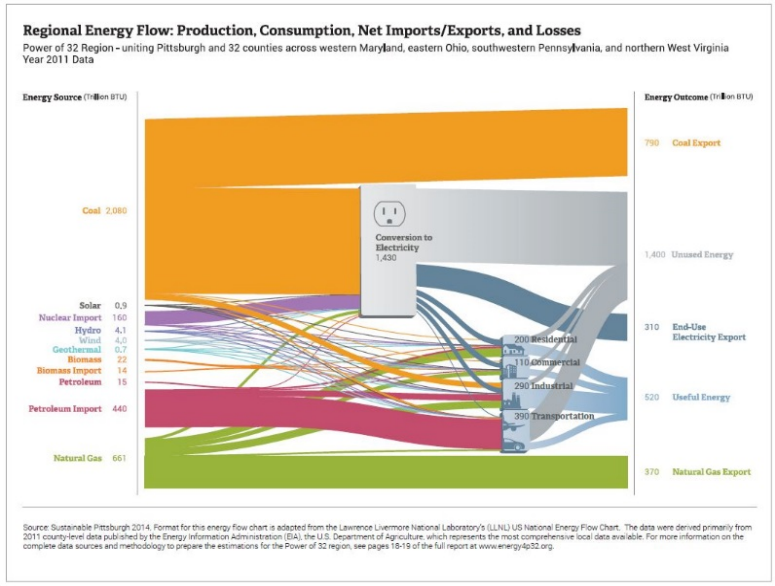
EPA eGRID Emission Factors Year 2004 and Year 2012 Comparison

	EPA eGRID Y2004 RFC-W	EPA eGRID Y2012 RFC-W
CO2 lbs/MWh	1,556.39	1,379.48
CH4 lbs/GWh	20.00	17.11
N2O lbs/GWh	24.00	21.67

Over the years, the grid has gotten inherently 'cleaner' resulting in an overall reduction in electricity related emissions. However, bold action is needed in order to deeply decarbonize the electric grid and recognize necessary emission reductions.

Greenhouse Gas Emissions from Transmission Loss & Inefficiency

As shown in the Sankey Diagram, significant amounts of energy is wasted due to inefficiencies in production and delivery of energy and electricity. Nearly 41% of the energy in the Power of 32 Region (32 counties in southwestern Pennsylvania, eastern Ohio, western Maryland and northern West Virginia) is 'wasted'. This is largely due to waste heat in the energy generation process, especially in the conversion of coal to electricity.



Objective: Reduce line loss by 50% by 2030

Line Replacement and Methane Mapping Project

An essential first step in reducing energy emissions is to reduce wasted energy. Due to a lack of data, Pittsburgh's previous inventories have not been able to account for the emissions related to natural gas leaks, electricity transmission loss, and energy that is lost while being used to treat water. However, recent studies show that transmission loss, of electricity and natural gas, accounts for about 9% of the region's energy consumption. These transmission loss emissions comprise 3% of Pittsburgh's community emissions profile. Duquesne Light Company and People's Gas are taking initiative and enacting multiyear infrastructure upgrade and grid modernization projects in order to improve the efficiency of delivery systems and reduce these losses.

For People's Gas, infrastructure upgrades mean replacing miles of aging pipe used to deliver natural gas to customers. Working with Google Earth Outreach, Carnegie Mellon University, and the Environmental Defense Fund, People's is improving the tracking of methane leaks across their infrastructure in order to target specific locations for line replacement and infrastructure improvement projects.

For this project, Google Map vehicles equipped with sensors that could more effectively and efficiently detect methane leaks created a map of leaks throughout the Pittsburgh. There were 201 leaks identified during the study period, many in the 50% of natural gas pipes that are more than 50 years old. These leaks do not typically have immediate risk implications but can have a serious impact on climate. Since it has a warming potential more than 80 times greater than Carbon Dioxide, reducing the natural gas leaking from these pipes can create major greenhouse gas reductions.

The methane mapping pilot was one step in a larger, 20-year pipeline replacement plan. Over the next 20 years People's will invest $100 million a year in infrastructure upgrades with 60% of that capital being focused within the City of Pittsburgh. Throughout this process, People's is also working with Carnegie Mellon University to create a risk ranking of pipe infrastructure. These rankings take into account pipe age, material, and leak history in order to prioritize areas for upgrades. As a result of these investments, People's will be able to considerably impact and reduce Pittsburgh's overall emissions inventory.

Objective: Modernize Energy Systems

In order to reach the 2030 Goals, Pittsburgh needs to (1) reduce energy demand, (2) create efficiency district energy systems, (3) decarbonize the electric grid, and (4) convert systems from combustion to electrification. (*Demand reductions are addressed in Chapter 3, Buildings and End Use Efficiency. More information on Electrification can be found in Chapter 3, Buildings and End Use Efficiency and Chapter 4, Transportation and Land Use*.)

Decarbonize the electric grid

In order to decarbonize the electric grid, Pittsburgh needs to install more local renewable electricity generation systems, eliminate dependence on coal powered electricity, and protect existing zero carbon nuclear power. Action such as converting coal fired power plants to natural gas and protecting the nuclear facilities which provide 60% of Pittsburgh's electricity without producing carbon emissions are important components of any plan to decarbonize the electric grid.

Western Pennsylvania Energy Consortium

The City of Pittsburgh manages the Western Pennsylvania Energy Consortium (WPEC), a group of 30 local government entities and universities who use reverse auctions to purchase electricity at a lower cost. WPEC acquired 10% non-certified REC in the first auction in 2008, and has increased that percentage by 5% each auction, and currently purchase 35% non-local

non certified renewable electricity. The City of Pittsburgh has committed to using 100% renewable electricity to meet its operational loads by 2030 through both city-owned generation and purchase power agreements that install more renewable electricity production locally. In collaboration with the other members of the WPEC, the City of Pittsburgh will design options that allow members to transition to 100% local renewable electricity purchase, acknowledging that some existing members already reach or aspire towards these goals via multiple means.

Local Renewable Electricity

In order to fully realize the benefits of renewable electricity, a focus on local generation is needed. Generation of renewable electricity in southwestern Pennsylvania can provide a multitude of benefits. Increased availability of local renewable electricity will connect large power consumers with local providers. Deployment of local renewable electricity will spur economic growth, create employment opportunities and enhance residents' well-being while improving Pittsburgh's economic competitiveness. As Pittsburgh looks to transition to clean electricity sources, the goal is to install 200MW of new, local renewable electricity. Local generation of renewable electricity in southwestern Pennsylvania will provide a myriad of economic, resiliency, and air quality benefits in addition to reduced greenhouse gas emissions.

District Energy

Municipalities across the nation face issues with deteriorating energy infrastructure. It has been shown that up to 60 percent of the energy that moves along aging gas and electric lines can be lost during transmission.[1] The City of Pittsburgh, in partnership with the Department of Energy, the National Energy Technology Lab, Duquesne Light, and the University of Pittsburgh Center for Energy, is currently developing a 21st century energy infrastructure plan to address these issues. The plan calls for the expansion and optimization of district scale energy systems, such as microgrids, thermal loops, combined heat and power systems and other innovative technologies.

Most cities rely on energy provided by power plants far outside of the city boundaries. A district energy system allows a city to develop energy infrastructure on a smaller scale to optimize delivery, create resiliency in the grid system and minimize energy disruption. District scale systems also deliver cleaner and more efficient energy to customers while promoting economic development. A district energy system can provide local, reliable and affordable energy for urban communities, while also providing economical solutions for commercial and industrial consumers and lowering greenhouse gas (GHG) emissions.

A microgrid is, in many ways, a smaller version of a traditional power grid. It is a discrete energy system with clearly defined electrical boundaries consisting of components for power generation, distribution and demand management. A microgrid can act in parallel with, or independent from, the main power grid. However, microgrids provide a much closer proximity between power generation and usage, resulting in increased efficiency. Microgrids can also take advantage of renewable electricity sources such as solar and wind power, geothermal and combined heat and power systems as well as other innovative energy production systems.

Distributed energy resources (DER) are smaller than utility-scale generating systems and are located closer to the customers that they serve. Due to this proximity, there is a reduction in thermal line-losses associated with transmitting electricity over long distances from centralized power plants. The electrical resistance of transmission and distribution lines results in energy being “lost” to heat. These thermal line losses increase as demand on the electrical grid increase. At peak times, line losses are approximately 50% higher, and can approach 8-10% of the power sent through the lines. Locally-sited district energy resources would reduce the need for long-distance transmission and distribution of electricity, Duquesne Light believes that the deployment of microgrids and their associated DER has the ability to significantly reduce the line-losses for electricity generated by DER. If line-losses were reduced by the 8-10% mentioned above, then 8-10% less electricity would need to be generated in order to provide end-users with electricity. Assuming that this 8-10% of electricity was being generated by fossil-fuel power plants, district energy resources have the potential to reduce greenhouse gas emissions. In addition, during peak usage or at times of primary power grid failure, a microgrid can operate independently of the larger grid. If problems arise within the microgrid, it can isolate itself without affecting the larger grid's integrity. Microgrids are also capable of supplying power back to the larger grid during times of grid failure or power outages.

The electrical grid uses AC (alternating current) because large power plants create AC power and transformers need AC power to step up the voltage to send electricity long distances with lower transmission loss. Direct current is not ideal for long transmission but works well for local energy networks, and eliminates the need to convert grid AC power to DC in order to power LED lights, electronics, data and telecommunications. The grid was built in an era of fossil fuel expansion, where having a coal-fired generator on every block was not a desirable situation. However, solar and wind power can be integrated into the fabric of the city with enough regularity to feed a DC grid, and renewable sources already generate DC power. For this reason, District Energy Pittsburgh has proposed two DC microgrids powered by solar photovoltaic electricity; one at the Duquesne Light training facility and one at the Second Avenue parking lot.

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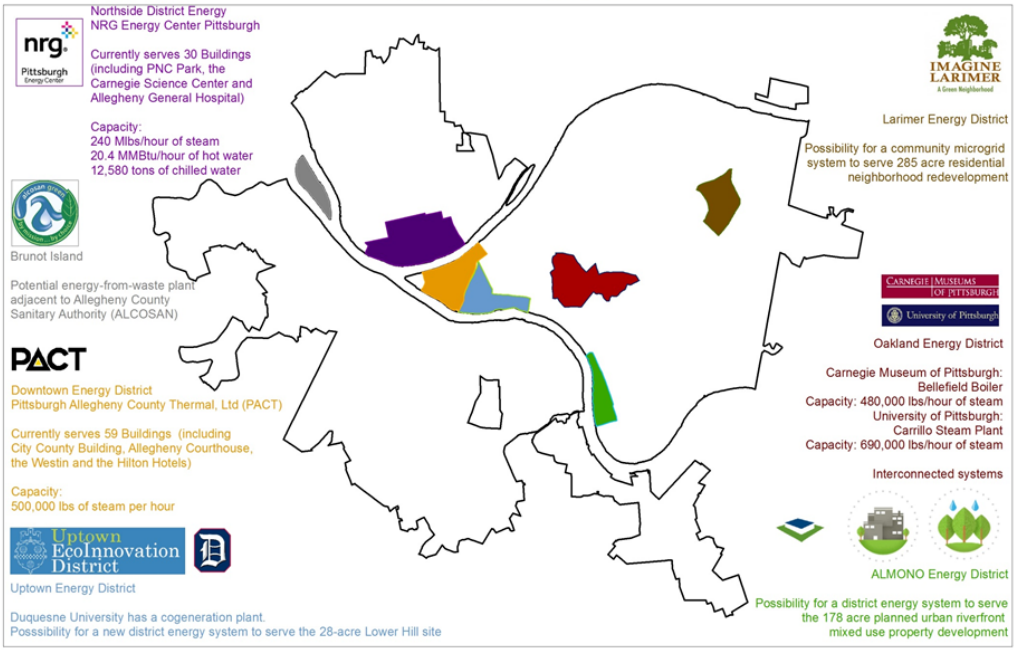
District Energy in Pittsburgh, PA



Designing systems around the specific energy needs of a neighborhood will allow developers to create systems that take advantage of local resources, infrastructure, and other regional features. While these systems may require more up-front engineering, they can be highly efficient and more cost effective than traditional, off-the-shelf technologies. Pittsburgh already has two steam districts in the downtown triangle, two interconnected university steam systems, and a university cogeneration plant. These systems are all evaluating opportunities for increased efficiency; several opportunities for new district energy systems have been identified.

District-scale energy systems also have a number of notable benefits when compared to the development of multiple stand-alone systems in individual buildings or businesses. A broader customer base will allow for higher utilization rates as well as a broader range of systems available for development. A single point of maintenance (compared to having to go into each commercial and residential building served by the system) will streamline upkeep and repairs, requiring only one system to be monitored for optimal operation. Economies of scale and reduced overhead will decrease the cost of potential upgrades and expansion of a single system compared to many separate systems deployed in different buildings. An example of this is Duquesne University, which has continued to upgrade its combined heat and power (CHP) system, integrating cooling systems and thermal storage. District energy systems within the City of Pittsburgh can provide secure, reliable energy with higher efficiency, lower carbon emissions, and lower capital and operating costs. They will enhance the integration of distributed and renewable electricity sources and enable integration of smart grid technology. District energy systems will minimize the City's carbon footprint and greenhouse gas emissions by maximizing clean, locally controlled energy generation.

Pittsburgh is at the leading edge of a global model for the development of municipal energy production to provide area communities and businesses with clean, affordable, efficient energy. The successful design and deployment of energy districts will enable these systems to be replicated throughout the region. Pittsburgh can become a center for innovation, not just in energy district design, but also in the advanced energy technologies that will sustain those districts.

EcoInnovation District: Case Study

The EcoInnovation District is a unique initiative that was developed to address many of the typical challenges faced across Pittsburgh's neighborhoods. It is a plan that combines the goals of EcoDistricts, dedicated to equity and environmental resiliency, with the goals of Innovation Districts that focus on job growth through the establishment of new and innovative businesses. The EcoInnovation District in Pittsburgh is an area "dedicated to sustainability, innovative development practices and inclusive job growth" In other words, it is a community plan that centers on supporting existing residents while increasing job opportunities and protecting the environment.

The EcoInnovation District in Pittsburgh encompasses the Uptown and West Oakland communities. These neighborhoods present both challenges and opportunities. They are located between the thriving Downtown and Oakland areas. However, they have not seen the same level of growth and recovery as these other regions. As the Downtown and Oakland areas

experienced significant growth, the Uptown and West Oakland communities have faced divestment and deterioration. In addition, due to their location near transportation corridors, they suffer from problems of air quality, access as well as safety. They also face significant challenges related to housing affordability, storm water runoff and infrastructure issues. However, community organizations in Uptown and West Oakland have encouraged investment while creating opportunities for local residents. As prices rise and space for development falls in the Downtown and Oakland areas, the EcoInnovation District presents an opportunity to develop an environmentally resilient community based on equitable land use, job growth for residents and reliable transportation and infrastructure systems.
Community ownership of this plan is essential and all members of the community were invited to participate in the process. Collaboration and trust among community residents, institutions, businesses, and government is essential in order for successful investment and sustainable growth in the corridor.

The EcoInnovation District reflects a new approach to development that is focused on job growth and economic opportunity, universal access, smart and efficient infrastructure and green building practices. Neighborhoods that are walkable, bikeable, and transit-oriented result in healthier lifestyles for residents, promote greater equity in access, and create a better environment for businesses to succeed.

