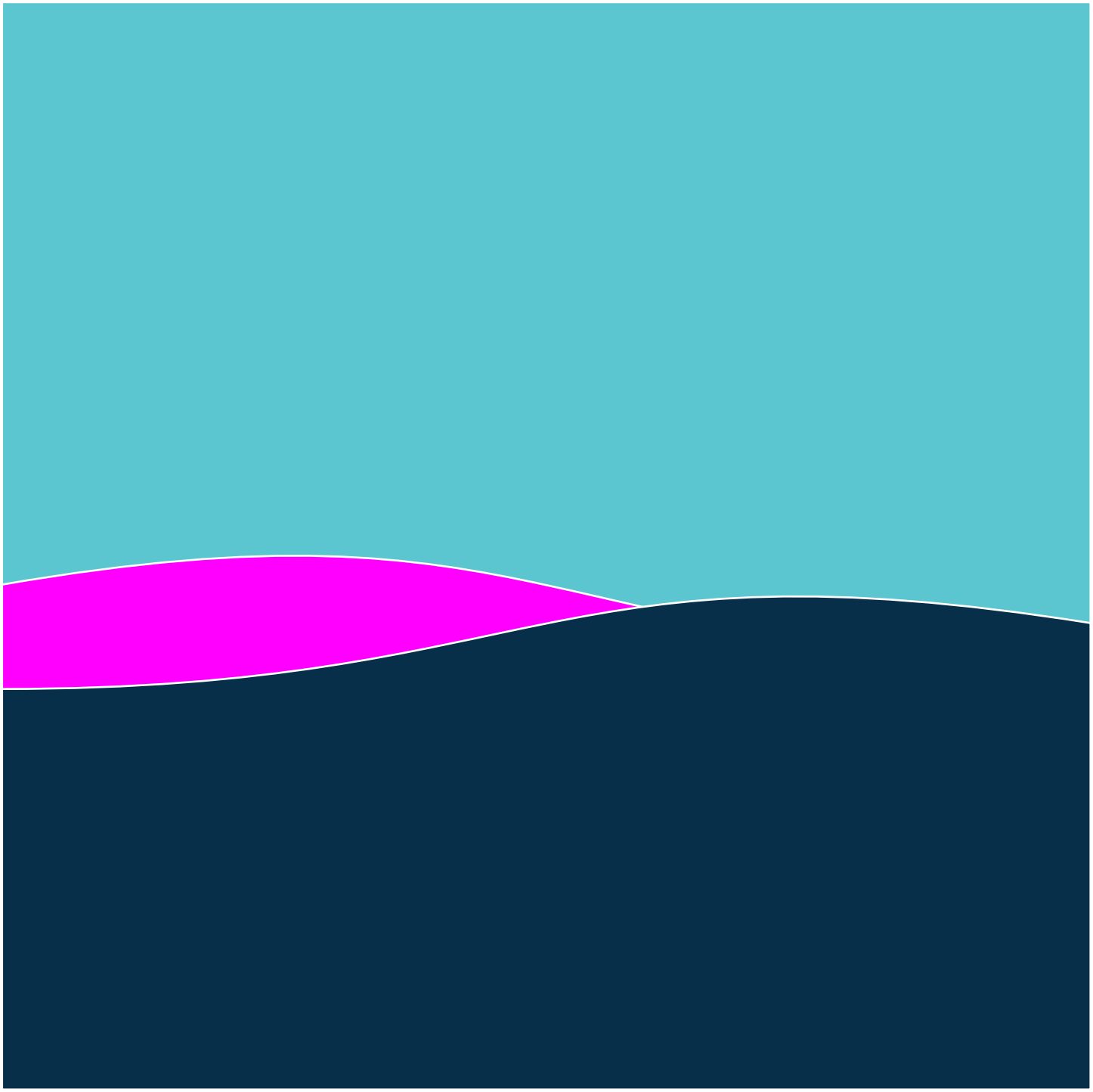
City of Athens

2019 Greenhouse Gas Inventory

Power A Clean Future Ohio



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For questions about this analysis, please contact:

Jon-Paul d'Aversa, AICP
Principal
UNPREDICTABLEcity
e: jpdaversa@UNPREDICTABLE.city

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At a Glance

Year	**2019**
Geography	**City of Athens, Ohio**
Tool	**US EPA Local Greenhouse Gas Inventory Tool**

GHG Emissions	**201,376 MT CO_2e** Total net GHG emissions for Athens in 2019	**8,006 MT CO_2e** Emissions sequestered by Athens's tree canopy in 2019	**5.8 MT CO_2e per Capita** Athens's per capita emissions is one of lowest in Ohio
Action Priority Sectors	**Residential** The residential sector was responsible for 46% of emissions in 2019, 77% of which were from personal transportation sources	**Commercial** The commercial sector was responsible for 50% of emissions in 2019, 55% of which were from the use of electricity and natural gas	
Action Priority Sources	**Vehicles** were responsible for 57% of total emissions in 2019	**Building Energy Use** was responsible for 41% of total emissions in 2019	
Action Priority Fuels	**Gasoline/Diesel** was responsible for 57% of total emissions in 2019	**Electricity** was responsible for 26% of total emissions in 2019	**Natural Gas** was responsible for 15% of total emissions in 2019
Home Energy Burden	**58%** of households in Athens have affordable energy bills	**18%** of households in Athens may struggle with some of their home energy bills	**25%** of households in Athens cannot afford their home energy bills

Inclusion Priority Communities	Women, those belonging to BIPOC communities, the un- and underemployed, those without a college degree, and youth.
Additional Communities for Inclusion	LGBTQIA+, veterans, elderly, immigrant and first-language-not-English populations, people with disabilities.

The Inventory

What is a greenhouse gas inventory?

A greenhouse gas (GHG) inventory is an accounting of the emissions which result from the different processes that support everyday life. An inventory itself should not interpret results, but simply provide data in an objective manner for further analysis.

Data

This inventory assesses emissions for activities that occurred within the city limits of Athens, Ohio. When data were not available, estimates were used if a certain level of confidence could be achieved. Data were provided by the City of Athens or estimated by UNPREDICTABLEcity.

Sectors

This analysis uses the common reporting sectors of residential, commercial, and industrial. As such, transportation emissions are captured within their respective sectors. Emissions from local government operations are included in the Commercial sector.

Important Definitions[1]

The following terms are used in the report:

CO_2e

This stands for carbon dioxide equivalent. Various gases contribute to climate change; however, some contribute more to climate change than others. To make sure we're comparing apples-to-apples, this analysis provides emissions data in terms of CO_2e.

The gases included in CO_2e are primarily carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

MT

Emissions are presented in metric tons or MT, which is the international standard for reporting emissions. A metric ton is equal to 2,204.62 pounds.

Scope 1

Scope 1 GHG emissions are direct emissions from sources that are owned or controlled by individuals or organizations within the geography of analysis. For Athens, this is primarily from natural gas being used to heat water and buildings, emissions from vehicles, and wastewater treatment.

Scope 2

Scope 2 GHG emissions are indirect emissions from sources that are owned or controlled by individuals or organizations within the geography of analysis. For Athens, this is primarily electricity.