CHAPTER THREE: Buildings and End Use Efficiency

Goal: Reduce energy and water consumption by 50% by 2030

Objectives:

- Improve quality of energy and water use data
- Ensure all new buildings are carbon neutral by 2030
- Ensure all new buildings have optimum location efficiency by 2030
- Mitigate high energy burdens in vulnerable communities
- Improve energy efficiency in residential, commercial, and industrial buildings
- Reduce sewer volume by 50% below 2013 levels by 2030
- Improve the efficiency and effectiveness of public street lighting and traffic signals

Strategies:

- Collect monthly electricity consumption data by sector by zip code
- Collect monthly natural gas consumption data by sector by zip code
- Collect monthly potable water use data by sector by zip code
- Implement Commercial Building Energy Benchmarking Ordinance
- Create legal framework for Property Assessed Clean Energy (PACE) program
- Encourage demand response program participation
- Promote Green and Healthy Homes Initiative and related programs
- Allow for 'green' information to be included in the Allegheny County Multi List Service
- Support state level legislation enabling residential energy and water disclosure
- Support state level legislation enabling adoption of most recent building codes
- Promote Passive House building guidelines
- Create a location efficiency overlay and use transfer of development rights to encourage density while protecting open space
- Educate homeowners and renters on existing energy efficiency programs
- Create a building owner manual and expand first time building owner classes
- Create a revolving loan fund for energy and water efficiency retrofits
- Create a map/matrix of resources for energy efficiency retrofits
- Promote home energy scores and home energy audits
- Install smart meters to provide better customer data access
- Pass local graywater and rainwater use legislation to facilitate irrigation/toilet flushing with graywater and rainwater
- Implement a stormwater fee to improve green infrastructure and prevent stormwater from entering the combined sewer
- Transition to LED Streetlights

Challenges:

- Buildings currently account for 81% of Pittsburgh's greenhouse gas emissions
- Pittsburgh has the among the highest energy burdens in the United States
- More than 70% of Pittsburgh homes were built before 1970

Existing Projects and Previous Work:

- Building benchmarking ordinance
- 2030 District

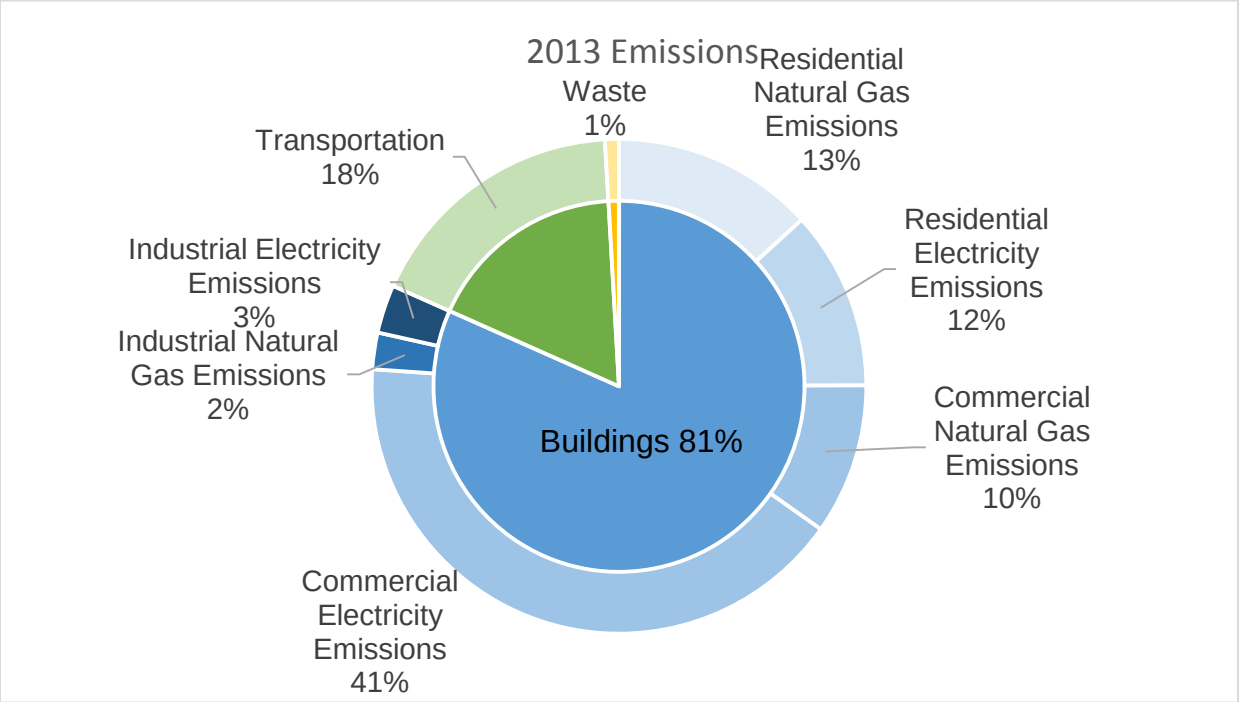
- Green Garage Initiative
- Green and Healthy Homes Initiative

Building Champions

- Green Building Alliance
- Pennsylvania Environmental Council
- Conservation Consultants Inc.
- Pittsburgh Water and Sewer Authority
- Urban Redevelopment Authority
- Pittsburgh Parking Authority
- Sports and Exhibition Authority
- Department of City Planning

Greenhouse Gas Emissions from Buildings

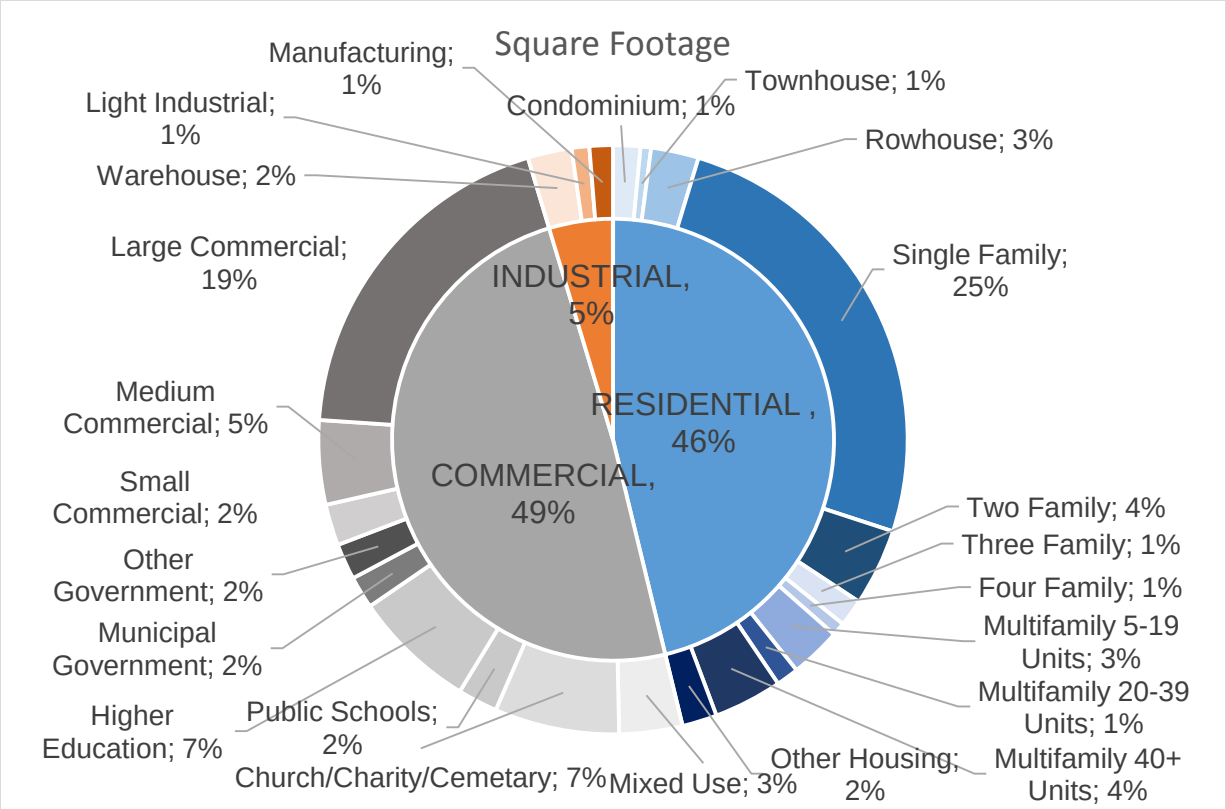
Based on Pittsburgh's 2013 sector-based GHG inventory, buildings are responsible for 81% of the city's carbon emissions through electricity and natural gas consumption.



As the city's largest contributor of greenhouse gas emissions, Pittsburgh's vertical built environment provides many opportunities for deep carbon reductions. Improving energy generation and distribution systems is one approach to reduce GHG emissions. However, improving end use conservation and efficiency will also significantly reduce emissions. For both energy source and end use demand, Pittsburgh's building stock offers many improvement

opportunities in the commercial, residential, and industrial sectors; strategies specific to each end use type abound and have much opportunity to be deployed at greater scale.

Energy Use Intensity



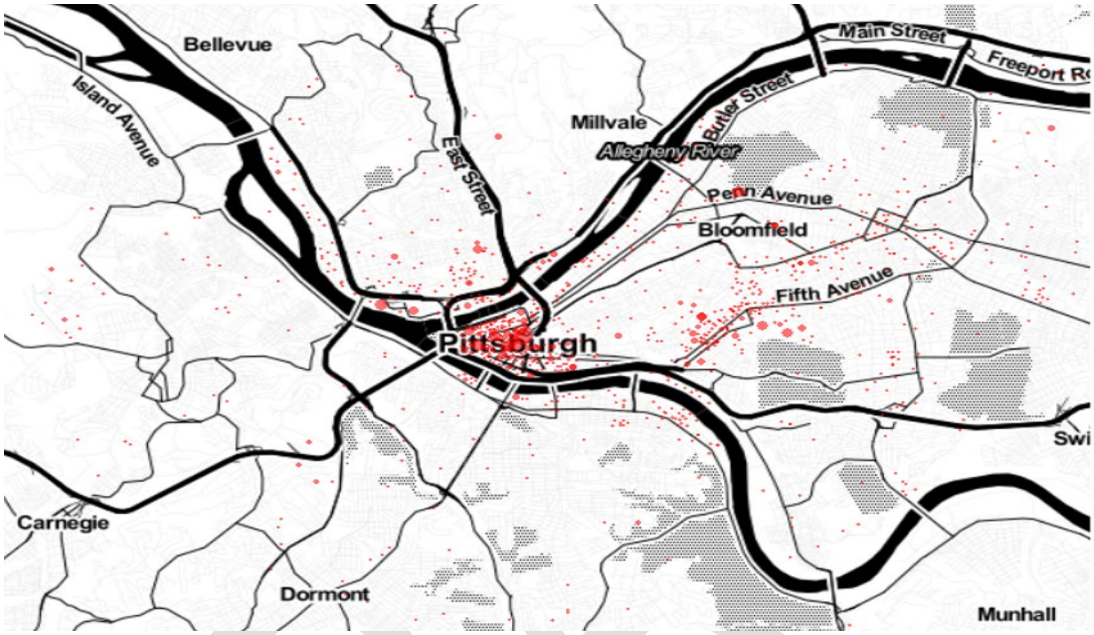
Energy use intensity (EUI) measures how much energy a building uses per square foot, which is largely determined by the building use type with other contributing factors such as occupancy, building age, and quality of building systems. For example, a manufacturing facility with heavy machinery traditionally uses much more energy than a simple warehouse; a home building to passive house standards will be more efficient than a poorly insulated home, thus using less energy per square foot. Using EUI measurements allows for efficiency to be analyzed and compared to similar buildings regardless of building size.

Given currently available local data sources, it is not possible to link energy use back to a specific building or use type, so energy use by sector is divided by that sector's total square footage. In future years' inventories it will be possible to link energy consumption to building use type, size, and geographic location to tell a better story of Pittsburgh's energy use.

Objective: Improve energy efficiency in existing commercial buildings

Building Benchmarking

In October 2016, the City of Pittsburgh adopted a new Building Benchmarking ordinance requiring all nonresidential building 50,000 square feet and larger to report annual water and energy consumption starting in June 2018.



Map of buildings in the City of Pittsburgh 'covered' by the benchmarking ordinance

"You can't manage what you can't measure." The first step in making any reductions in building energy and water use is to get a better understanding of how and where those resources are used. Benchmarking buildings allows owners, operators, and tenants to understand how each building is performing in relation to its local and national peers. This detailed, benchmarking information can then help inform future decisions and investments, perpetuating cost and resource savings.

In adopting building benchmarking legislation, Pittsburgh joined 16 cities across the U.S. in requiring transparency towards measurable success. In New York City, the first year of benchmarking legislation, resulted in nearly 6% cumulative energy savings; San Francisco saw an 8% energy reduction with a similar policy. Given that commercial buildings contribute 51% of the city's GHG emissions profile, Pittsburgh hopes to recognize similar cost, resource, and emissions reductions.

Pittsburgh 2030 District

Pittsburgh's building benchmarking ordinance will expand upon the efficiency improvements already being recognized within the Pittsburgh 2030 District. A Green Building Alliance strategic initiative, the Pittsburgh 2030 District is a collaborative, nationally recognized, local community of high performance buildings in Downtown, Oakland, and 3 other neighborhoods. It consists of building owners, facility managers, and community and resource partners working together to dramatically reduce energy and water consumption, decrease transportation emissions, and improve indoor air quality while increasing regional competitiveness and returns on investment.

Using performance targets provided by the global Architecture 2030 Challenge, the Pittsburgh 2030 District is demonstrating that high performing buildings are the most profitable buildings in the City.[1] Over 492 buildings have already committed to reducing energy use, water consumption, and transportation emissions 50% below baselines by the year 2030.

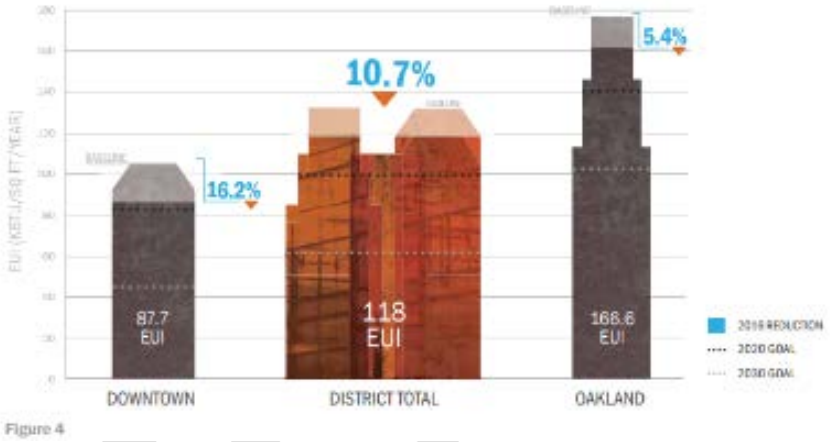


Figure 4

Since 2012, the Pittsburgh 2030 District's partners has reduced energy consumption an average of 10.7% below the baseline. This equates to 2.6 Billion kBTUs -- the equivalent of more than 305,000 tons of CO_2 equivalent -- and savings of $52.3 million.

These collective efforts have established the Pittsburgh 2030 District as an international example of a multi-sector endeavor that maximizes performance and profitability while significantly reducing greenhouse gas emissions. This type of collaborative action will keep Pittsburgh competitive as it makes ongoing investments in Pittsburgh's future.

Energy Intelligence Network

Through a partnership with Carnegie Mellon University's Center for Building Performance and Diagnostic Performance and Metro 21 center, the City of Pittsburgh recently rolled out a building energy use dashboard. This dashboard is part of a larger 'Energy Intelligence Network' (EIN) currently in development.

The Energy Intelligence Network is designed to improve data quality and access in order to better understand and thus reduce the environmental impact of City facilities. Starting in the City

County Building, the EIN utilizes a number of monitors to collect and display real time energy consumption data. While these monitors have currently only been piloted in the City County Building, the City will expand the Energy Intelligence Network to all 300 city owned facilities. Real time, granular data about the energy being used by plug loads, lighting, and HVAC systems as well as the total energy being consumed can be used in numerous future projects and decision making processes.

Demand Response

Improved data quality as supplied by initiatives such as the Energy Intelligence Network can improve energy management capabilities. Energy management such as demand response programs can reduce energy costs and emissions and improve the resiliency of electric grid infrastructure. Demand response allows building operators to reduce or shift energy consumption during periods of peak consumption across the grid. Through a variety of options individual buildings can impact the demand and supply ratios of electricity in order to help ensure the demand does not exceed the available supply. Additionally, a more level load throughout the day will ensure that the supply is not too great which results in wasted energy.

Currently, if electric companies are unable to manage peak demands for energy, additional sources of energy generation, typically supplied by 'restarting' coal fired power plants, must be added to the grid. Peak load shaving, load shifting and time of use pricing, are a few demand response programs that can help reduce energy costs and prevent grid failures. Through participation in a formal demand response program, building owners can receive payment for reducing or shifting their peak loads. Building owners and operators may use these payments to pay for additional building efficiency improvements, permanently reducing energy loads.

Building Code Updates

Building Codes are put in place to protect the health and wellbeing of building occupants and ensure that best practices are used in construction and renovations. As codes are updated, new technology, techniques, and best practices are incorporated.

The Commonwealth of Pennsylvania follows the 2009 International Building Codes (IBC), despite the International Code Council (ICC) instituting twice updated codes in 2012 and 2015. To date, state level legislation has prevented the adoption of the most up to date building codes.

Composition of the 2009 building codes began in 2006, meaning that technology developed in the past 10 years are not accounted for in Pennsylvania codes. Due to the lack of adoption of present day codes, Pennsylvania buildings are subjected to higher insurance premiums, higher building operating costs (due to the lack of compliance with leading standards and improved efficiencies), and higher greenhouse gas emissions. The content of modern building codes includes updated technology and standards that allow buildings to be more energy efficient, cost-effective, and resilient.

With the help of many stakeholders, the City of Pittsburgh continues to advocate for adopting up-to-date building codes in the Commonwealth of Pennsylvania. ACT 35 of 2017 amended Pennsylvania's Uniform Construction Code (UCC) thus allowing first class cities (a city with a population greater than one million) to independently adopt more stringent building codes. Philadelphia is the only first-class city in the state of Pennsylvania so everyone else is unable to enforce any building codes beyond the UCC. Moving forward, the City of Pittsburgh is campaigning for, at minimum, a similar amendment allowing second class cities (population of 250,000 to 999,999) such as Pittsburgh to adopt up to date building codes. However, the ideal situation would be an amendment that automatically updates the UCC to the most recently passed IBC. An amendment such as this would prevent future lags in code adoption and have economic, environmental, and safety benefits across the entire state of Pennsylvania.

Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) is an initiative to provide funding for projects that improve energy efficiency, utilize renewable electricity or promote water conservation.

PACE is a national initiative with locally established programs. Individual states pass legislation that authorizes municipalities to develop appropriate PACE programs. Currently, 33 states plus the District of Columbia have authorized PACE financing for energy projects.

PACE programs provide multiple benefits to property owners and local governments. By providing 100% of project funding upfront, it allows immediate, significant energy savings while spreading the cost over an extended period of time. Businesses may benefit from a positive cash flow because annual energy savings are often greater than the annual assessment. For local governments, PACE is an Economic Development initiative. The program creates local jobs, lowers the cost of doing business and encourages new investment in the area. PACE projects also have a positive impact on air quality and energy efficiency, creating healthier, more livable neighborhoods.