Scope 3

Scope 3 GHG emissions are from sources not owned or directly controlled by individuals or organizations within the geography of analysis but are related to the activities that occur there. For Athens, this is primarily from waste production and the tree canopy.

[1] **Scope 1, 2, and 3 definitions adapted from the US EPA. https://www.epa.gov/greeningepa/greenhouse-gases-epa. Accessed: 08 Dec 2021.**

Source Definitions[2]

Stationary Combustion
The onsite combustion of fuels to produce electricity or heat using equipment in a fixed location. This is primarily natural gas and heating oil.

Mobile Combustion
The combustion of fuels to power a moving vehicle, such as gasoline or diesel fuel in a car or truck.

Solid Waste
Organic waste that anaerobically decomposes in landfills emits methane.

Wastewater
The treatment of wastewater produces methane and nitrous oxide.

Electricity
Fossil fuel-based electricity generation (primarily coal and natural gas) produces carbon dioxide, methane, and nitrous oxide.

Water
Importing water requires electricity, which produces greenhouse gases during its production.

Agriculture and Land Management
Greenhouse gas emissions from agriculture come from livestock and the application of fertilizers.

Urban Forestry
Greenscapes, and trees in particular, sequester carbon from the atmosphere. Urban forestry tends to reduce a community's total emissions.

Waste Generation
Some solid waste is exported to landfills outside of the community. Emissions from this source are considered Scope 3 as the community has little control if any to influence how the waste is managed.

[2] **Definitions provided by or adapted from the US EPA. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions. Accessed: 29 Mar 2022.**

Community-Wide Emissions by Scope, Source, and Gas

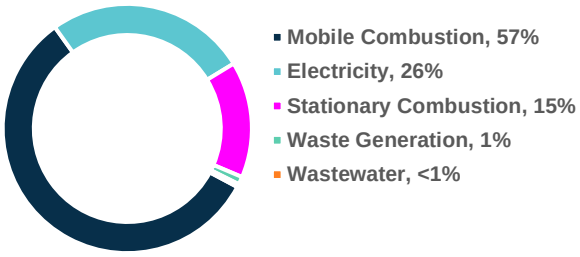


Figure 1.
Percentage of Gross Emissions by Source – City of Athens 2019

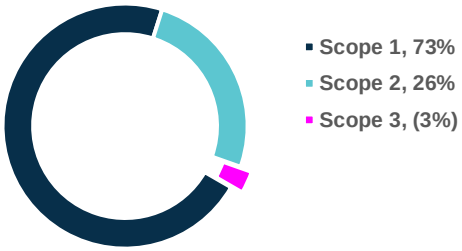


Figure 2.
Percentage of Emissions by Scope – City of Athens 2019

2019 Emissions by Source - MT CO_2e	CO_2	CH_4	N_2O	Total	Percent of Total
Scope 1	146,322	528	5,443	152,293	73%
Stationary Combustion	32,294	72	18	32,384	15%
Mobile Combustion	114,028	449	4,548	119,025	57%
Solid Waste[3]	-	-	-	-	-
Wastewater Treatment	-	7	877	884	<1%
Scope 2	54,962	127	215	55,304	26%
Electricity[4]	54,962	127	215	55,304	26%
Scope 3	(8,006)	1,785	-	(6,221)	(3%)
Water[5]	-	-	-	-	-
Agriculture & Land Management[6]	-	-	-	-	-
Urban Forestry	(8,006)	-	-	(8,006)	(4%)
Waste Generation	-	1,785	-	1,785	1%
2019 Total Gross Emissions	201,284	2,441	5,658	209,383	100%
2019 Total Net Emissions	193,277	2,441	5,658	201,376	

[3] Waste is not landfilled within city limits.
[4] Includes carbon offsets purchased through Athens' aggregation program.
[5] The City of Athens does not import water.
[6] Fertilizer use values were not included nor estimated for this inventory.

Community-Wide Emissions by Sector

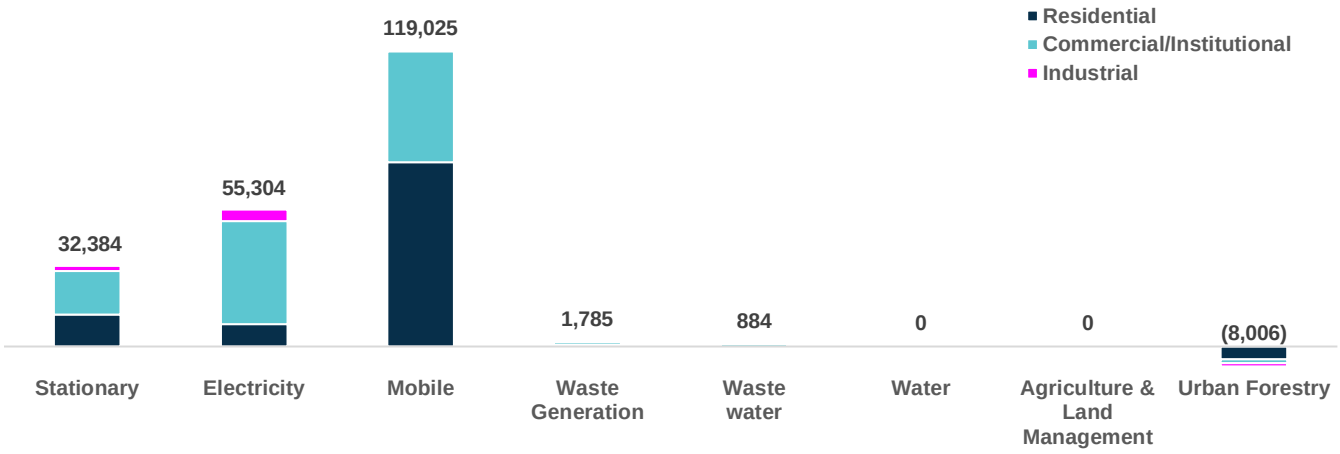


Figure 3.
Emissions by Source and Sector – City of Athens 2019 ($MTCO_2e$)

2019 Gross Emissions by Sector	Total MT CO_2e	Percent of Total
Residential	97,209	46%
Commercial/Institutional	105,497	50%
Industrial	6,677	3%

2019 Gross Emissions by Source and Sector	Stationary	Electricity[7]	Mobile	Waste Generation	Wastewater	Water	Ag + Land Mgmt.	Urban Forestry	Total Gross MT CO_2e	Total Net MT CO_2e
Residential	12,987	9,040	74,379	803	-	-	-	(5,060)	97,209	92,149
Com/Inst[8]	17,343	41,642	44,646	982	884	-	-	(1,735)	105,497	103,762
Industrial	2,055	4,622	-	-	-	-	-	(1,212)	6,677	5,465
Total MT CO_2e	32,384	55,304	119,025	1,785	884	-	-	(8,006)	209,383	201,376

[7] See footnote 4.
[8] Industrial mobile and waste generation emissions are included in the Commercial/Institutional sector in order to not identify individual entities.