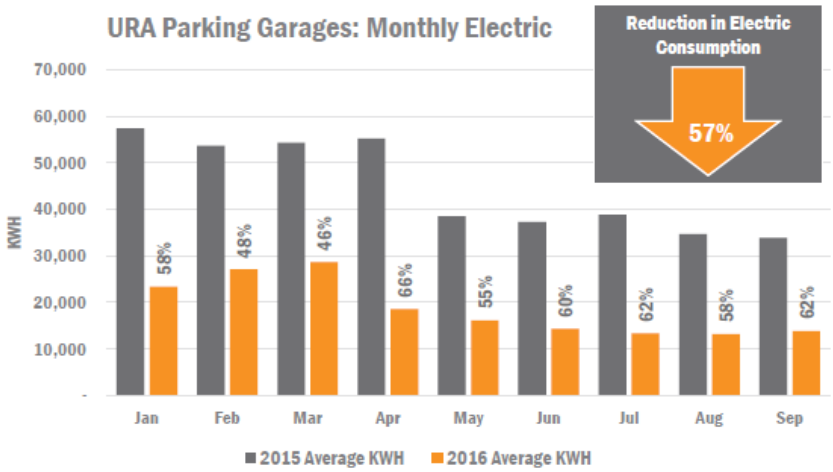
In Pennsylvania, Senators John Blake and Guy Reschenthaler, with the support of business, labor and environmental communities, have introduced legislation to establish a PACE program. If this legislation passes, Pittsburgh will be able to implement PACE programs locally.

Case Study: Pittsburgh Green Garage Initiative

Though wide in scope, the Pittsburgh Green Garage Initiative (PGGI) is an example of a cross-sector collaboration galvanized by a simple energy efficiency approach. Several local owners realized that dramatic energy savings could be realized by reconciling a few lines of building code, allowing for the use of more controlled and complex LED lights in parking garages. As a result, PGGI was created as a collaboration between the City of Pittsburgh, Green Building Alliance (GBA), Pittsburgh Parking Authority (PPA), Sports and Exhibition Authority of Pittsburgh and Allegheny County (SEA), and Urban Redevelopment Authority (URA). PGGI's goal is to improve parking garages' energy efficiency, reduce environmental impacts, and encourage sustainable solutions for municipally operated parking facilities in Pittsburgh.

The model for much of PGGI's activity has been the SEA which experienced a 64% reduction in annual electricity use at two garages following lighting and controls upgrades**.** In 2014, the PGGI collaboration built on this approach and received a $470,000 state PEDA grant for lighting upgrades and controls that the collaboration leveraged into sustainable revolving funds for PPA and URA.

As part of PGGI, URA retrofitted five local parking structures that are averaging a 57% reduction in electricity use (in their first 9 months of operations). The URA's complete retrofit portfolio includes five parking garages with a total of 3,051 parking spaces lit by 1,436 new fixtures. The URA is investigating applying a similar model on its one other parking garage – and leveraging savings by reinvesting into other facilities via a new sustainability revolving fund.



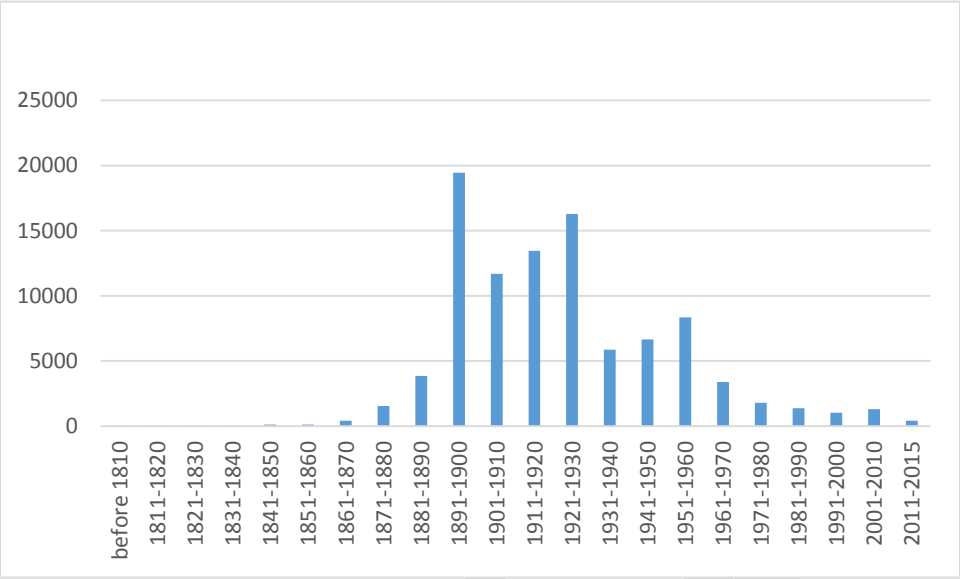
Pittsburgh Parking Authority completed a similar lighting and controls upgrade on its First Avenue Garage in August 2016. This enterprise is expected to have comparable extraordinary electricity reductions of up to 60%. PPAP is now designing similar retrofits on nine additional garages in the City. A recent study also concluded that 6,000 kW of solar photovoltaics (PV) could be installed on Pittsburgh Parking Authority garage roofs and at its the Second Avenue parking lot. The installation of solar PV can further reduce the GHG emissions resulting from the operation of these parking garages. This is an excellent example of how energy efficiency upgrades and renewable electricity generation can be combined to have the greatest impact, eventually allowing for net zero buildings.

Objective: Improve energy efficiency in existing residential buildings

Residential Building Data

With 51% of emissions coming from commercial buildings, it is easy to focus attention solely on commercial energy efficiencies. However, residential efficiency actions also offer opportunities for significant impact. As with commercial buildings, updated building codes will help ensure that energy efficiency is prioritized as new homes are built. However, over seventy percent of existing residential buildings in Pittsburgh were built prior to 1960, many years before energy

efficiency standards were integrated into national building codes in the 1970s. While sturdily built, these older homes need renovations to improve efficiency, health and safety.



Residential energy efficiency projects can offer equity benefits in addition to the potential emission reduction benefits. The American Council for an Energy-Efficient Economy (ACEEE) recently ranked Pittsburgh among the top ten cities where energy burdens, the ratio of utility bills to annual household income, were found to be greatest for low-income households. Nationally, the average energy burden for American households is approximately 4%. However, low income households' in Pittsburgh experience an energy burdens upwards of 15%.

In commercial buildings, electricity reduction offers the greatest opportunity for energy savings. In residential buildings, natural gas efficiency generates the maximum impact. Heating-related natural gas usage constitutes up to 56% of all natural gas usage in the City, 38% of all non-transportation energy usage, and up to 25% of the non-transportation related greenhouse gas emissions in the City. The residential sector is of particular interest, as up to 68% of gas usage in that sector is heating-related, amounting to an estimated 17% of energy use for the City (not including transportation sector emissions). Especially with the aging housing stock, which often lacks insulation or other heat saving updates, a significant amount of heat-related energy is 'lost' or wasted.

There have been a number of initiatives targeting residential improvements however, the ReEnergize Pittsburgh Coalition identified key barriers to increasing residential energy efficiency in Pittsburgh including;

1) Lack of homeowner education and awareness around energy efficiency programs and home performance issues
2) Difficulty connecting homeowners with available programs
3) Homeowner misconceptions about the value and ease of energy efficiency project implementation
4) Uncertainty around demand for and ability to sustain a skilled workforce

ReEnergize Pittsburgh Coalition also identified key strategies for improving residential efficiencies that include; improving consumer education resources, monetizing the value of home energy investments, integrating regional organizations and planning efforts, and identifying financing options and opportunities (Solving the Residential Home Energy Efficiency Challenge).

Green and Healthy Homes

In July 2017, Pittsburgh became the 19th United States city to join the Green and Healthy Homes Initiatives (GHHI). The Baltimore based organization utilize 8 key elements to help create healthier, more energy efficient homes. These whole-house strategies address issues from lead-based paint contamination, to poor indoor air quality, to energy efficiency in order to reduce housing costs specifically in low income households. These actions can help alleviate costs due to not only high energy burdens but also the socio-economic costs of related issues such as lead poisoning, asthma, lost labor force productivity, and high residence turn-over rates. In the United States, nearly six million households are exposed to 'unhealthy homes.' Led by Conservation Consultants Inc. (CCI), Green and Healthy Homes is striving to improve the living conditions in those households through education, hazard remediation, advocacy, and efficiency services. Moving forward, the City of Pittsburgh will help promote and implement Green and Healthy Homes Initiatives.

Residential Energy Labeling

The new building benchmarking ordinance mandates transparency in the commercial building sector, however, similar transparency does not always exist at the residential level. The US Department of Energy offers a Home Energy Score program that aims at improving residential energy efficiency. Similar to vehicle fuel efficiency, the Home Energy Score provides useful energy use and efficiency information to homeowners and buyers. The scoring process also provides homeowners with suggested energy efficiency projects or updates for the home. Promoting Home Energy Scoring and increasing the number of households that utilize this program can have benefits comparable to those expected to be seen through benchmarking in the commercial sector.

Greening the MLS

A multiple listing service (MLS) is used by real estate brokers to share information about residential and commercial properties with other brokers and their agents. The information is also utilized to enable accurate appraisals.

The West-Penn Multiple List Service is the primary source of information for realtors, home buyers, and appraisers in the Pittsburgh area. Green information such as, solar panels, high-efficiency HVAC, insulation levels, or Home Energy Scores, are not currently included in multi-listing databases. However, this information could have a significant impact on appraisal values and accounting for the true value of these items. Additionally, potential buyers would be able to search for environmentally friendly features and make a better informed purchase. Multiple studies have found that energy efficiency and green features are important to new home and

property buyers, and that buyers are willing to pay more for those features. The *ENERGY STAR® for New Homes* label was found to be "very important" to 91% of new home buyers.[1] A survey of home buyers and sellers found that heating and cooling costs were "important" or "very important" to 84% of respondents.[2] It was also found that 73% of home builders have built or are planning to build a net-zero home and green construction is projected to continue to grow.[3] Home energy scores, green listings, and point of sale energy audits can help improve transparency in the home buying process. Increasing the information available to potential homeowners can allow those individuals make informed decisions and, as with the commercial energy benchmarking ordinance, begin to prioritize energy efficiency in residential reality.

Act 129

Utility-managed energy saving initiatives, such as Act 129 in Pennsylvania, represent a significant portion of available efficiency programs available for homeowners, renters, and commercial or industrial buildings owners. While these programs have a number of applications and benefits, they are often underutilized. Act 129 is legislation which requires Electric Distribution Companies (EDCs), such as Duquesne Light, to reduce electricity consumption. Improving education and access to Act 129 benefits can help significantly reduce energy use in cost-effective way. In the residential sector, Act 129 provides an opportunity for efficiency upgrades that would otherwise be unaffordable for homeowners. Increased utilization of Act 129 programs is an important tool in order to reduce energy burdens.

Objective: Improve energy efficiency in existing industrial buildings

Despite Pittsburgh's heavily industrial past, industry currently accounts for only 5% of greenhouse gas emissions in the City of Pittsburgh. While that 5% includes activities such as potable water and sanitary treatment, a granular analysis of the emissions sources has not yet been conducted. The first step to improve industrial efficiency is to conduct this analysis and set a better baseline of industrial based GHG sources. Greenhouse gas emissions from industrial sites is often a single indicator of overall environmental impact; onsite activity can have additional air, water, and soil quality implications, which in turn affect human and environmental health. In order to better account for the true environmental impact of industry in the city, a concise database is needed. With improved information, key stakeholders can be brought to the table and further action can be taken.

Additionally, while the industry may only account for 5% of the GHG emissions inside boundaries of the City of Pittsburgh, there are industrial activities in Southwestern Pennsylvania that do not factor in to Pittsburgh's GHG inventory but that have a significant impact on air quality and water quality in Pittsburgh. In Beaver County, about 30 miles North West of Pittsburgh, a new petrochemical processing complex is set to be developed. This single site is permitted to emit 2.2 million tons of CO_2 equivalent annually. For comparison, if Pittsburgh reaches the 2030 goal of 50% emission reduction, 2.1 million tons will be eliminated, compared to the 2003 baseline. This Climate Action Plan addresses what can be done within the 58 square miles that make up the City of Pittsburgh. However, regional action is needed to ensure a healthy future for southwestern Pennsylvania.

Objective: Ensure all new buildings are location efficient by 2030

Updated building codes will help ensure that all new construction incorporates new beyond a building's energy and water use, location has a significant impact on greenhouse gas emissions. If a new building is sited on a green field far away from residential areas and transit, the building decreases carbon sequestration and increases emissions from cars traveling to it. If the building is far from existing infrastructure, there is additional cost and energy loss conveying electricity and natural gas to the site. (More about location efficiency can be found in Chapter 4: Transportation and Land Use)

Beyond a building's energy and water use, location has a significant impact on greenhouse gas emissions. If a new building is sited on a greenfield far away from residential areas and transit options, the building will most likely increase overall emissions due to the distance vehicles will have to travel to and from the building. If the building is far from existing infrastructure, there will also be additional cost and energy loss conveying electricity and natural gas to the site. Pittsburgh defines a location efficiency using overlay map that integrates the walksheds around job centers (1/4 mile), walksheds to frequent service transit (fixed guideways) and protected bikeways to job centers/frequent service transit.

Objective: Ensure all new buildings are carbon neutral by 2030

Enacting the most up to date building codes will ensure that all new buildings, at minimum, incorporate the latest energy efficiency measures. However, buildings can go beyond meeting minimum code requirements and choose to build to passive house standards.

The Passive House, or more accurately, Passive Building, is based on standards designed to cut carbon emissions and energy consumption while providing superior comfort, air quality and resilience. In addition to energy efficiency, passive building standards produce exceptionally resilient buildings. Passive design strategies balance factors such as heat emissions from occupants and appliances to maintain consistent indoor temperatures, even in extreme weather conditions. Continuous ventilation also provides superior indoor air quality.
A Passive Building is designed and built in accordance with five principles:

1. Continuous insulation throughout the building's thermal envelope with no thermal bridging. The thermal envelope is the building's heat flow control layer and a thermal bridge is an area that has higher thermal conductivity and results in heat transfer into or out of a space.
2. An air-tight building envelope that prevents the infiltration of outside air and the loss of conditioned inside air.
3. High-performance windows and doors
4. A balanced heat and moisture recovery ventilation system and a minimal space conditioning system.
5. Management of solar effects to maximize heat gain during the heating season and minimize heating during the cooling season.

Passive building principles can be applied to all types of buildings from single-family homes to multi-family apartment buildings, businesses and large-scale office buildings. These principles minimize the renewable electricity that is required, and therefore provide a potential means to achieve Net-Zero and Net-Positive buildings.

CHAPTER FOUR: Transportation and Land Use

Goal: Reduce on-road transportation emission by 50%

Objective:

- Reduce on-road transportation relate emissions by 50% by 2030
- Reduce Vehicle Miles Traveled per capita by 50% below 2013 levels by 2030.
- Increase shift in fuel sources by promoting vehicle electrification
- Reduce freight emissions by 25% by 2030

Strategies:

- Develop a Comprehensive Plan for the City of Pittsburgh
- Synchronize traffic signals to ensure smooth traffic movement, bus prioritization, after hours freight prioritization, etc.
- Increase bike commute rate to 10% of trips
- Increase walking commute rates by 50%
- Implement citywide bike plan and increase access to bike infrastructure
- Promote and grow bike share programs
- Increase Port Authority ridership
- Implement Bus Rapid Transit system
- Integrated bike infrastructure with public transit systems
- Expand transit hubs to promote multimodal trips
-

Challenges:

- Due to the nature of transportation, accurate, complete data is difficult to compile
- As population of Pittsburgh increase and additional jobs are created in the city, mobility needs will also increase
- Overcoming inequity in access to transit systems

Existing Projects and Previous Work:

- Bus Rapid Transit System
- Uptown EcoInnovation District
- Bike Plan
- Complete Streets Plan
- Bike Share

Transportation Champions

- Pittsburgh Community Reinvestment Group
- Port Authority of Allegheny County
- Department of Mobility and Infrastructure
- Pittsburgh Parking Authority
- Bike Pittsburgh

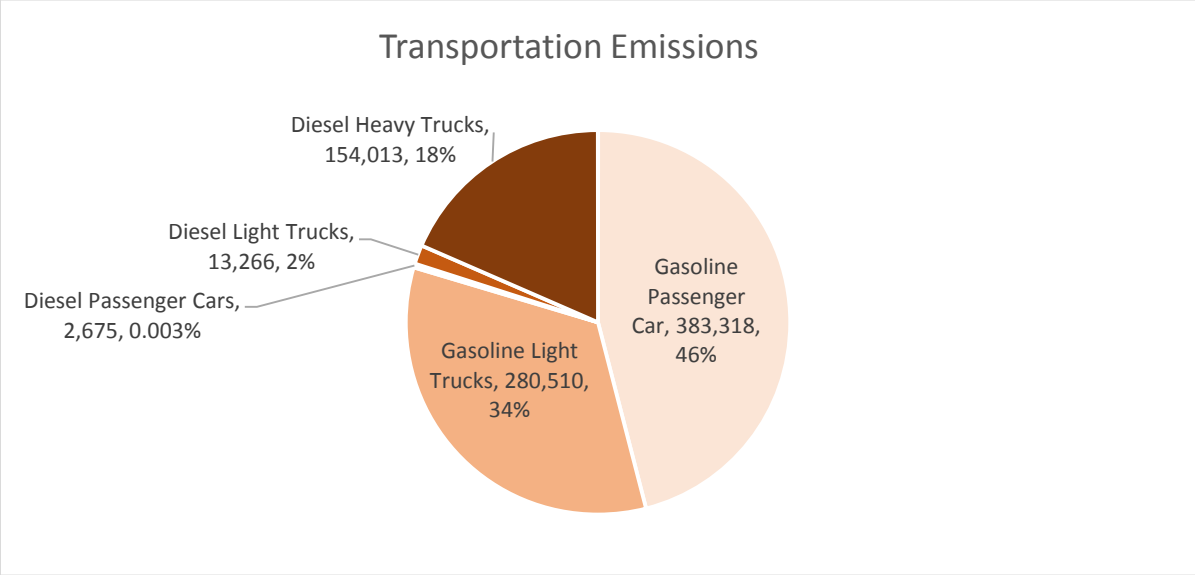
Greenhouse Gases from Transportation

Transportation sources of greenhouse gas emissions in Pittsburgh include on-road vehicles such as passenger cars, mass transit, freight trucks, and off-road vehicles, such as construction vehicles, boats and trains.