2019 Gross Residential Emission Source	Total MT CO_2e	Percent of Total
Stationary	12,987	13%
Electricity[9]	9,040	9%
Mobile	74,379	77%
Waste Generation	803	1%
Wastewater[10]	-	-
Water[11]	-	-
Agriculture + Land Management[12]	-	-
Gross Sector Total	97,209	100%
Urban Forestry	(5,060)	(5%)

2019 Gross Commercial/Inst. Emission Source	Total MT CO_2e	Percent of Total
Stationary	17,343	16%
Electricity[13]	41,642	39%
Mobile	44,646	42%
Waste Generation	982	1%
Wastewater	884	1%
Water[14]	-	-
Agriculture + Land Management[15]	-	-
Gross Sector Total	105,497	100%
Urban Forestry	(1,735)	(2%)

[9] See footnote 4.
[10] Emissions from wastewater treatment are captured in the Commercial/Institutional sector.
[11] See footnote 5.
[12] See footnote 6.
[13] See footnote 4.
[14] See footnote 5.
[15] See footnote 6.

2019 Gross Industrial Emission Source	Total MT CO_2e	Percent of Total
Stationary	**2,055**	**31%**
Electricity	**4,622**	**69%**
Mobile[16]	**-**	**-**
Waste Generation[17]	**-**	**-**
Wastewater[18]	**-**	**-**
Water[19]	**-**	**-**
Agriculture + Land Management[20]	**-**	**-**
Gross Sector Total	**6,677**	**100%**
Urban Forestry	**(1,212)**	**(2%)**

[16] **Emissions from mobile combustion in the Industrial sector are included in the Commercial/Institutional sector.**
[17] **Emissions from waste generation are included in the Commercial/Institutional sector.**
[18] **See footnote 7.**
[19] **See footnote 5.**
[20] **See footnote 6.**

Emissions Impact of Aggregation Program

The previous tables provide an accounting of the emissions the result from activities that occur in Athens, inclusive of carbon offsets purchased through their aggregation program. Provided by Sustainable Ohio Public Energy Council, participating residents and small businesses are serviced with electricity offset by renewable energy credits (RECS). The following tables provide an accounting of actual emissions, offsets, and how they are attributed.

2019 Electricity Emissions - MT CO_2e	CO_2	CH_4	N_2O	Total
Electricity (Actual)	**73,621**	**171**	**288**	**74,079**
RECS Offset (Aggregation)	**(18,659)**	**(43)**	**(73)**	**(18,775)**
Electricity Emissions After Offsets	**54,962**	**127**	**215**	**55,304**

2019 Electricity Emissions by Sector - MT CO_2e	Total (Actual)	RECS Offset (Aggregation)	Electricity Emissions After Offsets
Residential	**22,661**	**(13,621)**	**9,040**
Commercial/Institutional	**46,796**	**(5,154)**	**41,642**
Industrial	**4,622**	**-**	**4,622**
Total	**74,079**	**(18,755)**	**55,304**

Emissions per Capita

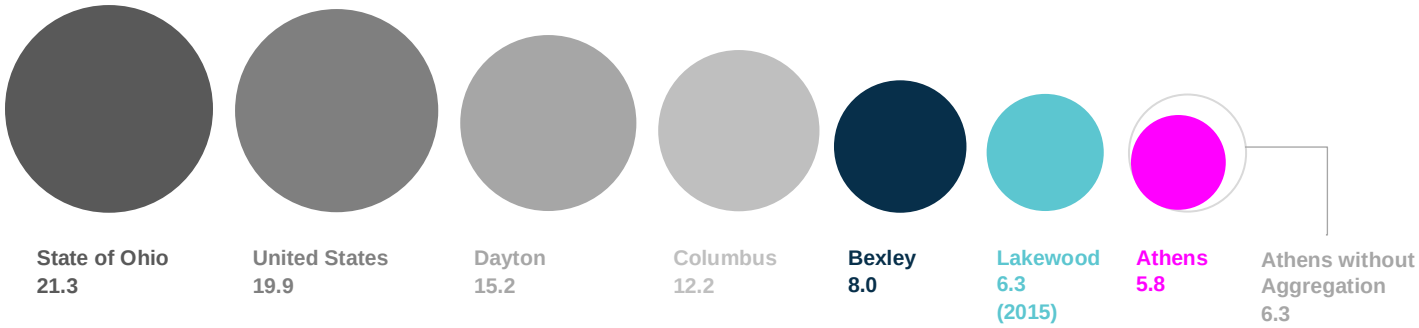


Figure 4.
2019 Gross Emissions per Capita

Gross Emissions per Capita	2019 MT CO_2e per Capita
State of Ohio	21.3
United States	19.9
Dayton, Ohio	15.2
Columbus, Ohio	12.2
Bexley, Ohio	8.0
Lakewood, Ohio (2015)	6.3
Athens, Ohio (without Aggregation)	6.3
Athens, Ohio	5.8

Equity Considerations

Approaching climate action with a lens of equity means that we are cognizant of, and responsive to, the individual needs of all residents in our communities. Often, this means prioritizing the inclusion of those groups that have been intentionally and unintentionally excluded from the decision-making process in the past.

We know climate change is and continues to disproportionately impact low-income communities and communities of color. As well, low-income communities in particular are less able to adapt to the new normals we face, be it heat waves, cold snaps, or flooding. This disadvantage broadens the gap in health and livelihood outcomes.

Underscoring our responsibility to address equity issues now, is the continued persistence of these issues. Study after study confirms that a child born in poverty will most likely live at least a portion of their adult life in poverty. As poverty and income are indicators of resilience, they are inherently tied to climate change.

Another example is educational attainment. On average, 34% to 40% of children will go on to complete college by age 25. For those who lived at least half of their childhood in poverty, however, only 3% will have completed college by 25 years of age.[21] Through no fault of their own, many Americans are born into cycles that make personal progress difficult, if not impossible. These issues left unaddressed will further reduce one's ability to be resilient in the face of climate change.

Who lives in Athens?[22]

Census data have limits, but they can help us begin to develop a picture of our communities and the issues they face. Using Census data in this manner should be viewed as a first step and can serve as a starting point for more in-depth conversations.

How do residents experience Athens?

As one can see from the following data, the City of Athens has compounding factors for climate security such as high poverty rates.

[21] C. Ratcliffe. " Child Poverty and Adult Success." Urban Institute. Link: https://www.urban.org/sites/default/files/publication/65766/2000369-Child-Poverty-and-Adult-Success.pdf. Accessed 08 Dec 2021.

[22] US Census 2019 ACS 5-Year Survey. Accessed: 16 Feb 2022.

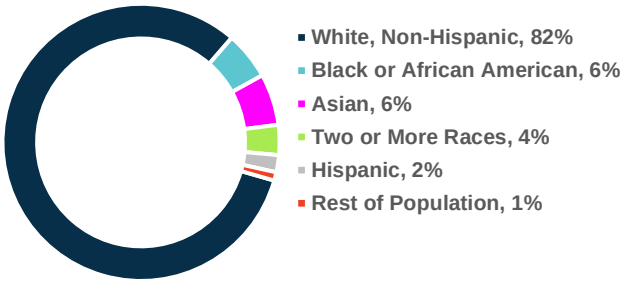


Figure 5.
Population by Race – City of Athens 2019[23]

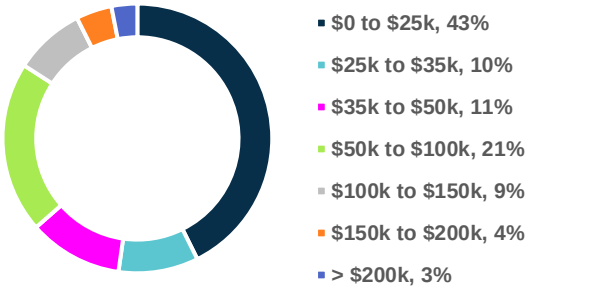


Figure 6.
Households by Income – City of Athens 2019

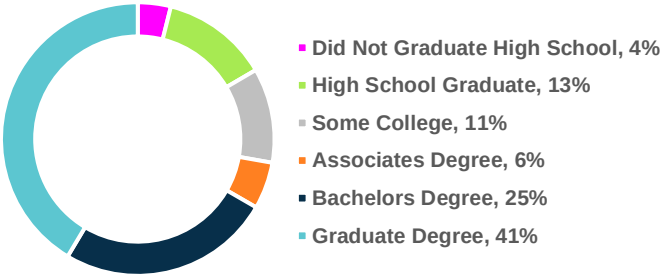


Figure 7.
Educational Attainment – City of Athens 2019

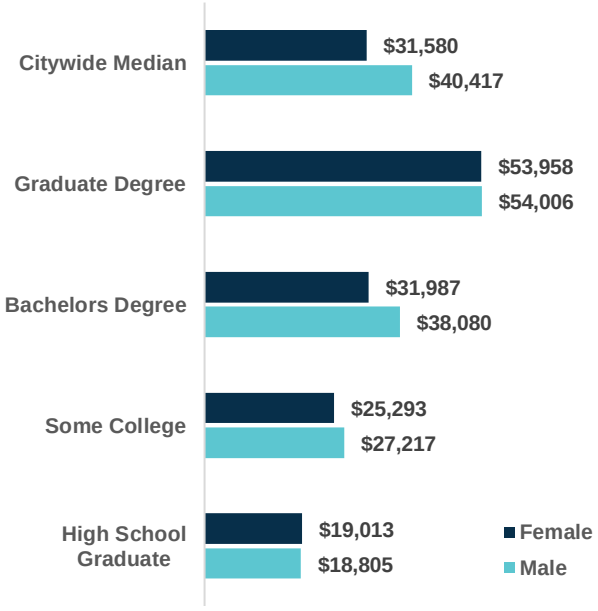


Figure 8.
Median Salary by Education – City of Athens 2019

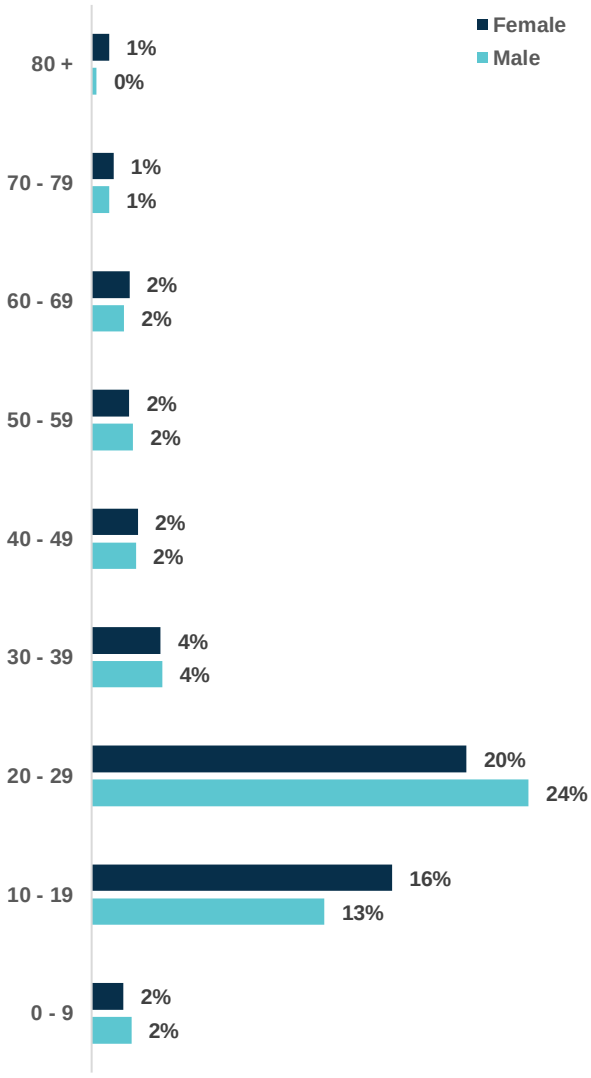


Figure 9.
Percentage of Age Cohort by Sex – City of Athens 2019

[23] **Rest of population includes categories of less than one percent and those who did not identify.**

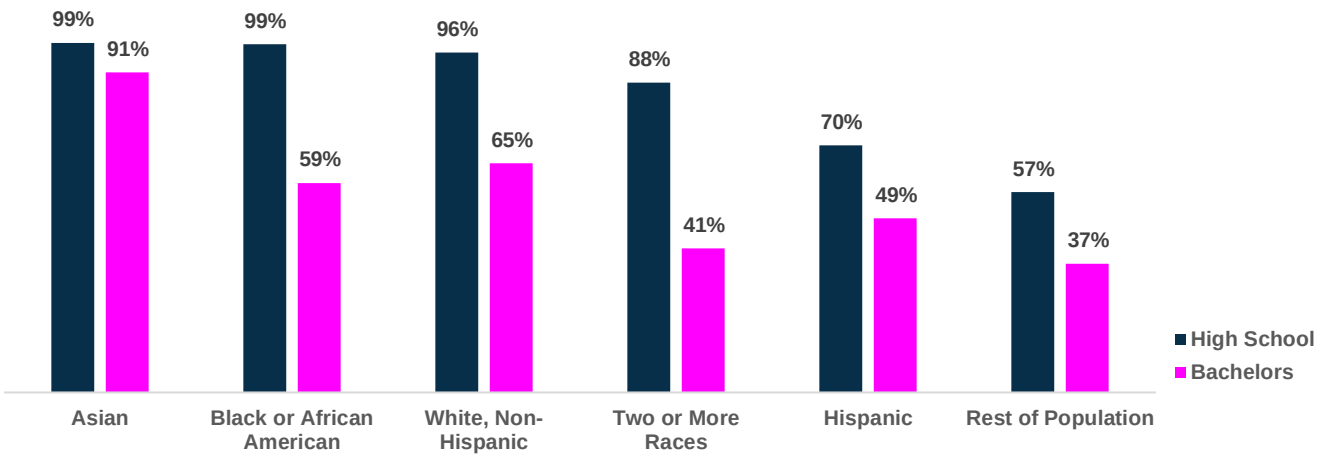


Figure 10.
Educational Attainment by Race – City of Athens 2019[24]