It is important to have accurate measurements of GHG emissions from various modes of transportation. Emissions from the use of electricity and natural gas are able to be calculated from aggregate consumption information for specific geographic areas that can be collected from utility monopolies. However, for gasoline and diesel fuel, the location of fuel sales and the location at which emissions are produced are not necessarily the same. Therefore, total fuel sales within a boundary are not used to calculate transportation emissions. Instead, vehicle miles traveled and emissions per mile are used.

An estimated 18% of Pittsburgh's greenhouse gas emissions come from the tailpipes of vehicles traveling on roads within Pittsburgh city limits. However, there are significant data challenges that require assumptions within this calculation. In order to estimate annual vehicle miles traveled in the city boundary, the Southwestern Pennsylvania Commission (SPC), the Pittsburgh region's local Metropolitan Planning Organization, used a transportation model to provide the weekday total vehicle miles traveled (VMT) on all Pittsburgh roads. A local breakdown of vehicle types was unavailable, so the national average road composition was used, along with average emission factors for each vehicle type. This model only considers gasoline and diesel vehicles, and does not account for emissions from idling vehicles.

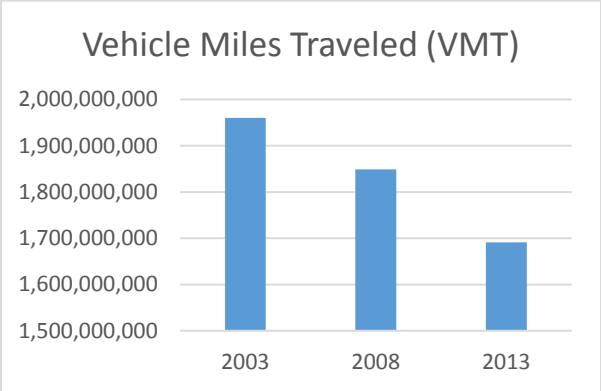
To improve the inventory in the future, the model should simulate the entire year of VMT and include emissions from idling. The model should also use the local vehicle composition from DMV registrations, which will allow for emission factors based on vehicle make, model, and year, rather than relying on national averages.



2013 Sector based profile for transportation related emission

Based on the modeling done by SPC and Carnegie Mellon University, emissions were categorized by vehicle and fuel type. Of the 833,000 tons of CO_2 emissions from transportation, 80% are created by gasoline powered vehicles. In order to reach the 2030 Goal of 50% reduction in transportation-related emissions, significant reductions in vehicle miles traveled (VMT) by gasoline powered vehicles must be attained.

Vehicle Miles Traveled



Since 2003, emissions from on-road vehicles have been tracked in Pittsburgh and the City is following the national trend in decreased vehicle miles traveled (VMT). Since 2004, total VMT in the U.S. has declined slowly. In 2012, total VMT reached the lowest level since 1996 (State Smart Transportation Initiative, 2013).

The decrease in VMT and increase in average fuel efficiency of vehicles has resulted in a decrease in transportation-related greenhouse gas emissions between 2003 and 2013; however, these emissions still account for 18% of Pittsburgh's overall GHG emissions. In order to achieve Pittsburgh's 2030 goals and carbon neutrality, several actions will be required. The increasingly stringent US EPA vehicle emission and fuel economy standards will help reduce on-road transportation emissions. Achieving target reduction will also require actions that reduce vehicle miles traveled on Pittsburgh roads, shift modes away from single occupancy motor vehicles, and shift away from relying on fossil fuels. In addition, equitable access to public transit and alternate modes of transportation is essential to ensure that all residents in the City of Pittsburgh are able to access essential resources such as major job centers, social and human services, grocery stores, recreational centers, schools, and medical facilities.

Objective: Reduce Vehicle Miles Traveled by 50% per capita below 2013 levels

As vehicle fuel efficiencies improve, transportation-related emissions per vehicle will decrease. However, if Pittsburgh's population increases and the number of jobs within the city increases as expected, the demand for transportation will increase thus adding more emissions. To counteract the increased population, the per capita VMT must be reduced. By shifting away from single occupancy vehicles, vehicle miles traveled (VMT) within the city can be drastically reduced. This will help reduce emissions, improve air quality, reduce infrastructure maintenance costs and reduce congestion throughout the City of Pittsburgh.

The best way to reduce VMT is to increase the percentage of trips made by other modes of transportation. Increasing the use of public transit, shared rides, or non-motor vehicle trips will

reduce the trips taken in single occupancy vehicles, the largest contributor to transportation related emissions.

Comprehensive Plan Priorities

The City of Pittsburgh is developing its first Comprehensive Plan, which will include a transportation component and complete streets guidelines, prioritizing pedestrian, cyclist, public transit and carpool trips over single occupancy motor vehicles. By weaving together a cohesive network of public transit, bike and pedestrian infrastructure, car sharing and Transportation Network Company (TNC) services, Pittsburgh will become a city in which single occupancy auto ownership is not required for a high-quality lifestyle. Planning for transit-oriented development and mixed use, walkable neighborhoods will reduce the miles people must travel to meet their needs and will deter personal vehicle ownership. It has the added benefit of significantly reducing household transportation costs, improving mobility, and addressing issues of equitable access to goods, services, and places of employment.

While the City aims to reduce reliance on personal auto ownership, there are also efforts in place to also increase the viability of electric vehicles and replace internal combustion engines that negatively impact Pittsburgh's air quality and cause adverse health effects. The plan will also include a streetlight overhaul converting sodium bulbs to LEDs, designed to improve visibility and safety for all users of the road.

Setting 2030 Mode Shift Goals

The Pittsburgh Community Reinvestment Group was has led efforts around determining realistic city-wide mode shift goals, identified in the table below:

Mode	2016 Commuter Mode Split	Objective	2030 Commuter Mode Split Goal
Walk	10.3% (+/- 0.6)	55% increase	15.5%
Bike	2.6% (+/-0.2)	285% increase	10%
Public Transit	18.1% (+/- 0.7)	100% increase	36.2%
Single Occupancy Vehicle (Drove Alone)	55.5% (+/-0.9)	50% decrease	27.75%

Mode split for commuter trips in Pittsburgh and goal mode split for 2030

In the Southwestern Pennsylvania Commission's 2015 travel model, it is estimated that approximately 29% of all trips were commuter trips, 35% of car-based trips were commuter-based, and around 49% of transit trips were commuter trips. The existing data covers only commuter trips, not leisure trips. Better data for non-commute trips is needed in order to get a more accurate mode split analysis. Assessments such as the Green Building Alliance, Make My Trip Count survey can help provide this data in the future.

Increasing Mode Shift

There are various transportation demand management (TDM) strategies and actions that can impact mode shift from personal autos. These include having employers and landlords offer universal transit passes, car/bike share subscriptions, telecommute and flexible work schedules, road and parking pricing, and road space allocation to promote bike lanes and transit-only lanes. In order to decrease the percentage of commuters driving alone, there must be other viable and easily accessible choices available to replace or supplement driving.

Increasing Port Authority Ridership

Increasing the percentage of public transit trips requires capital outlay to accommodate increased demand with more frequent routes, additional busses and drivers, and bus facility space available. The Port Authority is currently working to identify the latent demand of people who could potentially take transit but currently are not. Another reconfiguration of the system, to update reforms enacted in 2009-11 should be explored as well.

Increase Bikeability and Walkability

Commuting by bike has shown a steady increase in the past few years and is expected to continue to grow with the creation of new bike infrastructure, including the expansion of total miles of protected bike lanes and bike repair stations. However, there are still deterrents to the choice of a bicycle as one's primary mode of transit, such as winter weather and unsafe traffic conditions. Difficulty using more than one mode of transportation per trip can also deter potential bike commuters. Increasing multi-modal choices through the further integration of biking with transit such as including bike racks on all buses, installing bike share stations at bus and T stops, increasing dedicated bike storage on the T, integrating access to Bike Share with ConnectCard, and ensuring secure bike parking at transit hubs will help promote biking.

Increasing the percentage of commuters walking to work is difficult without strategic land use changes designed to create more walkable and complete neighborhoods. Overall, to see real changes in mode shift, a general shift in development patterns and land use designation – specifically around zoning – is required in order to have a real impact across the City of Pittsburgh. As the city continues to transition and begins attracting more people to the region, it is important to emphasize that all new development projects and re-development efforts are focused on creating a multimodal environment.

Bike Plan

The Pittsburgh Department of City Planning is creating a new citywide bike plan that will clarify the strategy for expanding the city's biking infrastructure, policies, events and education initiatives. This new Bike Plan will replace the 1999 version and will set the agenda for Pittsburgh's goal to improve the city's bicycling environment. Meetings were held so that residents provide feedback to indicate which areas should become safer and more accessible for cyclists. Residents also provided input on what types of infrastructure, such as bike racks and bike lanes, the city should invest in and where bike share stations should be located.

Designing and Implementing Transit Streets

Strategically designing streets to balance transit operations, car volumes, and pedestrians/cyclists is vital for people to easily and efficiently access destinations, across any city. In particular, many cities have re-focused their efforts to design transit streets in economic centers to address “growth in these areas, mode shift, carbon neutrality, and economic development.”

Generally, transit streets offer a way to efficiently integrate on-street transit vehicle facilities, service-enhancing stops and stations, pedestrian and bicycle infrastructure, and general traffic lanes in a variety of street sizes and types. Additionally, transit streets offer a way to design streets through the combination of several elements to form a vibrant streetscape with transit as its spine. When creating these street environments, several key elements should be considered for implementation: service design, capital facilities development, wayfinding, and placemaking.

Complete Streets Policy

On November 21, 2016, the Pittsburgh City Council approved the Complete Streets Policy. The purpose of the policy is “to develop a safe and accessible multimodal transportation system that will promote enhanced mobility for all users regardless of mode of travel, including people of all ages and abilities.”

The Complete Streets policy is based on several existing principles for the City’s mobility and design planning. It aims to provide access to safe, comfortable travel for all users and modes of transportation while preserving Pittsburgh’s environment and incorporating green infrastructure when applicable. Equity for every neighborhood is a goal so that communities dependent on walking, biking and public transportation have access to safe, convenient, connected infrastructure. For new projects, consideration of all users must be addressed from the start of a project, and the burden is on decision-makers to accommodate all forms of transportation. For existing infrastructure, Complete Streets principles are to be implemented, incrementally over time as the areas are maintained and improved.

In addition, the Policy directs the City to work with other agencies such as PennDOT to incorporate Complete Streets principles as appropriate.

Bus Rapid Transit

Allegheny County, the City of Pittsburgh, Port Authority of Allegheny County, and the Urban Redevelopment Authority of Pittsburgh have proposed a Bus Rapid Transit (BRT) system that connects Downtown Pittsburgh with Uptown, Oakland, and Wilkinsburg, and includes branches to Squirrel Hill and Highland Park.

This route is projected to link more than 30,000 people across 24 neighborhoods via rapid, frequent, and more reliable transit service that's as fast and comfortable as light rail, but could be built much sooner and at a fraction of the cost. In addition to enhancing public transit, this project has the potential to unlock development and contribute to neighborhood growth and link residents to job centers, educational opportunities, medical services, and cultural attractions.

Parking Codes and Reform

Parking regulations can contribute to transportation efficiency by allowing flexibility in addressing vehicle parking and access issues. Parking reform can be a disincentive to driving by limiting parking spaces, enforcing metering and removing the existing requirement for minimum parking at buildings.

The City of Pittsburgh promotes bicycle commuting in order to lessen car-related congestion by requiring the provision of adequate and safe facilities for the storage of bicycles. The Code also allows for a reduction in required automobile parking spaces when bicycle parking is accommodated and defines minimum bike parking requirements for most new development. The code specifically lists that 60% of bike parking for multifamily dwelling developments must be protected parking in order to replace a portion of car parking requirements.

Transit stops can also be incorporated into new development in order to satisfy current standards. Up to 20% of the required parking spaces can be eliminated, provided that certain conditions are met. Transit stops must be clearly identified and open to the public, designed as an integral part of the development project, with direct access to the station or a covered waiting area. They must be well-lit with seating for a minimum of twenty persons. The transit stop must also be maintained by the developer for the life of the project. Additionally, clearly defining Transit Oriented Development (TOD) in the Code would help to limit the various interpretations of what “direct access” to a stop means and would offer an opportunity to develop a TOD overlay

Other cities such as Cleveland, Indianapolis and Philadelphia have successfully developed parking codes that promote alternatives to car transportation. They require a minimum number of bike spaces for new development and may allow up to 10% of parking requirements to be met by bike parking spaces. Developers may also reduce the number of required parking spaces if they include electric-car charging stations, car sharing spots, or other “green” amenities. Parking requirements may also be reduced by 10, 30 or even 50% if development is in close proximity to transit systems. Defining what “close proximity” means within the Code is essential for developers to abide by. Implementing similar codes and policies in Pittsburgh can significantly reduce the number of single occupancy vehicles being used.

Land Use and Transit Oriented Development

Despite having many high frequency transit corridors in the city – including Penn Avenue, Butler Street, and Centre Avenue – accessing these frequent service corridors can be difficult. The City will consider implementing a location efficiency policy, such as establishing priority development areas, for all new multi-unit developments and commercial developments within the city limits to create a targeted investment strategy.

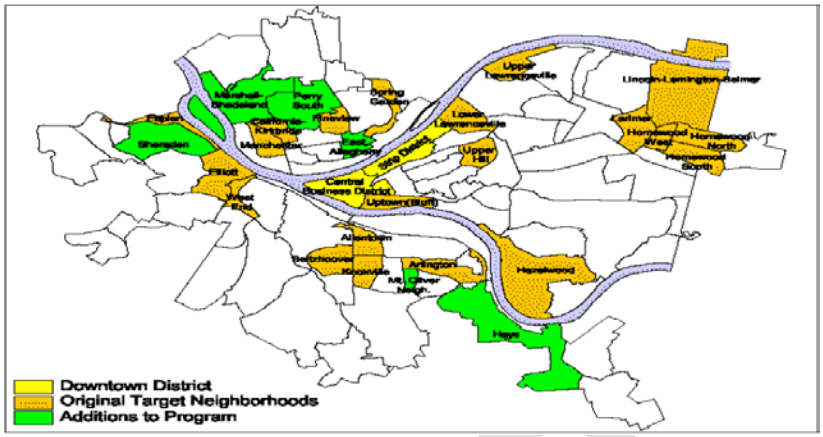


Figure 1, Pittsburgh's Targeted Growth Zones, 29 total neighborhoods (URA)

Location Efficiency through Tax Abatements

There is a common misconception that property tax abatements are only available for new homeowners rather than for homeowners' repair or rehabilitation projects. Real estate property tax abatements can greatly improve the quality of the existing housing stock by making renovation financially feasible for property owners. Additionally, property tax abatements can allow a wider range of socioeconomic groups to maintain rents at affordable levels. For developers interested in building affordable housing units, tax abatements are a tool that can be used to spur the development of affordable housing.

The Local Economic Revitalization Tax Assistance (LERTA) is a Pennsylvania tax abatement program that was created to improve the economic and business climate of certain residential and commercial districts with declining populations, blighted, vacant properties and a dwindling tax base by lessening the tax burden and encouraging new development. The City of Pittsburgh currently offers various types of tax abatement assistance programs depending on the type of property involved, including the Residential LERTA, the Residential Enhanced LERTA, the Commercial LERTA, and the Act 42 Enhanced Residential Abatement.

Too often in southwestern Pennsylvania, affordable housing developments are designed using traditional suburban methods, contributing to urban sprawl. Consideration must be given to the essential overlap between reliable access to transportation, housing, and job centers. Ultimately, by ensuring this balance of transportation, housing, and job centers, the smart growth model ensures location efficiency by reducing the likelihood of long commute times, mitigating traffic congestion, and creating more opportunities for alternative means of travel.

Location Efficient Affordable Housing

Other tools exist, such as Tax Increment Financing (TIF), to provide incentive for economic development in areas where a high number of vacant or distressed parcels exist. TIF is a tool that has already been utilized in Pittsburgh, and there are approximately 20 sites across Pittsburgh that currently utilizes TIF. Aside from TIF and tax abatement options, there are many

other possible solutions that have not yet been utilized in the Pittsburgh region, including Developer Impact Fees, Inclusionary Zoning/Housing, Special Improvement Districts, and District Improvement Funds.