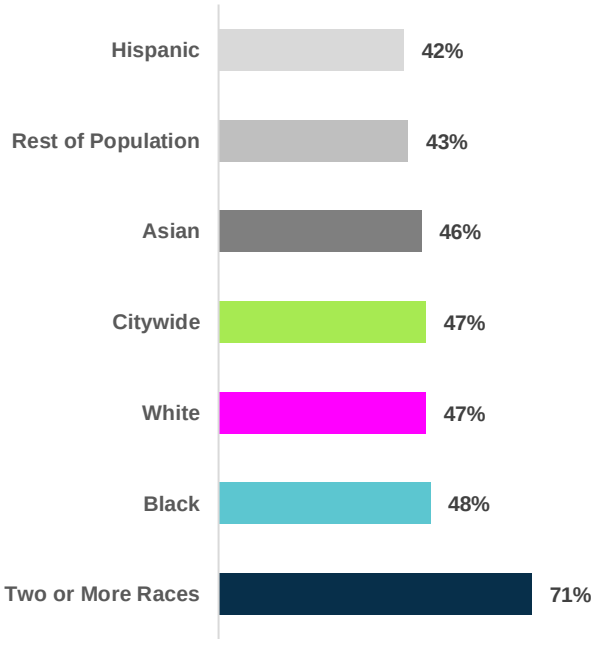


Figure 13.
Poverty Rate by Race – City of Athens 2019

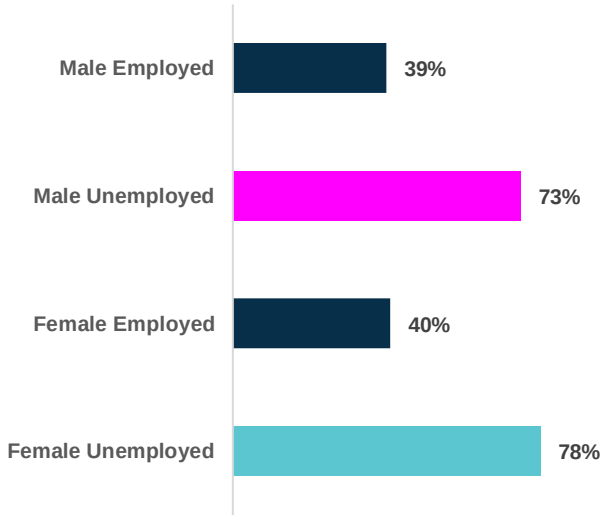


Figure 14.
Poverty Rate by Sex and Employment Status – City of Athens 2019

[24] **Rest of population includes categories of less than one percent and those who did not identify.**

Home Energy Burden

What is home energy burden?

Home Energy Burden is the percentage of your household income that goes towards your home energy costs (heating, cooling and electricity). A healthy home energy burden is under 5%. Between 5% and 10%, a household may struggle to pay a bill here and there, but generally is able to manage though often at the expense of other needs. Over 10%, a household will almost certainly need assistance and will often fall behind on bills.

Why is it important?

Energy is a need, just like food and shelter. As climate change continues to become more severe, our need for heating, cooling, and transportation will certainly grow. To ensure that everyone is prepared, we will have to truly understand the individual needs in our communities.

In Athens, a household income of roughly $25,000 is needed to maintain an energy burden below 5%. This assumes an individual or family is living in the average size and age home for Athens. As was noted in the Franklin County Energy Study,[25] older homes are more likely to be inefficient and so other considerations may be necessary.

Who earns enough?

In Athens, those with at least some college education in their household will likely be earning enough to meet their energy needs, however nearly half of Athens' population is experiencing poverty.

Roughly 43% of households in Athens are struggling to some degree to meet their energy needs. It is essential to ensure their inclusion in the development of climate actions, as they will be at a significant risk to the impacts of climate change.

[25] **MORPC. Franklin County Energy Study. 2018. Link: https://www.morpc.org/wordpress/wp-content/uploads/2018/06/2018-Franklin-County-Energy-Study.pdf. Accessed: 16 Feb 2022.**

58% of Athens households can afford their home energy bills.

Households with less than 5% home energy burden

18% of Athens households may be struggling with some of their home energy bills.

Households with home energy burdens between 5% and 10%

Another **25%** of Athens households are unable to afford their home energy bills.

Households with home energy burdens above 10%

Recommendations

We measure greenhouse gases in order to minimize the impacts of climate change. For Ohio, those impacts are primarily:

- An increase in extreme heat events
- An increase in extreme cold events
- An increase likelihood of economic disruption across sectors
- An increase in flooding events, both frequency and severity
- An increase in nighttime temperatures during the growing season
- A longer vector-borne disease season
- A decrease in health and livelihood outcomes

Decreasing our emissions now will lessen the severity of these impacts in the future, however, it will be years before the course can be reversed. We should expect to see the impacts of climate change grow over the next few decades. This is why we must take the two-pronged approach of mitigation and adaptation.

The recommendations that follow focus on efforts that will mitigate future impacts and increase our resiliency in the present. These are not exhaustive and additional interventions should be identified and pursued. Adaptation measures not discussed in these recommendations must be considered as well.

Tackling climate change and addressing equity go hand-in-hand. This inventory illuminates two very specific target sectors: building energy consumption and transportation. Energy efficiency, renewable energy, and fuel switching reduces our current emissions (a mitigation approach that protects the future), can improve our health outcomes, and will insulate our current economics from price and supply fluctuations that can be expected with climate change.

As well, this report identifies groups that are essential to equitable program development in Athens: women, those belonging to BIPOC communities, the un- and underemployed, those without a college degree, and youth.

Be sure to think about these recommendations holistically. Often it will make sense and be easier to accomplish these simultaneously or in tandem.

Building Energy Consumption

Efficiency

Reducing energy demand is always the first step. For one, it reduces the amount of energy needed, thus ensuring resources are not unnecessarily spent on superfluous generation. Secondly, it frees up capital to take additional climate action. Most importantly, energy efficiency immediately reduces our exposure to air pollution and other environmental toxins, particularly when it involves the reduction of fossil fuel consumption.

Prior to considering any intervention, the City should commit to making energy efficiency a priority. Through this, the City ensures actions have teeth and continue through to completion. Additional information follows to help guide decisions.

Actions to Take Next:

1. Create a task force to serve as both an advisory and working group to establish the City's focus on energy efficiency.
2. Ensure the task force is familiar with energy equity considerations.
3. Identify stakeholders. It will be essential to have open channels of engagement with community groups.
4. Set a target for energy efficiency based on climate and equity goals. Be sure that no resident experiences a home energy burden above 5%.
5. Pass a resolution to ensure action is taken and establish the City's commitment.
6. Identify priority actions to achieve the energy efficiency target. Be sure to focus on local government operations, private homes, and commercial buildings.
7. Agree to the priority actions. This may include opportunities such as: utility programs and property assessed clean energy (PACE).
8. Identify action partners. Not only will you need people with technical skills to implement projects and programs, you will also need community partners to help with outreach and for evaluation.
9. Identify funding sources.
10. Develop a work plan and begin.