Objective: Increase Vehicle Electrification

City of Pittsburgh Fleet Conversion

The City of Pittsburgh has set a goal of converting to a 100% fossil fuel free fleet. As a part of this goal, a fleet assessment was conducted to better analysis the needs and best options for the fleet.

Downsize of City Fleet

The City of Pittsburgh has had a vehicle replacement policy that requires departments to retire a vehicle before purchasing a replacement, unless the department can demonstrate the need for additional vehicles. However, there are 122 sedans, 35 SUVs and 123 pickup trucks that average fewer than 8,000 miles per year, which indicates opportunities reduce the size of the fleet. The City of Pittsburgh is committed to working with each department to determine the necessity of each vehicle and exploring alternatives such as Zipcar on demand car sharing.

Shift Vehicle Types

Beyond selling off underused vehicles, the City of Pittsburgh plans to identify the necessary vehicle specifications and minimum performance standards for all vehicle uses in the fleet to ensure that each department is well equipped to perform services, using electric vehicles and fuel efficient models wherever possible.

Procurement and Operations

The Equipment Leasing Authority (ELA) and the Office of Management (OMB) maintain a 5-year vehicle acquisition plan that is updated annually. The plan identifies vehicles to retire and aims for a six year turnover of sedans and a 10 year turnover of trucks. The ELA established a Green Vehicles Ordinance in 2008 to prioritize purchasing vehicles with high fuel efficiencies and alternative fuels. The fleet currently includes 7 gas-electric hybrid vehicles, 5 CNG trucks, and 24 diesel refuse trucks outfitted with biodiesel tanks.

ELA has drafted a 3-year Electric Vehicle Acquisition Plan that allocates $5 million dollars to purchase 10 electric motorcycles, 81 electric sedans, 14 electric medium SUVs and 107 level 2 charging stations from 2017 to 2019. Electric vehicles will be rotated into the fleet as conventional vehicles are retired and as technology improves.

The City was recently awarded $250,000 in funding from the Alternative Fuels Incentive Grant Program (AFIG) run by the Pennsylvania Department of Environmental Protection. Of these funds, $80,000 funds will be used to help purchase 10 electric vehicles to begin the conversion of the Bureau of Permits, Licensing, and Inspection's (PLI) fleet to fossil fuel free vehicles. The

PLI vehicles are ideal candidates for electrification due to their low daily mileage and non-emergency usage.

Purchase and Install Renewable electricity

Given the state of the grid, Pittsburgh recognizes the need to purchase or install renewable electricity to cover the projected demand for electric vehicle charging. The City of Pittsburgh already purchases 35% renewable electricity through the Western Pennsylvania Energy Consortium, a power purchasing agreement with almost thirty local governments and schools. However, these non-certified Renewable Energy Credits (RECs) are not local and will not displace local coal-fired power. Where possible, the City of Pittsburgh plans to install carbon free charging infrastructure for EV chargers. $170,000 of AFIG funding will go towards the installation of this charging infrastructures. As a starter, Pittsburgh is looking to install portable, solar powered charging stations. These stations will allow EVs to be charged without having to tie into the grid. Additionally, these stations can be deployed throughout the city in emergency situations, blackouts or interruptions in electricity supply which will improve the overall resiliency of Pittsburgh and its residents. The first charging stations will charge the DPLI fleet at night and then will be open to the public during the day.

Conversion of other Fleets

Port Authority

In addition to the City of Pittsburgh fleet, electrification of the Port Authority of Allegheny County, whose fleet of over 700 diesel public transit buses have a significant impact on local air quality, is a top priority. Electrifying the public bus fleet will improve rider experience, reduce vehicle lifetime costs and increase the visibility of electric vehicles. In 2017, the Port Authority received a $500,000 grant to transition the 88 Bus line to electric buses. This is a first step in an overall goal of transitioning all buses to electric.

Institution Fleet Conversion

As the City moves towards a fossil fuel free fleet, facilitating the conversion of private fleets will also be a priority. Shuttle buses used by universities, hospitals, and other large campuses can easily be converted with existing technology.

Private Vehicle Electrification

The Pittsburgh Parking Authority (PPA) operates 10 parking garages and one large surface lot, on Second Avenue, in Downtown Pittsburgh. There are currently 15 level-2 electric vehicle chargers in PPA garages. As commercial and municipal fleets move towards electric vehicles, available charging infrastructure will continue to expand. Improved access to charging stations and increased visibility of electric vehicles will help drive the integration of EVs into individual households.

Resilient EV Charging Hubs

Pittsburgh neighborhoods typically lack driveways and garages, making home charging prohibitive for many city residents. Neighborhood charging stations would not only insure access to localized charging infrastructure, but these neighborhood stations would be operated with off-grid solar generation and battery backup, providing a resilient hub for residents to gather and charge devices or vehicles in times of grid failure. The kiosk can also serve other two-way communication purposes, such as a base to distribute weather advisories or similar information in times of emergency.

As an EPA air quality nonattainment zone, vehicle electrification comes with the very important co-benefit of improving local air quality by reducing tailpipe emissions. Using the Resilient EV Charging Hubs as a reporting station for idling or other air quality violations would enable residents to make the connection between the carbon reduction benefits of electrification and their direct health. The Hubs could also be utilized to improve the ease of commuting via less carbon intensive transit modes, as a place to purchase bus tickets, post City transit option maps, and connect people to car, van and bike pools. The kiosks can also provide space for advertising to offset the cost of energy and maintenance.

Objective: Reduce freight emissions by 25% by 2030

In addition to municipal and private vehicle emissions, it is important to address freight-related emissions within the City of Pittsburgh. Conversion to alternative fuel cannot be required, but it is critical to enforce existing laws and policies concerning freight deliveries, idling laws, truck routes and loading zones. Loading and unloading can be incentivized during off-peak hours. In addition, improved signage around loading zones will encourage compliance. Designated loading zones can be designed to take advantage of existing transit lanes and plans can be developed for efficient coordination of freight deliveries.

CHAPTER FIVE: Waste and Resource Recovery

Goal: Zero waste landfilled by 2030

Objective:

- Achieve zero waste goal by 2030
- Shift towards a circular economy
- Improve data quality on waste characterization and existing diversion rates

Strategies:

- Implement the Roadmap to Zero Waste
- Modernize waste collection systems
- Improve education around waste diversion efforts and options
- Decrease organic materials in landfills
- Utilize anaerobic digestion technology
- Increase composting efforts
- Pursue a circular economy
- Support a statewide bottle bill
- Promote composting
- Increase collection of yard waste
- Increase ‘hard to recycle’ events and drop off locations
- Distribute recycle bins to all residents
- Enforce existing waste and recycling policies

Challenges:

- There are large data gaps in relation to privately hauled waste
- Numerous private waste haulers operating in Pittsburgh
- Low recycle participation rates
- Decreasing market for recycled materials
- Hauling waste to landfills requires a ~75 mile round trip

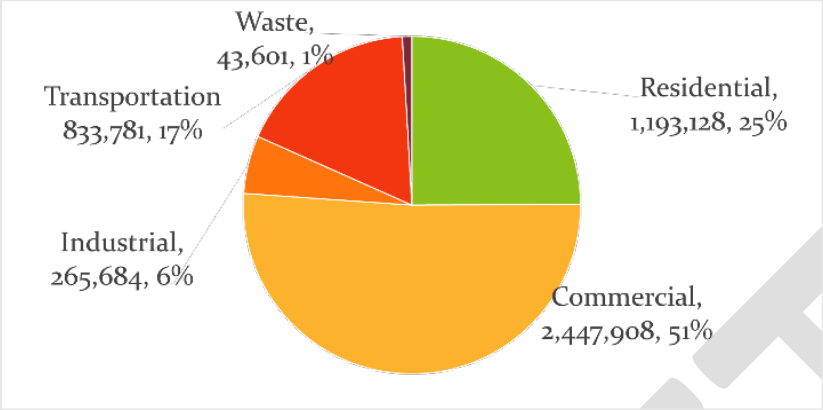
Existing Projects and Previous Work:

- Roadmap to zero waste
- Northside bin distribution pilot
- Sustainable Pittsburgh Challenge

Waste Champions:

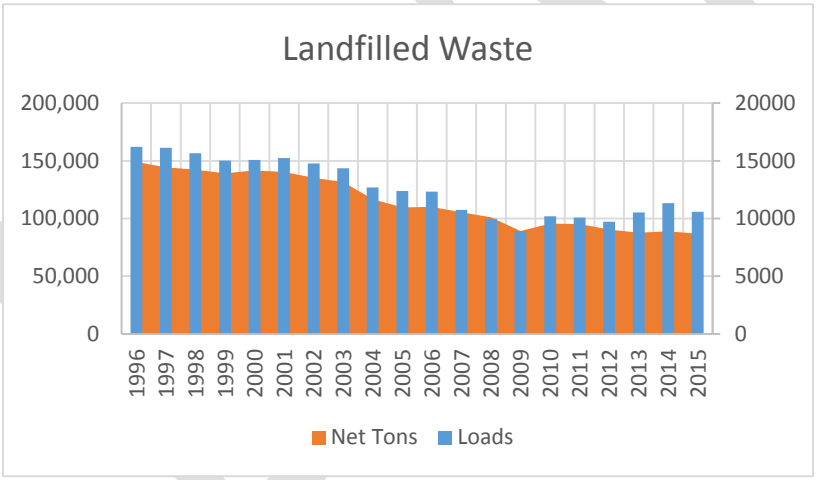
- Pennsylvania Resources Council
- Sustainable Pittsburgh
- Department of Public Works

Waste Data



2013 Sector Based Emissions

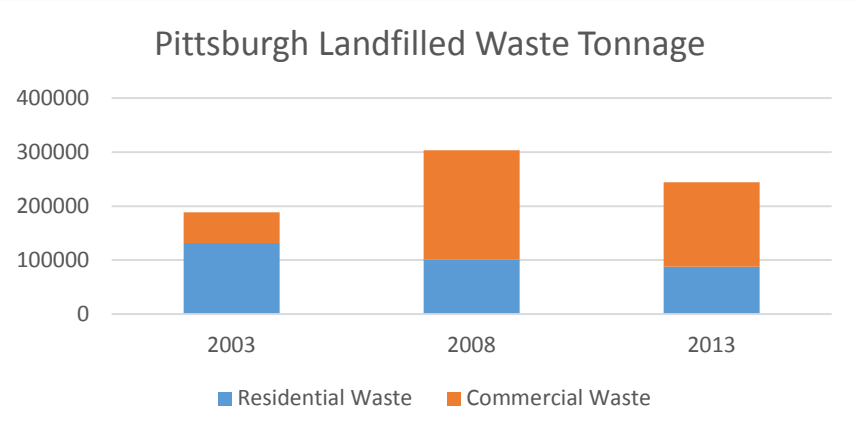
Based on 2013 data, waste-related emissions only accounted for 1% of the City's total emissions. However, the sector-based inventory methodology, used to develop Pittsburgh's greenhouse gas inventory, only reflects a very small portion of the greenhouse gases that are emitted as a consequence of consumption and waste habits. The sector-based inventory measures only the methane that escaping from landfills, rather than taking into account all sources.



The City of Pittsburgh Department of Public Works - Environmental Services (DPW ES) only collects waste and recycling from residential buildings with four or less units. Therefore, the waste data collected by DPW-ES only accounts for a portion of the total waste being generated in Pittsburgh. Over the years, the scope of service of DPWES has changed, so though total volume and loads of waste hauled to landfill have decreased, this does not necessarily mean that the average Pittsburgh household is producing less waste.

Commercial buildings, including multi-unit residential buildings, individually contract with private waste haulers. Approximately 50 local private waste haulers operate within city limits. Due to the number of buildings that fall within this category it is difficult to gather data about privately

collected waste. Solid waste volumes are reported to the state by county of origin so it is possible to estimate Pittsburgh's waste volumes based on the Allegheny County profile. In 2013, Allegheny County landfilled the equivalent of 4 pounds per person per day. Given Pittsburgh's 2013 residential population of 306,062, the city generated an estimated 221,675 tons of solid waste. Of that estimate, 87,710 tons were collected by DPW ES, leaving 133,965 for private collection.



Based on the available data, waste hauled from Pittsburgh has increased between 2003 and 2013. By 2030, Pittsburg has a goal of diverting 100% of waste from landfills. Because the goal is to reach zero waste, the baseline data is not as important for waste as in other sectors.

EPA Diversion Rates

The US EPA produced a report based on 2013 national municipal solid waste and found that after diversion for compost and recycling, landfill volume had the following composition, here applied to the total estimated landfill waste generated within Pittsburgh.

	2013 EPA US Discard Composition	Pittsburgh Volume (tons)
Paper & Paperboard	15.10%	33,472.99
Yard Trimmings	8.10%	17,955.71
Metals	9.10%	20,172.46
Glass	5%	11,083.77
Plastics	17.70%	39,236.55
Wood	8%	17,734.03
Food	21.10%	46,773.51
Rubber, leather & Textiles	11.60%	25,714.35
Other	4.30%	9,532.04

The EPA also produces the Waste Reduction Model (WARM) to help estimate greenhouse gas reductions from solid waste management practices. If the City of Pittsburgh were to recycle all the paper, metals, glass and plastics and compost all food waste and yard trimmings, it would result in 260,078 MT CO2e avoided, rather than 34,733 MT CO2e emitted.

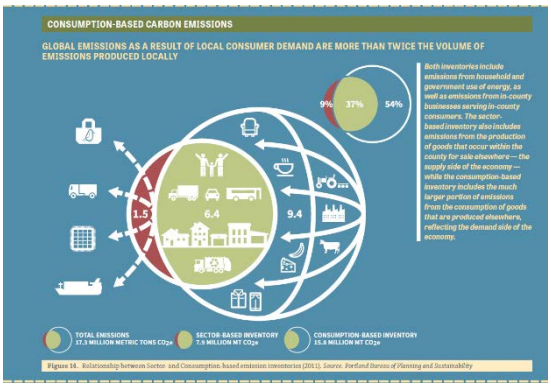
Objective: Improve waste related data quality

Consumption Based Inventory

The most efficient way to reduce waste is to reduce consumption. Reducing consumption completely removes materials from the waste stream. Additionally, reduced consumption will help mitigate emissions from the creation, transportation, and distribution of materials and products. Before significant consumption changes can begin, a better understanding of consumption trends and practices is needed. With a better understanding of consumption patterns, steps can be taken to reduce the associated environmental impact.

The sector-based greenhouse gas inventory uses the national average waste characterization to determine waste composition and therefore the amount of methane that is released as the waste decomposes. Both landfills that receive Pittsburgh waste have methane capture-in-place systems. However, some gas still escapes into the atmosphere. This methane release is only 1% of Pittsburgh's total greenhouse gas emissions. However, the greenhouse gas implications of Pittsburgh's consumption and waste are much larger. The emissions from the manufacturing, utilization and transportation of products that ultimately end up in the landfill are not easily accounted for in the sector based inventory.

Portland and Multnomah County in Oregon use a consumption-based inventory to track greenhouse gases that are burned outside of their boundaries in the production and transportation of products to satisfy demand within their boundaries. This inventory concluded that 54% of emissions are due to consumption. When comparing the sector-based inventory and the consumption-based inventory, emissions increased from 7.9 million MT CO2e to 17.3 MT CO2e respectively. A consumption based inventory provides a better look into what goods are transported into the city as well as the origin of those goods. This information can be utilized to reduce emissions and to determine key areas of economic development that could provide local alternatives to previously imported goods.



Waste Characterization Study

In addition to a consumption based inventory which analyzes the sources of various goods, a waste characterization study is needed in order to get a better understanding of Pittsburgh's waste streams. A characterization study of the waste that is collected by the City and private hauling companies will help to quantify what is currently

being taken to the landfill, what is being recycled, and what recyclable items are not being diverted from landfills.

Building on the waste characterization study, a long-term waste tracking system is needed. The characterization study sets the baseline but a measurement system is needed to track progress towards the 2030 goal. Studies show that active measurement and tracking of recycling information increases participation and encourage citizen ownership of waste reduction goals.

Objective: Implement improved waste collection system

Roadmap to Zero Waste

In partnership with the 100 Resilient Cities, the City of Pittsburgh worked with R20, a non-profit environmental organization, to develop a 'Roadmap to Zero Waste". The roadmap outlines a 13-year strategy for achieving zero waste by the year 2030. Actions that can be started or completed in the first five years are extracted for the purposes of the Climate Action Plan.

Current vs Proposed Collection Systems

Under the current system, the City provides trash, recycling, and yard waste collection service only to single-family homes and multi-unit buildings with five units or less. There is no food waste collection program and no bins are provided by the City for trash or recycling.

Under the system proposed by the Roadmap, each route and neighborhood will be evaluated to determine the feasibility of using automated cart tipping for waste collection. Where appropriate, automated collection bins and dual-compartment trucks will be used. This will allow one driver to support both the trash and recycling route service at the same time. The new trucks will be fueled by bio-gas since City garbage trucks at 3 miles per gallon of fuel are the largest contributors to air pollution in the City vehicle fleet. Traditional rear-loading trucks could be used for routes where automated trucks are not feasible. They would also continue to be used for yard waste pickups, for special pickups such as Christmas trees, and for collection of construction and demolition waste from various City projects. Unneeded trucks will be sold. It is also recommended that there be an increase in collection frequency for recycling to once-per-week. The frequency of recyclables collection must at least equal to that of trash collection in order to encourage recycling.

Supporting Policies

It is essential that enforcement be a part of any effective Zero Waste plan. Requirements for recycling are currently in place, but not being enforced. The current source separation mandate will be enforced to encourage support of the recycling program. Education and technical assistance will be provided for multi-family unit residents and for businesses in order to enforce participation in recycling and composting programs and reach recovery rates above 70%.

2015 Northside Bin Initiative: Case Study

The Northside Bin Initiative is a pilot project in which approximately 1100 recycling containers were distributed to residents served by a single recycling route in the Northside area of Pittsburgh. It was developed to test the impact of converting the collection system from bagged set-outs to provided bins. During the course of the project, data was gathered in order to analyze the impact of the City's proposed new approach for recycle collection. These considerations included: impact to the City's vehicle fleet, staff time, routing, finances, changes to recycling participation rates, material quality and contamination levels, and resident feedback. The primary objectives of this pilot program were to:

- Decrease blue plastic bag contamination at the Materials Recovery Facility (MRF)
- Determine baseline recycling participation data
- Increase resident awareness of recycling
- Increase tonnage of materials recycled
- Measure & track changes in pre/post bin distribution participation & weight
- Measure & track impact to City and route operations
- Educate as many residents in person as possible about recycling and the bin project

The information gathered through this pilot project will assist in the City's plan to expand the bin recycling system citywide. The pilot project will serve as building block for the City of Pittsburgh's "Roadmap to Zero Waste" in the pursuit of a more circular economy. The next phase of implementation will expand the bin initiative from a neighborhood level to a citywide scale that will encompass about 115,200 households. Expanding the project will cost an estimated $2,923,400 to cover bin purchase, distribution, and education citywide. The pilot project was funded by the ALCOA Foundation with support from the City of Pittsburgh and the Pennsylvania Resources Council. Continued funding for the expansion of this project is proposed for the 2018 City of Pittsburgh capital budget, and the City is seeking further grant opportunities.

Benefits of the Northside Bin Initiative

CO2 Reduction**:** The main goal of this project was to increase the City's diversion rate and reduce waste going to the landfill. More than 44,000 tons of CO_2 equivalents can be attributed to the waste collected by the City of Pittsburgh Department of Public Works. Although this is only about 1% of the City's total greenhouse gas inventory, it is an area in which deep cuts can easily be made. An additional 154,000 tons of CO_2 equivalent are due to the use of diesel heavy trucks, such as refuse vehicles. By increasing diversion rates and reducing waste being dumped at landfills, emissions can be reduced from both the 'waste' and the 'transportation' sectors of Pittsburgh's Greenhouse Gas Inventory.

Economic co-benefits**:** Increased recycling will reduce the cost of waste hauling by reducing the number of trips to the landfills. This will save money through reduced tipping fees, reduced operational and fuel costs, and an increase in the lifespan of refuse vehicles.
RFID tags added to the bins will allow the City to collect better data about household participation and diversion rates. State of the art garbage bin sensor technology will alert the

City's Department of Public Works when public garbage bins need to be emptied. This will allow DPW crews to strategically plan collections, resulting in improved efficiency and the elimination of unnecessary trips to cans that are not full.

Environmental co-benefits**:** Reduction in the volume of waste traveling to landfills and improved quality of materials being processed at the MRF will improve the system's efficiency and resource recovery. Improved waste practices will also help to reduce the amount of 'illegal dumping' that occurs in the City.

Health co-benefits**:** Improved data will allow optimization and reduction of routes that refuse vehicles take to the local landfill. This will reduce vehicle emissions and improve the local air quality.

Social co-benefits**:** Using a bin system will help to reduce recycling clutter, keeping sidewalks clear for pedestrians and bicyclists, and improving neighborhood aesthetics. Resident outreach and education will increase participation and the quantity of material recycled.

The bin distribution, educational components, and data collection developed through the Northside Bin Initiative will help to advance the City's Zero Waste goal.

Drop-off Sites

Drop-off sites will primarily be used for tires, excess yard waste, scrap metal and for residents with an excess of "traditional" recyclables that will not fit in the recycling bin.
In order to improve these sites, bins at each site should be clearly labeled, hours of the manned sites will be extended to include weekly Saturday hours in order to improve accessibility for residents with day jobs. The sites could also consider adding other hard-to-recycle materials to the list of acceptable materials at the manned sites.

Objective: Eliminate organic materials from landfills

Yard Waste

It is recommended that the residential yard waste collection service be expanded. Current options for City residents include two designated, curb-side, yard waste collection days each year. City residents can also choose to bring their yard waste to one of three manned drop-off sites. These sites also take larger branches, shrubs and Christmas trees, but the drop-off hours are limited to Monday-Friday from 8:00 a.m. to 2:00 p.m. In addition, residents are allowed to set out yard waste on their designated garbage collection day. Any yard waste collected on these days is transported with the garbage to the landfill

Food Waste

It would prohibit food waste from large volume commercial and industrial generators of food waste entering the landfill. In order to meet that goal, the City will work with the state and the county to promote growth of the infrastructure of facilities to handle food waste. Potential

options include the construction of a City-owned compost facility for food waste and landscaping green waste, or enhancement of the County water treatment (ALCOSAN) system to include an anaerobic digestion. The City could also encourage private sector investment in newer/larger compost systems or encourage private sector investment in anaerobic digesters. They could also work with local farmers with existing manure digesters to upgrade their systems to include food waste. In order to reach Zero Waste, a food waste ordinance must be part of a systematic, long-term plan. Commercial businesses that generate more than a set amount of waste per week will be required to recycle organics. When fully operational for commercial businesses, the plan will add single-family households, multi-family housing units and smaller businesses. The plan could also require that new or renovated multi-family housing buildings have adequate handling systems for trash, recyclable and compostable materials collection.

Anaerobic Digestion

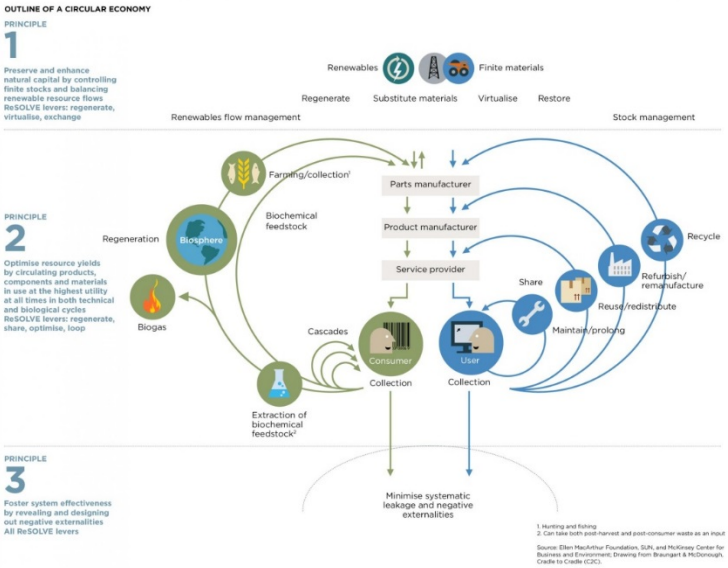
To effectively reduce the carbon footprint of waste, it is important to divert as much material as possible. Pre-sorting organic waste before it reaches the landfill would prevent methane release and allow the material to be used to create energy. Organic matter, including food and yard waste, occupies approximately 21 percent of landfill space. These organic materials can be separated from the municipal solid waste (MSW) stream and processed in an anaerobic digester to produce biogas. Organic waste that can be broken down by anaerobic digesters includes food and yard waste, fats, oils, and greases, industrial food waste, biosolids from sewage sludge, waste water, and animal manures. All anaerobic digestion systems adhere to the same basic principles, no matter what organic material is being processed.
Anaerobic digestion also produces digestate, a nutrient-rich material that is left over following the anaerobic process. Technology exists to separate the digestate into solid and liquid components that have multiple potential uses. The solid component can be composted or heat-processed into fertilizer pellets. It can also be used for animal bedding or converted into other products such as flower pots. The liquid component of digestate can be directly applied to land as a fertilizer or soil amendment. Land application of digestate can improve overall soil health.

Objective: Pursue a more circular economy

Circular Economy

Beyond greenhouse gas emissions, the way we use and dispose of products, is a significant concern. We are rapidly depleting the world's natural resources at a rate much faster than they can be replenished. Vast quantities of energy are consumed in the extraction of raw materials in order to manufacture products that are then discarded, creating the need to extract even more resources. Our goal is to transition to a closed loop system, or circular economy, in which materials are regenerated, recovered and restored in order to create is zero waste.

The concept of a circular economy is in contrast to our current industrial model that relies on a “take, make and dispose” process. Our current, linear economic model is based on the consumption of large quantities of inexpensive materials and energy that are finite in nature. A circular economy is based on renewable energy sources and relies on innovation to redefine products and services in order to design out waste and minimize negative impact. A circular economy is a continuous cycle that has both technical and biological components. In the biological cycle, resources are used and regenerated through natural processes. In the technical cycle, materials are designed to be recovered and restored with the highest quality retention through minimal use of renewable energy. (Ellen Macarthur Foundation, Towards a Circular Economy: Business Rationale for an Accelerated Transition, November 2015)



CHAPTER SIX: Food and Agriculture

Goal: Improve local food systems

Objective:

- Eliminate food waste by increasing food donation systems
- Strengthen the local food system
- Increase the demand for locally grown produce
- Increase the supply of locally grown produce
- Increase small farm profitability
- Promote growth and sales of local produce
- Determine realistic baseline numbers and relevant KPIs
- Increase composting of food waste

Strategies:

- Work with local schools in order to promote healthy eating habits
- Promote 'ugly' fruits and vegetables
- Increase cooking education
- Increase awareness of garden donation programs
- Pilot community composting programs
- Utilize biodigestion to reduce food decay in landfills
- Reduce beef consumption by 30% to meet USDA guidelines
- Adopt a City-wide definition of 'local' food
- Develop an Office of Food Initiatives
- Develop a regional food plan
- Increase institutional purchase of local foods
- Create a prescription program
- Promote climate-resilient, small-scale production methods such as silvopasture and alley cropping
- Increase the number of gardens, urban farms, and peri-urban farms
- Support alternative growing platforms such as hydroponics, aquaponics, and green rooftops
- Continued support for 2012 Healthy School Food requirements
- Create food hubs
- Create cottage food law
- Promote grant programs such as Local Foods, Local Places

Challenges:

- Reliable baselines have not yet been determined for many strategies and objectives
- Inequity in food access
- Poor soil quality limits growing ability

Previous Work:

- Mulan Food Compact
- Food Policy Council
- Adopt-a-Lot program
- Food Bank
- Sustainable Restaurants Program

Food Champions:

- Food Policy Council
- Greater Pittsburgh Food Bank
- Sustainable Pittsburgh
- Grow Pittsburgh

Food System Greenhouse Gas Emissions

The city of Pittsburgh is currently not a major agricultural producer and consequently does not collect data for this category of GHG emissions. However, there is data at the state level that can be used as a proxy for measuring the potential benefits in changes at the city level. The Department of Environmental Protection divides agricultural emissions into three categories: enteric fermentation from livestock digestion, agricultural soil management from fertilizer application, and manure management. According to the Pennsylvania Greenhouse Gas Emission Inventory, each factor contributed approximately 48.47 percent, 34.13 percent, and 17.29 percent, respectively, to the state's agricultural emissions. (See *Figure 1*)

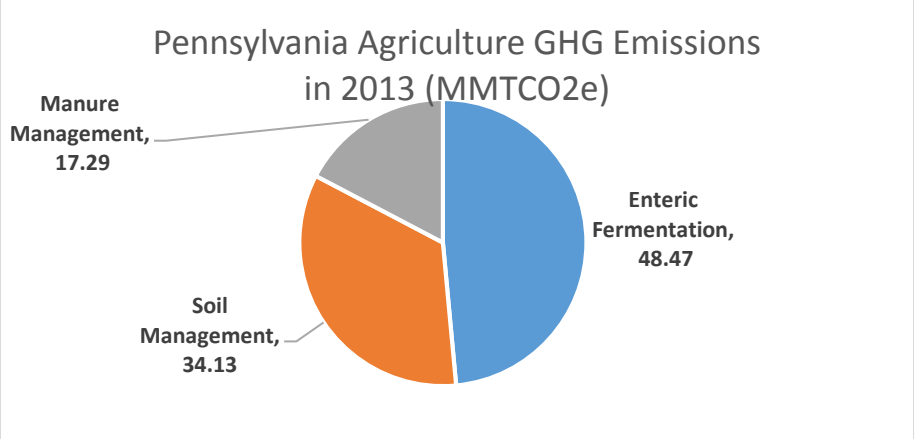


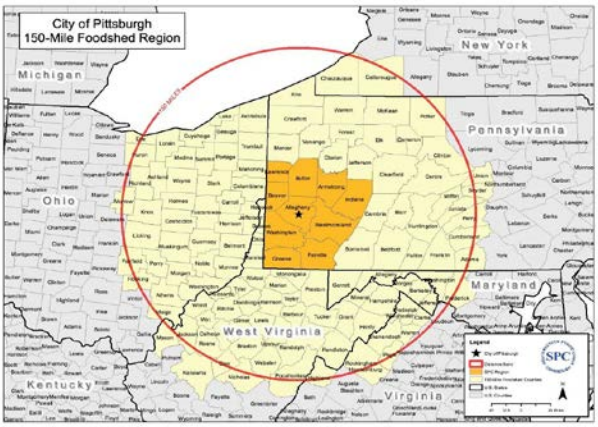
Figure 1 – 2/3 of agricultural emissions are a direct result of livestock management, with 1/3 resulting from incorrect application of fertilizers.

Nationally, the agriculture sector as a whole contributes up to one-third of all greenhouse gas emissions when emissions from the farming operations, fertilizer manufacture and the machinery and vehicles used for production, transportation, and storage are factored in. Although there are no large livestock farms or vegetable farms within the city, residents can help

reduce food-related emissions and improve resiliency by supporting the development of local and regional food systems, and reducing food waste.

Objective: Setting baselines

Define 'Local'



While there is no universally agreed upon definition of "local food," informal interviews suggest that a 150-mile radius from the City center is appropriate. Pittsburgh food distributors and organizations, including Parkhurst, Paragon Foods, Giant Eagle, Sustainable Pittsburgh, and the Pittsburgh Public School system all use a 150-mile radius to define locally sourced food. (See *Figure 2*) In practice, farmers tend to travel even less, although they may be encouraged to drive in from further away if there is sufficient demand for their products. Because 150-miles can include multiple counties or states, many food systems professionals and activists also advocate for cities to form partnerships to develop a regional food plan that will account for shared watersheds and growing climates.

Determine Baseline Metrics

As this is the first inclusion of a Food and Agriculture chapter in the Climate Action Plan, baseline data is not as robust as in other chapters. The City of Pittsburgh will work with local stakeholders such as the food policy council to determine the best metrics by which to track the 'quality' of local food systems. Upon choosing these metrics, baselines will be determined using the best available data. This will allow for consistent comparison of progress in future years.

Objective: Support local food systems

Promoting Seasonal Local Food

Increasing and promoting seasonal local food production serves a number of purposes. First, 83 percent of the greenhouse gases associated with food are a result of the methods used to produce it, while 11 percent are result of transportation. Therefore, consuming seasonal produce from closer to home can reduce both the emissions associated with transportation and storage, as well as avoid the emissions generated from heated greenhouses during winter months. With ninety percent of domestically grown broccoli, grapes, strawberries and tomatoes coming from California, the opportunity to reduce emissions by eating more locally produced fruits and vegetables when in season is huge.

As the chart below shows, Southwestern Pennsylvania produced less than 10% of what it consumed in 2012, so there is considerable room for more growth in the local agricultural sector.

	Production per Capita - 2012 ($)				Maximum Local Food		
USDA Category	USA	PA (Adjusted)**	SW PA	150-Mile Foodshed (Adjusted)**	PA(% of US)	SW PA (% of US)	150 -Mile Foodshed (% of US)
Fruits, tree nuts, and berries	$ 39.62	$ 6.05	$ 0.54	$ 9.02	15.26%	1.37%	22.76%
Grains, oilseeds, dry beans, and dry peas	$ 423.47	$ 96.16	$ 40.93	$ 164.02	22.71%	9.67%	38.73%
Other crops and hay3	$ 51.14	$ 20.69	$ 15.04	$ 25.82	40.46%	29.42%	50.49%
Vegetables, melons, potatoes, and sweet potatoes	$ 36.43	$ 7.49	$ 4.23	$ 7.74	20.56%	11.62%	21.26%
Aquaculture	$ 7.71	$ 3.19	$ 0.02	$ 1.14	41.38%	0.31%	14.75%
Cattle and calves	$ 240.99	$ 55.64	$ 18.99	$ 79.76	23.09%	7.88%	33.10%
Hogs and pigs	$ 57.52	$ 28.80	$ 0.13	$ 17.74	50.06%	0.22%	30.84%
Milk and other dairy products from cows	$ 110.39	$ 110.39	$ 32.80	$ 110.39	100.00%	29.71%	100.00%
Other animals and other animal products3	$ 3.91	$ 2.61	$ 0.77	$ 2.54	66.63%	19.66%	64.87%
Poultry and eggs	$ 113.31	$ 88.78	$ 0.48	$ 113.31	78.35%	0.43%	100.00%
TOTAL	$ 1,158.11	$ 419.78	$ 115.12	$ 608.85	36.25%	9.94%	52.57%
Compiled by SPC staff, April 2017							
SOURCE DATA: USDA Census of Agriculture (2012) & USDA ERS Food Availability (Per Capita) Data System (2016).							