Resources:

USDN's ***A Guidebook on Equitable Clean Energy Program Design for Local Governments and Partners***
www.cadmusgroup.com/wp-content/uploads/2018/09/Cadmus-USDN-Equitable-Clean-Energy-Guidebook.pdf

US EPA's ***Energy Efficiency in Local Government Operations***
www.epa.gov/sites/default/files/2015-08/documents/ee_municipal_operations.pdf

US DOE's ***Residential Energy Efficiency for Local Governments***
www.betterbuildingssolutioncenter.energy.gov/bca/residential-energy-efficiency-local-governments

Energy Efficiency Decision Guidance

Energy Efficiency and Fuel Switching	Level of Technical Difficulty	Implementation Cost	Payback Duration
Existing Residential Buildings			
Lighting - Residential	Low	Low	Short
Appliance and Electronics - Residential	Low	Low	Short
Space Heating - Residential	High	Moderate	Moderate
Cooling - Residential	High	Moderate	Moderate
Water Heating - Residential	Moderate	Moderate	Moderate
Water Fixtures - Residential	Low	Low	Short
Building Envelopes - Residential	Moderate	Moderate	Moderate
Existing Commercial Buildings			
Lighting - Commercial	Low	Low	Short
Appliances and Electronics - Commercial	Low	Low	Short
Space Heating - Commercial	High	Moderate	Moderate
Cooling - Commercial	Moderate	Moderate	Moderate
Water Heating - Commercial	Moderate	Moderate	Moderate
Water Fixtures - Commercial	Low	Low	Short
Building Envelope - Commercial	High	High	Moderate
New Residential Buildings			
Efficient Construction - Residential	Low	Moderate	Short
Appliance and Electronics - Residential	Low	Low	Short
Space Heating - Residential	High	Moderate	Moderate
Cooling - Residential	High	Moderate	Moderate
Water Heating - Residential	Moderate	Moderate	Moderate
Water Fixtures - Residential	Low	Low	Short
Building Envelopes - Residential	Moderate	Moderate	Moderate
New Commercial Buildings			
Efficient Construction - Commercial	Low	Moderate	Short
Appliances and Electronics - Commercial	Low	Moderate	Moderate
Space Heating - Commercial	Low	Moderate	Moderate
Cooling - Commercial	Low	Moderate	Moderate
Water Heating - Commercial	Low	Moderate	Moderate
Water Fixtures - Commercial	Low	Low	Low
Building Envelope - Commercial	Low	Moderate	Moderate
Existing Municipal Buildings			
Lighting - Municipal	Low	Low	Short
Space Heating - Municipal	Moderate	High	Moderate
Cooling - Municipal	Moderate	High	Moderate
Building Envelope - Municipal	Moderate	Moderate	Moderate

Energy Efficiency and Fuel Switching	Level of Technical Difficulty	Implementation Cost	Payback Duration
New Municipal Buildings			
Lighting - Municipal	Low	Moderate	Short
Space Heating - Municipal	Low	Moderate	Moderate
Cooling - Municipal	Low	Moderate	Moderate
Building Envelope - Municipal	Very High	High	Long
Street & Other Public Lighting			
Streetlights	Low	Moderate	Moderate
Traffic Signals	Low	Moderate	Moderate
Wastewater Biogas-to-Energy Optimization			
Biogas-to-Energy from Anaerobic Lagoons	Moderate	Moderate	Moderate
Biogas-to-Energy from Anaerobic Digesters	Very High	High	Long
Water Conveyance Pump Improvements			
Water Conveyance Pump Efficiency	High	High	Long

Key:

Level of Technical Difficulty: Low – Self or existing staff; High – Requires specialist

Implementation Cost: Low – Likely fits within existing budget; High – Likely requires financing

Payback Duration: Low – 1-3 years; Moderate – 3-10 years; High – 10+ years

Building Energy Consumption

Solar

According to National Renewable Energy Laboratory's State and Local Planning for Energy platform, Athens County has over 92 gigawatt hours (GWh) of annual solar generation potential for residential and commercial systems.[26] To put this in perspective, the entire City of Athens consumed just over 152 GWh of electricity in 2019. When also accounting for utility-scale solar systems, an additional 5,600 GWh of electricity could be produced annually within the county.

These are technical potentials however, and further considerations are necessary to understand what is actually achievable. Although solar has a net-positive payback over the lifetime of the system when sized correctly, it typically requires a significant upfront cost for owners. A barrier for certain, but not insurmountable. As well, there are employment, environmental, and resilience components to onsite solar that can make its pursuit worthwhile.

To illustrate the impact that solar can have, several residential solar penetration goals were modeled by UNPREDICTABLEcity for the City of Athens. Although emission reductions are relatively low compared to the City's 2019 total gross emissions, a modest 5% solar goal for residential buildings would save consumers nearly $60,000 annually, while $165,499 annually would remain local to stimulate Athens's economy. It should be noted that emission savings will likely decrease as utilities decarbonize their generation facilities (see the table on following page).

It is important to recognize that the City has entered into an agreement with Sustainable Ohio Public Energy Council (SOPEC) to provide eligible customers with electricity backed by renewable energy credits through their aggregation program. This is an important step in moving the United States towards a clean energy future.

For 2019, the Athens aggregation program resulted in 18,775 metric tons of CO_2e being avoided, roughly 9% of total community-wide emissions. If full residential participation had been achieved (and allowable), Athens would have seen an additional reduction of 9,040 metric tons of CO_2e, or an additional 4% of total emissions.

Athens should consider future opportunities to include more Ohio-based renewable generation in their aggregation program in order to ensure that the economic and resilience benefits provided by local clean energy are realized.

In order for the City of Athens to take advantage of the benefits of solar, the following actions are suggested. Power a Clean Future Ohio members can take advantage of PCFO's solar market development technical assistance to facilitate this work.

Actions to Take Next:

1. Work with the efficiency task force to identify the amount of local renewable generation needed to reach your equity and climate goals ***after*** efficiency is taken into account.
2. Identify stakeholders. It will be essential to have open channels of engagement with community groups.
3. Pass a resolution that creates a city-wide goal for solar installations, incorporating equity and access considerations.
4. Ensure that zoning, permitting, and inspection processes are up to date and in line with best practices.
5. Identify and agree upon priority actions to achieve the solar goal. Pursue utility-scale projects on city-owned land.
6. Identify action partners. Not only will you need people with technical skills to implement projects and programs, but you will also need community partners to help with outreach and for evaluation.
7. Identify funding sources.
8. Develop a work plan and begin.

Resources:

Power a Clean Future Ohio
poweracleanfuture.org

[26] **National Renewable Energy Laboratory, State and Local Planning for Energy. https://maps.nrel.gov/slope/. Accessed 05 May 2022.**

Residential Solar Penetration Goal	Electricity Produced (GWh)	Annual MT CO_2e Reduced Regionally	Percent of Athens 2019 Gross GHG Emissions	Annual Residential Savings ($USD)	Annual Dollars Kept Local ($USD)
5%	1.3	600	<1%	$58,553	$165,499
10%	2.7	1,220	0.6%	$118,852	$335,932
20%	5.3	2,365	1.1%	$230,450	$651,363

Transportation

Mass transit and active transportation, such as bicycling, are the most cost-effective and environmentally friendly options for moving people. Unfortunately, commuting by bus, bike, or foot does not always meet our needs, particularly when traveling long distances, for those with children, or those who are less abled. As Ohio communities are and will likely remain car-dependent for the foreseeable future, the recommendations below are focused on transitioning personal vehicles from gasoline-powered internal combustion engines to electric vehicles (EV). It is nonetheless recommended to identify mode-shift solutions whenever possible, in particular, mass transit capable of providing accessible transportation for all residents.