Figure 3: Comparing Regional Food Production Capacity

In the past, the Pennsylvania *Buy Fresh Buy Local*® (BFBL) program, coordinated by the Pennsylvania Association for Sustainable Agriculture (PASA), organized events and marketing campaigns to promote local foods. This program has been discontinued in Southwestern Pennsylvania due to lack of funding, but local government and organizations can utilize advocates at the state level to secure funding to reinstate programs such as BFBL. The City will also continue to host its own food entrepreneur networking events with the SPC and Allegheny Conference, and promote the resources such as *PA Preferred* website that provides links to local food producers and shops carrying local foods.

The City will also encourage residents and development partners to seek out grants from federal programs such as *Local Foods, Local Places*, that assist in local food system development. *Local Foods, Local Places* "helps cities and towns across the country protect the environment and human health by engaging with local partners to reinvest in existing neighborhoods as they develop local food systems." In 2017, these partners invested $810,000 in twenty-four communities that were selected to implement projects such as creating local food cooperatives, community gardens and farmers markets.

Promote Community Building

When community members take the time to get to know their local farmers and food processors, they can build relationships that encourage cooperation and accountability. A localized food system is more responsive to the needs of its community and will know if members are willing to support the implementation of specific low emissions practices such as construction of solar panel milking stations, biodigesters for organic waste, and new varieties of crops that are more drought tolerant.

Increase institutional purchasing of local foods

The successful development and promotion of a local food system will require the participation of all city sectors. The municipal government can lead this effort by offering local produce and products in government buildings, public institutions, and City schools. In 2017, for example, City employees were invited to participate in a Community Supported Agriculture (CSA) program. Participants paid in advance for a weekly or biweekly share of a farmer's harvest, which they later picked up at the Department of City Planning. CSA programs are not new, but encouraging City employee participation is one way to support the local food economy and show private businesses how easy it can be to incorporate a similar program in their offices.

The Pittsburgh Public School District (PPS) also actively seeks to increase its number of food contracts with local farmers and producers. According to the most recent Farm to School Census Report published by the USDA, PPS devoted approximately 24 percent of its almost $7 million food budget to local foods during the 2013-2014 school year.

To further promote the purchase of local produce and food products, the City will implement a local food procurement policy for public institutions and government entities that would give preference to local farmers and producers that may otherwise be overshadowed by large corporations. The Los Angeles Unified School District, for example, successfully increased its purchasing of locally produced fruits and vegetables from 9 percent to 25 percent after enacting its Good Food Purchasing Program in 2012. Vermont, New Hampshire, and New York City have also enacted local food procurement policies that may serve as models for the creation of a Pittsburgh local food procurement plan.

Encourage institutions to grow gardens

Growing fruit and vegetable gardens in schools and other institutions throughout the City serves two purposes. First, depending on the entity's certification level, produce may be harvested and used in school lessons and workplace lunches, thereby increasing local produce consumption and decreasing the city's carbon footprint. Second, the gardens serve as an educational tool and encourage individuals to make fresher, better food choices for healthier lifestyles in an era of rising rates of obesity.

In their mission to assist schools in expanding garden education, Grow Pittsburgh developed a CORE-aligned garden education program for schools and added 9,400 square feet of growing space in the City through 15 garden installations in public and charter schools. The program has engaged more than 6,000 students and teachers while educating them in food growth and production.

Many large hospitality and food service institutions are supplementing their purchases from local farmers by growing or expanding their on-site gardens. The David Lawrence Convention Center, operated by Levy Restaurants, has three outdoor spaces—in addition to its North Terrace with 27 rooftop raised beds gardens—that supply food for the convention center. Parkhurst Dining, another large corporation in Pittsburgh, has an extensive client portfolio, including Google, Reed Smith, Bayer Corporation, the Pittsburgh Steelers, and Chatham

University. At each of these locations, there is a rooftop or urban garden of some sort, providing a percentage of the produce, herbs, and honey direct to the businesses in which they are located.

Hospitals are also key players in sourcing locally grown foods, some even from their own facilities. University of Pittsburgh Medical Center (UPMC) at Magee Women's Hospital recently implemented food production and gardening classes in their Japanese garden as a component of the wellness program. Approximately 2,000 pounds of fresh vegetables harvested from the garden are used in patient meals and the hospital's cafeteria annually.

Increase the number of gardens—particularly in areas with high food insecurity rates. Urban farms and gardens will never replace the important role that rural farms, however, these smaller food production sites serve a multitude of important functions. Urban farms and gardens can provide an additional layer of food security to communities that may lack convenient or affordable access to fresh produce. These green spaces also help to capture carbon and improve air quality, minimize energy required by grey infrastructure systems to direct and treat stormwater, and electricity demands by mitigating the urban heat island effect.

Grow Pittsburgh has installed 26 school gardens throughout Allegheny County—in addition to its community gardens—and the Phipps Conservatory and Botanical Garden has installed nearly 200 private vegetable gardens for Homewood community members participating in its *Homegrown* project. Both organizations plan to significantly increase the number of gardens in the coming years, but have already greened more than three acres of land within the city of Pittsburgh, and given residents the capacity to produce approximately 10,000 pounds of food.

<u>Adopt-A-Lot</u>
The City's Adopt-A-Lot program has also helped many community groups and individuals to begin growing their own food. Created in November 2015, the Adopt-A-Lot program allows residents to obtain leases and licenses to establish vegetable, flower, or rain gardens on vacant, City-owned land. The leases are renewed each year and licenses can be renewed for a three-year term after the first year. As of December 2017, seventy-eight lots have been adopted with enthusiastic community members spending an average of $10,000 to create vegetable and rain garden on their lots. Much of the money is spent on improving the soil—which often contains little organic matter and may suffer from lead contamination. However, this investment returns big dividends as it increases the lot's capacity to sequester carbon, reduce stormwater runoff and grow more nutritious food. The planned Hilltop Farm, at the former site of St. Clair Village, expects to store and reuse over one million gallons of stormwater annually. It will also save 133,356 kilowatts of energy and reduce carbon emissions by 12,555 pounds.

Recognizing the significant financial investment that goes into creating some of these production areas, and the time commitment of garden members and urban farmers to keep their sites operating at maximum capacity, the City has begun to examine ways to give farmers and gardeners more secure land tenure. Whether through the Urban Redevelopment Authority, the Land Bank, the Land Trust, the Greenways program or some other community development

structure, preserving urban farmland will be important for both community food security and continued reduction of emissions totals through soil carbon sequestration.

Support the Urban Agriculture Act.

On September 28, 2016, Michigan Senator Debbie Stabenow introduced a comprehensive urban agriculture bill to the United States Senate for inclusion in the 2018 Farm Bill. The Urban Agriculture Act establishes an Office of Urban Agriculture within the USDA and provides funding for a number of programs committed to urban food systems in order to expanding community gardening, and urban farms and rooftop agriculture. The Office will develop pilot programs for municipal composting and other food waste reduction strategies and strengthen the connection between healthy food consumption, the environment, and health. The City, along with numerous local stakeholders, will advocate for this bill to better serve the community and further develop urban agriculture in Pittsburgh.

Encourage Planet-Rich Diets

A diet rich in vegetables reduces emissions from livestock production and feed, in addition to decreasing obesity rates. The country has already made huge strides over the past thirty years in terms of reduce beef consumption: USDA data shows that beef consumption peaked in 1976 at 91.5 pounds per person and had fallen to approximately 52.3 pounds by 2012. This has been largely due to increases in the price of beef and the growing popularity of chicken, but may also be partly attributed to the revival of historical campaigns like “Meatless Monday,” that bring attention to health and environmental implications of beef consumption. However, making a small effort to go beyond Meatless Monday campaigns to eat plant-based meals twice a week would reduce meat consumption by nearly 30 percent and make it easier for a larger portion of the city’s demand for meat to be met by local, sustainable, producers. For those who want to make a bigger impact, a switch to a weekday vegetarian diet would reduce meat consumption by more than 70 percent.

How Many Days Should You Cut Out the Meat to Make a Difference?

Number of Vegetarian Meal Days	**Percentage of Meat Consumption Reduced**	**Car Miles Reduced** (200 miles = 82.2kg CO_2)
1	14%	1 hamburger = 200 miles
2	29%	2 hamburgers = 400 miles
3	43%	3 hamburgers = 600 miles
4	57%	4 hamburgers = 800 miles
5	71%	5 hamburgers = 1,000 miles
6	86%	6 hamburgers = 1,200 miles
7	100%	7 hamburgers = 1,400 miles

Figure 5 Small changes in diet add up to big savings.

Expand food hubs

A food hub is a business or organization that collects produce from farms in the region and creates channels in which the produce can easily be distributed. Food hubs assist small and medium farmers and producers by aggregating, labeling, marketing, and selling their product for them. By selling the products collectively, hubs help small farmers reach the volume that they need to produce to compete for contracts with large grocery store chains and institutions. The hubs also reduce transportation emissions by having a single entity responsible for collection of the products and bringing them into the city. Penn's Corner Farm Alliance, Republic Food Enterprise Center, and Three Rivers Grown are examples of three food hubs that serve the greater Pittsburgh region, increasing small farm participation in the local market.

Adopt a cottage food law in Allegheny County

Food preservation techniques, such as canning, fermenting, and dehydrating, as well as preparing value-added food products help prevent the waste of imperfect and surplus produce and can provide an important source of additional income. These products are regulated by the Pennsylvania Food Safety Act, which designates residential kitchens as limited food establishments when used to create products intended for sale.

Although state law allows residents to create value-added products intended for sale in their homes, local regulations administered by the Allegheny County Health Department require these products to be made in a commercial kitchen. The local regulations, therefore, prevent residents and small business owners from producing value-added products intended for sale in their homes and impart additional barriers on individuals seeking new business ventures. The City will explore options with the County to remove or modify barriers in small-scale food production. This would give small food businesses the opportunity to grow without the burden of installing an expensive commercial kitchen.

Permitting food production in residential kitchens not only increases the quantity and diversity of local foods available, thereby reducing emissions totals from imported food, it can also have tremendous economic benefits. California enacted the California Homemade Food Act in 2012, and it went into effect in January 2013. Within a year, over 1,200 local food businesses opened their doors, generating income and supporting local food production. Similarly, Pittsburgh would have a more robust local food economy, while also combatting food waste, if it permitted food production in residential homes or provided easier access to commercial kitchens.

Objective: Prevent Edible Food from Entering Waste Streams

Food Waste Data

The EPA estimates that 40 percent of food is wasted: the United States spends "$218 billion a year, or 1.3% of GDP, growing, processing, transporting, and disposing of food that is never eaten." This wasted food accounts for 21 percent of all fresh water, 19 percent of all fertilizer, 18 percent of cropland, and 21 percent of landfill volume. If food waste were a country, it would be

the third largest producer of greenhouse gases in the world, after China and the U.S. Preventing food from entering the waste stream will eliminate GHG emissions from landfills as well as the production of that food. Most of this chapter focuses on removing food from the waste streams, additional information regarding composting, anaerobic digestion, and preventing organic waste from entering landfills can be found in Chapter 5: Waste and Resource Recovery

Eat "ugly" fruits and vegetables.

Notwithstanding its appearance, "ugly" produce is completely edible and just as nutritious as "perfect" produce however ugly produce typically ends up being thrown away because people choose to purchase food that looks perfect. 412 Food Rescue promote eating ugly produce to combat food waste and recently developed a partnership with Penn's Corner Farm Alliance to begin an UglyCSA program. Stores that offer imperfect fruits and vegetables at reduced prices, and consumers who purchase them, help to reduce this source of food waste and greenhouse gas emissions.

Create community canning centers

The City, its business, and philanthropic partners can help residents to reduce greenhouse gases from wasted food and food imported during winter months by creating community canning centers. Such centers used to be widespread and served as a place where individuals and families could go to get professional instruction and assistance in canning the harvests from home gardens. At a time when few people retain these skills, such community canning centers can significantly increase food security and reduce food waste. Community canning centers existing in neighboring states such as New York, Ohio, and Virginia could provide a model for Pittsburgh. Potential be funding for these centers could come through a grant from the USDA's *Local Food, Local Places* program.

Promote food recovery for all institutions and events.

Established in 2015, 412 Food Rescue is another organization that strives to reduce food waste. The organization utilizes volunteer "heroes" to "rescue" food from donors and deliver to other organizations that re-distribute food directly to those in the community that need it most. Since its inception, the organization has rescued nearly 1,600,000 pounds of food and served over 1,300,000 meals, reducing local emissions by over 855,000 pounds. PPS has begun creating "sharing tables" where kids can exchange parts of their lunch that they do not plan to eat instead of throwing the food away. At the University of Pittsburgh, students launched a food recovery program in fall 2014, collecting and delivering more than 4,000 pounds of food to local entities. In May 2016, Pitt became Food Recovery Certified by the Food Recovery Network, a student movement committed to fighting food waste and hunger. Students recovered over 9,300 pounds of food in 2016. As more companies and institutions support food recovery organizations, food waste will cease to be the major contributor to agricultural greenhouse gas emissions that is now.

Greater Pittsburgh Community Food Bank-Case Study

The Greater Pittsburgh Community Food Bank has led food recovery efforts in the southwestern Pennsylvania region for more than 35 years. Currently, the Food Bank receives donations from grocery stores, restaurants, distributors, manufacturers, farmers, gardeners, and stadiums. The Food Bank and its network of over 150 City-based partners serve 41,000 Pittsburgh residents struggling to put food on the table.

Currently, the Food Bank and their member agencies rescue about 15,000,000 pounds of food per year, including 3,500,000 pounds of food from retail stores, restaurants and other food donors within the City of Pittsburgh. Of those pounds, about 1,700,000 are high-value perishable products: produce, dairy, bakery and meat. Greater Pittsburgh Community Food Bank member agencies directly rescued 4,700,000 pounds of food last year. The Food Bank and its member agencies in the City rely on thousands of volunteers to sort product for safety and pack product for quick distribution. Greater Pittsburgh Community Food Bank is investing in its member agencies to increase their ability to transport and distribute product swiftly while ensuring safe and equitable distribution. 4,600,000 of the 15,000,000 pounds of food were picked up by agencies right at the donor's door, ensuring fresh food, and minimizing waste while complying with the rigorous food safety requirements of their contracts with us and our contract with Feeding America. Over the last five years, the Food Bank has doubled the pounds of food rescued directly by agencies. Efforts to increase this activity must be supported to ensure the greatest amount of food is going to the greatest number of people in need in the most efficient way possible.

The Food Bank is also implementing technology to streamline the connections between the food donors and food distribution agencies. In partnership with Feeding America, the Food Bank will be rolling out "Meal Connect," a localized platform for local donors to offer donations to local agencies trained and equipped to safely rescue food. The Food Bank played a leadership role in the creation of the Pennsylvania Agricultural Surplus System (Pass), a state funded program administered by the Department of Agriculture which provides food banks with the ability to defray the costs farmers incur picking and packing excess produce and other agricultural items. PASS has enabled the Food Bank to recover 1.7 million pounds of food that would otherwise have gone to waste since it was first funded by the Commonwealth in 2016.

Home garden donation program awareness

Working in partnership with the Greater Pittsburgh Community Food Bank, home gardeners are also able to donate surplus food at a number of locations throughout the City each day, and the Food Bank Community Harvest program ensures produce is provided to families in need. The City can support this program by providing information on how to donate produce and work with local organizations in donation marketing.

Objective: Develop an Office of Food Initiatives

For Pittsburgh to successfully address these issues associated with food and climate, there must be an individual leading the conversation. To that end, there is a need to develop an Office of Food Initiatives, which will act as a liaison between residents, the City, and the network of

stakeholders comprising the Pittsburgh food system to facilitate conversation and action in the local food climate. The Office will have a designated manager to represent the City in an official capacity at meetings and conferences pertaining to food, oversee the implementation of food-related policy recommendations, coordinate efforts related to food policy, and communicate with other food policy advisors and managers throughout the country. With the development of an office dedicated to food policy, the City will then be able to focus on creating a local food plan and working with regional partners to create a regional food plan guided by the principles of the Milan Urban Food Pact and the 100 Resilient Cities project. The Climate Action Plan only delineates a few of those initial steps, but a comprehensive food system plan will contain more information and strategies to further transform Pittsburgh into a more sustainable and resilient community that fosters and promotes a strengthened local economy and diverse food climate.

CHAPTER SEVEN: Urban Ecosystems

Goal: Increase carbon sequestration by 100% by 2030

Objectives:

- Increase tree canopy to 60% (from 42% now) by 2030
- Habitat conversion from lawns and concrete to urban forest
- Improve urban soil conditions through the use of compost and biomass material
- Increase biodiversity at all levels of the urban environment
- Species diversification/invasive species removal
- Prioritize wetland restoration
- Design and implement guidelines for the greenways

Strategies:

Based on current information, efforts can be made to improve the urban environment and its ability to reduce GHG, specifically CO2.