Over the next five years, Ohio will be receiving $140 million to facilitate the development of EV infrastructure as a part of the Bipartisan Infrastructure Law. The funds are available to "help states create a network of EV charging stations along designated Alternative Fuel Corridors, particularly along the Interstate Highway System." Furthermore, a second competitive grant program is to be announced later this year, focused on EV charging access in rural and underserved communities.[27]

As of 31 December 2021, there were 55 battery-powered EVs and 62 plug-in hybrid EVs registered in the City of Athens. Adoption will likely increase as car manufacturers phase out the internal combustion engine over the next 15 years. Preparing for this shift is essential to ensure the inclusion of all community members.

The City of Athens has partnered with Rural Action on a Department of Energy sponsored project to advance electric vehicle adoption through the development of EV Charging stations for public use. The City installed a public DC Fast Charge Station on East State Street, which will provide dedicated charging to the Athens Public Transit's first EV shuttle bus, arriving in 2022.

Electrify

In order to transition the City of Athens, its residents and its businesses to electrified transportation, everyone will need to feel secure in that their individual transportation needs will be met. This will include addressing range anxiety, affordability, and suitability of available technologies. This is more than most cities can handle on their own. Fortunately, there are many organizations active in Ohio that can help.

Although city fleets are responsible for less than 1% of total emissions for the City of Athens, electrification of city vehicles holds a significant opportunity for the City as a whole. Electrification of city fleets would:

- Catalyze the development of public EV charging infrastructure, which is needed especially for those who lack access to home charging, and
- Allow the opportunity for city employees to become comfortable with the technology, thus encouraging EV purchases at home.

We highly recommend continuing work with PCFO and Clean Fuels Ohio to take advantage of opportunities identified in the September 2021 fleet assessment. Be sure to consider aesthetics, ownership models, and maintenance.

Additionally, as transportation accounted for 57% of Athens's total emissions, the City could make significant progress towards emission reductions with programs and campaigns to facilitate EV purchases by residents and businesses. Many approaches to this can be taken. To help Athens decide which approach is best for them, the following table can be used to assist in justifying interventions. These values were modeled by UNPREDICTABLEcity in October of 2021 for the State of Ohio. Currently, gasoline prices are 50% higher due primarily to increased demand and international conflict. Current prices were not modeled as they are not expected to continue, though can be if desired by the City.

[27] **President Biden, USDOT and USDOE Announce $5 Billion over Five Years for National EV Charging Network, Made Possible by Bipartisan Infrastructure Law. February 10, 2022. https://highways.dot.gov/newsroom/president-biden-usdot-and-usdoe-announce-5-billion-over-five-years-national-ev-charging. Accessed 08 Mar 2022.**

Actions to Take Next:

1. Continue working with PCFO and Clean Fuels Ohio to implement the transition plan for city fleet vehicles.
2. Begin conversations around how Athens can address equity issues through the planning of a community-wide transition to EVs.
3. Identify and agree upon priority actions for an equitable community transition to EVs.
4. Identify action partners. Not only will you need people with technical skills to implement projects and programs, but you will also need community partners to help with outreach and evaluation.
5. Identify funding sources.
6. Develop a work plan and begin.

Resources:

Power a Clean Future Ohio
poweracleanfuture.org

Clean Fuels Ohio
cleanfuelsohio.org

UNPREDICTABLEcity's Transportation Burden Calculator
unpredictable.city

Rural Action Sustainable Energy Solutions
ruralaction.org/our-work/sustainable-energy-solutions/

Savings per Vehicle Switched to an EV from an Internal Combustion Engine - Ohio	Annual Dollar Savings in Fuel (USD)	Annual Reduction in Wasted Energy (Btu)	Annual Emissions Reductions (MT CO_2e)	Annual Vehicle Pollution Reductions (lbs)
Charged via Grid	**$1,027**	**16,422,692**	**2.65**	**107**
Charged via Residential On-Site Solar	**$1,215**	**42,932,326**	**4.26**	**111**

Equity

Low-income communities and communities of color will bear a disproportionate share of climate change's impacts. Energy consumption is expected to rise to counter hotter summers and colder winters. This will increase pollution exposure which is already concentrated in these communities. At the same time, home energy and transportation burdens will increase, further exacerbating the physical, social, and mental health impacts of climate change.

As these communities are at a disadvantage when it comes to adapting to climate change, it is paramount for the City to focus efforts here. Fortunately, addressing home energy efficiency can help. A 10% increase in residential energy efficiency would reduce the energy burden for 450 households to below 5%. A 20% increase would move 740 households into affordable energy burden levels.

Unfortunately, however, 1,900 households in Athens will likely struggle to afford energy despite energy efficiency goals due to exceptionally low incomes. As many of these households are rental units, our recommendations align with ACEEE's **Energy Equity for Renters** initiative and **Housing is a Human Right**'s goals to "protect tenants' right to fair, affordable, healthy, safe, and environmentally sustainable housing; preserve communities and housing as affordable for low-income residents; and/or produce housing that is both affordable for low-income households and environmentally sustainable."

ACEEE outlines equitable policy actions,[28] such as:

- Adopting a renter right of first refusal on property sale
- Creating a rental energy disclosure policy
- Promoting existing state and utility efficiency programs to renters and landlords
- Adopting a rental energy performance standard and assisting affordable housing providers with compliance
- Designing rental efficiency loan and grant programs with affordability covenants
- Granting renters the right to make efficiency improvements
- Instituting limited-scope (minor efficiency upgrades) rental property retrofit requirements
- Advocating to expand state and utility rental efficiency programs
- Coupling public housing energy-efficient rehab projects with inclusive workforce development
- Including energy efficiency in competitive affordable housing funding criteria

Similar to energy burden within the home, our transportation choices also carry a burden. Here, 10% of income is typically what is considered affordable for transportation. Lower-income residents are more likely to purchase used cars with cash than new cars with a loan. Whereas this eliminates a monthly car payment, older vehicles are typically less efficient thus increasing the amount of money spent on fuel, and likely have higher maintenance costs. For someone without a car payment, in order to maintain a 10% transportation burden they would need to have an income of at least $40,623 if the vehicle runs on gasoline. However, if the same person owned an EV without a car payment, they would only need an income of $27,953 to maintain a 10% transportation burden.

There is significant consideration that must be given here. On one hand, EVs have the potential to make transportation burden affordable for over 800 households. On the other hand, if these EVs are not powered by 100% renewable energy from Athens's regional grid, they will still contribute to climate change. Local pollution reductions from removing gasoline-powered vehicles should be strongly valued in this consideration.

Actions to Take Next:

1. Continue to develop the City of Athens's capacity to understand and address equity issues through PCFO's Equity Coaching Program.

Resources:

ACEEE's Energy Equity for Renters
https://www.aceee.org/energy-equity-for-renters

ACEEE's A New Lease on Energy: Guidance for Improving Rental Housing Efficiency at the Local Level
www.aceee.org/research-report/u2102

UNPREDICTABLEcity's Transportation Burden Calculator
unpredictable.city

[28] **ACEEE's Energy Equity for Renters https://www.aceee.org/energy-equity-for-renters. Accessed 08 Mar 2022.**

Future Greenhouse Gas Inventories

Greenhouse gas inventories are highly data-driven and rely on assessing the same geographies and sectors from year to year. Data collection processes are most consistent when conducted annually, thus ensuring familiarity with the process for those involved.

However, greenhouse gas inventories do not need to be completed annually, as most actions will take multiple years to implement and evaluate. It is recommended to conduct a greenhouse gas inventory at least once every three years, although annually is ideal. The most important thing is to commit to conducting them on a regular basis.

Known data points that should be collected and analyzed in future iterations:

- Natural gas consumption values for each sector
- Upstream losses from electricity production and transmission
- Natural gas leakage values
- Fertilizer use

Actions to Take Next:

1. Pass a resolution that establishes Athens's Greenhouse Gas Monitoring Program and empowers city staff to collect and share the data needed for a greenhouse gas inventory.
2. Inform outside organizations which data are needed and the timeframes that will be used.
3. Ensure that greenhouse gas inventorying is housed in one department and that it becomes the responsibility of the analyst, thus ensuring consistency. Make the process part of their written job description.
4. Identify areas of the inventory where data were calculated rather than collected. Utilize PCFO's education and training opportunities to ensure staff know how to complete additional analyses.
5. Identify additional areas where the inventory can be improved.
6. Document the process explicitly in order to ensure the continuation and consistency of the analysis.

Resources:

US EPA's Local Greenhouse Gas Inventory Tool
www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool

Power a Clean Future Ohio
poweracleanfuture.org

UNPREDICTABLEcity
unpredictable.city

About

The Project

This greenhouse gas inventory was developed as part of Power a Clean Future Ohio's Equity Coaching Program. For more information about PCFO and the services offered to cities, please visit **poweracleanfuture.org**.

The 2019 City of Athens Greenhouse Gas Inventory was created with the support of staff time from Paul Logue and Andrew Chiki of the City of Athens, Sarah Conley-Ballew of Rural Action, and Jacob Kemp, Americorps VISTA with both the city and Rural Action.

The Analyst

UNPREDICTABLEcity works with governments, nonprofit organizations, and community groups to strengthen the foundations of change in our built environment.

This analysis was completed by:

Jon-Paul d'Aversa, AICP
Principal

For further information about UNPREDICTABLEcity and services offered, please visit **UNPREDICTABLE.city**.

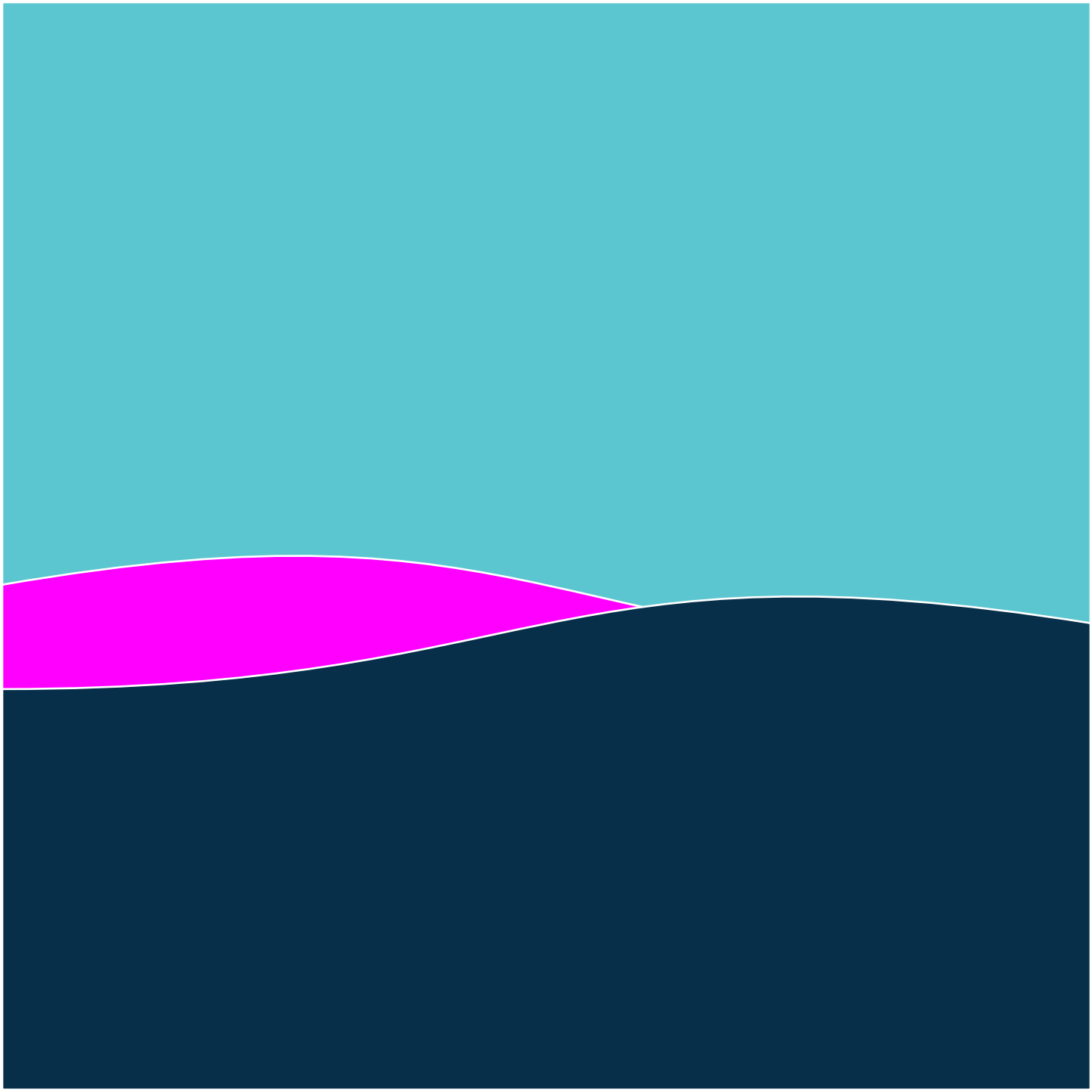
The Analysis

Even though 2020 data were available, this inventory uses 2019 data as it will likely be more reflective of 2021 and beyond. This inventory can be used as a baseline to measure the impact of future climate action.

The analysis uses the US Environmental Protection Agency's Local Greenhouse Gas Inventory Tool (last updated in November 2020). More information about the tool can be found on the US EPA's **website**.

Whereas there is sufficient confidence in the data analyzed, there is an acknowledgement that some data are missing. Further iterations of the greenhouse gas inventory for Athens should seek to include data that were unavailable for the 2019 inventory.

For questions about the inventory and data, please contact UNPREDICTABLEcity.



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