- Restore soil by increasing organic matter, reducing compaction
- Halt tree canopy loss due to development
- Minimize loss of trees due to pests and disease
- Encourage sound management practice to limit soil disturbance
- Support efficient water use and manage storm water, limit erosion
- Support sustainability in park design, development, maintenance, and management;
- Allocate adequate resources to sustain the public open space system
- Recover vacant spaces and brownfields for vegetation or urban agriculture
- Establish/continue public education efforts

Challenges:

- Climate change will increase invasive pest species & population
- Need better data
- Green space not functional
- Local regulatory conflict
- Local energy/development in competition with green space
- Development pressure from building industry & current practices
- Lack of species balance, e.g.deer overpopulation causing destruction of vegetation
- Need more funding/financial structures for green space
- Green space is often viewed as loss of tax revenue
- Need common priorities
- Anti-ecological habits & misinformation
- Legacy contaminants - soil quality

- Extreme weather events, challenge for vegetation, ecology, geology

Previous Work:

- Greenways Plans
- Biophilic Cities
- Shade Tree Commission
- PWSA Green First Plan

Ecosystem Champions

- Pittsburgh Parks Conservancy
- Phipps Botanical Garden
- BiodiverCITY
- Department of City Planning

Introduction to Urban Ecosystems

Urban areas have unique challenges and opportunities with regard to climate change. Many cities are growing, both in area and in population. They cover only 2-3% of the earth's surface, but hold more than 50% of the world's population and have been estimated to produce around 75% of the total global anthropogenic carbon dioxide emissions. However, urban ecosystems have also been shown to store more carbon per acre than surrounding regions. When discussing a carbon neutral goal, the amount of Carbon that can be sequestered by the City's ecosystems is a critical piece of the equation.

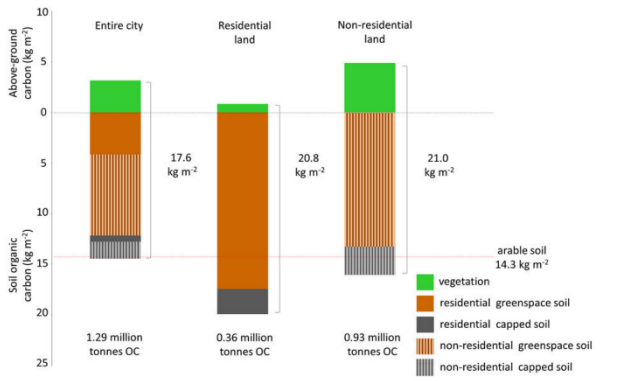
In Pittsburgh, there is an opportunity to protect and manage local ecosystems by lowering greenhouse gas emissions, through the assessment, protection, management, and improvement of the vegetation, soil, and water.

Objective: Calculate carbon sequestration capacity

Many cities are developing policies to promote urban vegetation in order to reduce their net greenhouse gas emissions. Urban centers are diverse areas with significant potential both to reduce carbon emissions and to increase carbon sequestration and storage. Carbon sequestration is the process of incorporating atmospheric carbon into plants, soil, and water. Terrestrial sequestration uses plants to capture CO2 from the atmosphere and store it as carbon in plants and soil. Geologic sequestration allows carbon to be deposited into long-term storage in geologic zones deep underground. Urban areas have both carbon sources and sinks. A source is any process or activity through which greenhouse gas is released into the atmosphere. A sink is an area of storage for this carbon. Carbon sinks in the carbon cycle include the atmosphere, vegetation, bodies of water, and soil.

Figure 3: Organic carbon storage density across the entire city (including the area covered by buildings), and in residential and non-residential land (excluding the area covered by buildings).

From: Organic carbon hidden in urban ecosystems



Research has been done over the years looking at ways CO2 can be sequestered via vegetation and soil. However, the potential for urban vegetation to remove CO2 from the atmosphere has not been well-documented. Assessments usually consider only the carbon accumulated by trees and do not take into consideration the effects of soil respiration or the emissions associated with the management of green spaces. In soil, living organisms interact with non-living materials, with microorganisms and bacteria driving decomposition and mineralization processes. Soil respiration is dependent on the microclimate within soil that integrates the combined effects of its temperature, water content and aeration conditions in addition to its organic matter characteristics and the presence of organisms. It has been found that vegetation may either act to sequester carbon or as a source of CO2 emission, depending on the species and its characteristics as well as the amount and conditions of pervious surfaces for soil respiration. In order to development an effective plan for management of urban ecosystems in Pittsburgh, more information is needed about the carbon sources and sinks within the city.

In order to develop the best practices for GHG reduction, carbon sequestration must be accurately calculated. Only then can the City and partners act to increase carbon sequestration and storage.

Objective: Ensure Healthy Vegetation is Able to Thrive

Tree Canopy Coverage

Pittsburgh leads major US cities in urban tree canopy coverage with 42% of the city sheltered by trees. Almost 40,000 street trees help Pittsburgh avert around 3,265 metric tons of CO2e through shading and cooling. These trees are able to sequester approximately 13,900 metric tons of CO2e (this considers only the carbon stored in the trees, not carbon stored in the soil). The existing tree canopy cover also provides shade, reduction the heat island effect, and are able to absorb runoff, reducing severity of flooding in cases of heavy rains. The existing benefits are significant, however, to pursue a carbon neutral goal for the City of Pittsburgh, more extensive carbon sequestration is needed. This can be accomplished protecting existing trees and vegetation and planting additional trees in order to maintain a widespread, healthy, urban forest.

Implement Biophilic Cities Initiatives

Biophilia is a term used to describe the extent to which humans are hard-wired to need connection with nature and other forms of life. Biophilic design is a growing field that recognizes

and implements the need for biophilic workplaces, gardens and natural light in hospitals, and for homes that utilize daylight, ventilation, plants, and greenery. Creative and effective means for incorporating nature on a city scale is becoming increasingly important as the world's human population becomes more urban. Biophilic cities are abundant in nature, provide residents opportunities to be outside and enjoy nature, are multisensory environments, place importance on education in biodiversity, and are globally responsible cities that recognize the importance of actions to limit the impact of resource use on nature.

The City of Pittsburgh partnered with Phipps Conservatory and Botanical Gardens to apply to the Biophilic Cities Network and was formally inducted into the global network on September 16, 2016. The City's main biophilic endeavors have focused on improvements to water and air quality, and to increasing city residents' engagement with the natural world. The City will create partnerships to enhance biodiversity, increase the tree canopy, install green infrastructure, daylight streams, and plan EcoInnovation districts. Pittsburgh will measure success in these areas through tree canopy coverage over time, extent of biodiversity, participation in monthly Biophilic meet-ups, percent of city budget devoted to nature conservation, restoration, and education, among other indicators.

Shade Tree Commission

The Shade trees play a vital role in the City's green spaces and they are an essential element of a healthy urban ecosystem. In April, 2017 Mayor William Peduto issued an Executive Order calling for new methods to protect the City's trees. A Task Force on Tree Protection was created in order centralize all of the City's tree policies and to build on the work being done by the Pittsburgh Shade Tree Commission and the Public Works Forestry Division. Included in the Order is the requirement for an inventory of the City's street trees and urban forest as well as a 10-year plan for maintenance, implementation and a streamlined process for disbursements from the PSTC dedicated funds. The Task Force will develop a tree policy manual and all Pittsburgh departments, agencies and contractors will adhere to those policies and will be held accountable to the Mayor for upholding the tree protection standards. The policies and standards established by the Task Force on Tree Protection will allow for ongoing maintenance, protection and sustainability of the City's vital tree canopy.

Prevent the Spread of Harmful Pests

As the climate change progresses, invasive species such as the Asian Longhorn Beetle pose a serious risk to native forests. As much as 70 percent of Pittsburgh's trees could be lost if the Asian Longhorn were to come to Pittsburgh. The Asian Longhorn Beetle is just one example of many invasive species that can endanger native flora and fauna. Due to the quick moving nature of invasive species, educating the public on how to identify, report, and prevent the spread of invasives is essential to protecting Pittsburgh's ecosystems.

Greenways Plan-Case Study

The “Greenways for Pittsburgh” program was established in 1980 in order to protect steeply sloped hillsides that were unsuitable for building and to consolidate and preserve this land. The Pittsburgh City Council defined the term “greenway” as a permanent, passive open space that benefits the adjacent neighborhoods and the general public. As of today, there are 12 designated greenways in the City, totaling 605 acres of protected land. Emerald View Park contains 61.5 of those acres, and three neighborhood parks contain a combined total of 8.9 acres. Currently, 14% of Pittsburgh’s public open space is designated as greenways. Twenty-one additional potential greenways would add over 450 acres to the system. As a point of reference, the City’s largest park, Frick Park, is 644 acres in size.

The Greenways for Pittsburgh program faces many obstacles to its success. Economic constraints have limited the time and staff available to maintain these open spaces, and defined methods for maintaining these areas must be developed. In addition, these areas are vulnerable to destructive actions such as overuse by motorized vehicles, dumping of refuse and possible unlawful activity. Greenways are also threatened by natural elements such as pests, disease and invasive species. Resources and methods to deal with all of these issues are needed. Residents of the City have indicated a desire for more greenways as well as improved access to and protection of existing natural areas that are not designated as greenways.

In July 2013, the City adopted the Open Space Plan. One recommendation that came from the plan was “Greenways for Pittsburgh 2.0”, an update of the Greenways for Pittsburgh project. The intent of Greenways 2.0 was to expand and enhance the City’s greenways, improve connectivity of open spaces, and to develop a network of hiking/biking trails. A second recommendation of the Open Space Plan was the development of a Natural Resources Manager. The Greenways for Pittsburgh 2.0 Resource Guide will be released in 2017. The Resource Guide is a how-to manual for citizens who are interested in becoming stewards of one of the City’s greenways. The Guide explains the Greenway Program and provides useful information for stewards of existing greenways or those interested in designating a new greenway. A second recommendation of the Open Space Plan was the development of a Natural Resources Manager. The role of this position would be to oversee the management and conservation of the City’s natural resources to meet the public desire for quality, accessible, connected open spaces while striving for the highest level of sustainability.

Objective: Improve Overall Soil Quality

Urban Soil Rehabilitation

Urban soils have unique characteristics that create unique challenges. About one-third of urban carbon emissions result from changes in land use, such as the replacement of vegetated surfaces with developed or industrial land.

Soil disturbance due to typical land development practices reduce the organic matter and carbon stored in the soil and increase the carbon emitted from the soil into the atmosphere during construction processes even when the topsoil is replaced. Land management practices for urban agriculture, landscaped areas and lawns can also increase emissions. In addition, urban soils often exhibit altered physical, chemical, and biological characteristics in

comparison to local non-urbanized soils. They can be contaminated by pollutants due to anthropogenic activities or degraded due to the influence of past land use on soil properties. These unique attributes can promote non-native invasive vegetation and can create novel soil types that cause difficulties for the ecological restoration of urban soils. Both the loss and gain of carbon in soil depend heavily on the pattern of interaction between plants, microbes, and the soil itself.

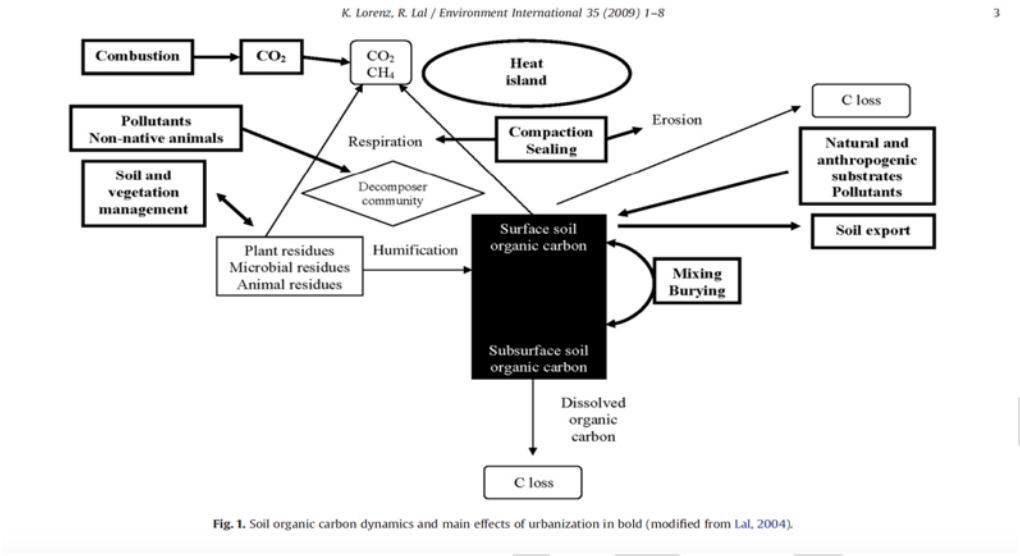


Fig. 1. Soil organic carbon dynamics and main effects of urbanization in bold (modified from Lal, 2004).

"Biogeochemical cycles in urban ecosystems are altered by human activities. Biological, chemical and physical properties of soil are changed; non-native plant and animal species and pollutants also affect the cycles. The atmospheric climate y be affected by the urban heat island and pollution island effect. However, urban soils also have the potential to store large amounts of soil organic carbon (SOC) and contribute to mitigation of increases in atmospheric CO2. This will improve retention of nutrients and water, and promote soil fertility.(Lorenz and Lal, 2009)

Improvement of urban soils is crucial to improving overall ecosystem function. Urban soil quality can be improved by using local resources such as composts and biosolids to restore soil and improve carbon sequestration. It has been shown that soil biodiversity has a positive impact on soil carbon sequestration. Ecosystems with high biodiversity sequester more carbon in the soil and living organisms than those with reduced biodiversity. Methods to reduce compaction of the subsoil also have potential to increase soil carbon storage below the surface. Soil rehabilitation can mitigate the risks from pollutants and improve the soil quality. It has been shown to have the potential to increase carbon storage both above ground and in below ground communities.

Residential Education and Landscaping

In addition to acting as carbon reservoirs, urban forests also affect the soil. It has been found that urban forest soils emitted the least CO2 as compared to lawns and landscaped cover. Conversely, the success of tree-planting projects in cities is also dependent on healthy soil. Healthy soils are critical for vigorous tree growth, so soil restoration, site preparation and management improves the traits of urban soils that are critical for success of any urban forestation projects. The preparation of urban soils for tree planting will improve the health of urban soils and therefore improve the entire urban environment. In the

City of Pittsburgh, 60% of private landscaping is residential. The greatest potential for urban forest occurs on residential land, but it is also the area of highest risk of removal of trees. Homeowners must be educated about the effects of their individual decisions on the urban ecosystem.

Vacant Lots and Land Use Decisions

Urban green-spaces and parks can also contribute to carbon sequestration. Urban park soils can act as a carbon sink. The type of land-cover within a park determines the effectiveness of each area. Wetland soils had the highest levels of stored carbon, although their effectiveness may be limited by the release of methane gases into the atmosphere. After urban forests, lawns and bare soils were less effective, but can still influence the carbon budget of urban parks. Turf grass is a major vegetation type in the urban environment; however, plants linked with fruiting and mushroom-type fungi have been found to store 70 percent more carbon per unit of nitrogen in the soil. In addition, management practices related to turf grass, such as species selection, irrigation, and mowing will also affect carbon release and storage. Therefore, understanding the land-use history and the choosing the correct type of land-cover in park planning can substantially impact the effectiveness of carbon sequestration.

Due to the decline of industrial manufacturing, many urban centers have experienced population declines that have resulted in large areas of vacant land. Since vacant lots have a limited capacity for carbon sequestration, urban agriculture may be an appropriate land use for these spaces. However, degraded soils are common. Soil amendments such as compost and urban yard waste can significantly improve soil quality and increase crop yields for urban agriculture, thereby improving potential carbon storage in these areas.

Improve ecosystem education

Education and outreach are needed to build an understanding of the importance of sustaining, protecting and improving the urban environment. Public education is necessary for citizens to understand the impact of the urban environment on GHG levels. Resource allocation is also needed in order to support efforts to manage the urban ecosystem. Cooperation between public and private sectors and innovative approaches to the various challenges are essential for success.

Protecting and improving the urban ecosystem in the City of Pittsburgh will provide many benefits to its residents, businesses and communities beyond reducing the impact of climate change. Natural ecosystems can not only provide climate benefits, but also make our city healthier and more livable. Creating a resilient urban ecosystem will benefit the environment and property owners as well as local and regional communities and economies. A successful process will respect and enhance the relationship between nature and the built environment.

Objective: Improve water quality and increase retention

Sound management of the urban ecosystem will take into account the possible effects on groundwater as well as local waterways. Proper maintenance of soils and vegetation will help to manage storm water run-off and prevent erosion. Erosion causes not only the loss of soil, but

also carries organic carbon into the waterways, impacting the health of aquatic habitats. In addition, reduction of GHG will reduce the presence of acid rain and its effects on the environment.

Carbon stored in organic matter gives soil its water-retention capacity. Soil with a higher organic carbon level will help prevent run-off and maintain healthy vegetation while requiring less maintenance and fewer resources. Soil water content and temperature directly affect the production and/or consumption of greenhouse gases. Increased water in the soil helps to increase microorganism and root activity in the soil and allow more carbon to be sequestered.

Ground and surface water are directly impacted by the condition of the soils in the area. Healthy soils not only help to sequester carbon but also filter pollutants, reduce runoff, control erosion and protect the water supply. Improving degraded soils with compost and biosolids will improve the soil ecosystem with minimal impact to surface water. Likewise, improving the efficiency of water use can reduce soil disturbance and therefore reduce the release of carbon into the atmosphere.

Application of Green Infrastructure

The Pittsburgh Water and Sewer Authority along with the City of Pittsburgh recently developed the ‘City-Wide Green First Plan’; a plan to manage storm water related issues. Utilizing ‘green first’ methods, the plan calls for increased green infrastructure to increase water retention, improve water quality, and decrease flooding events. Green infrastructure (GI) (as opposed to more traditional ‘gray infrastructure’ storm drains and concrete pipes’) can provide cost-effective, environmentally friendly water management strategies. Additions such as bioswales and rain gardens can not only reduce storm water runoff but also improve overall ecosystem quality and carbon sequestering capacity.