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Sustainability Solutions Initiatives
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2020 Greenhouse Gas Emissions Inventory

An Executive Summary
prepared for

City of Phoenix
May 2022



sustainabilitysolutions.asu.edu

Acknowledgements

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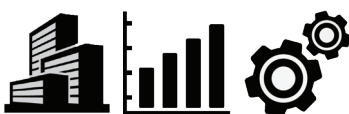
Finally, we would like to thank city of Phoenix employees, residents, and business owners, who are on the ground supporting the city's efforts and who are working toward reducing their own greenhouse gas emissions.

Government Operations Findings

In 2020, city of Phoenix government operations emitted 25.2% fewer GHG emissions than the 2005 baseline level of 716,143 MT CO₂e. This is a decrease in annual emissions of 180,467 MT CO₂e.

Community-Wide Findings

In 2020, community-wide GHG emissions for the city of Phoenix were 14.0% less than the 2012 baseline level of 17,622,666 MT CO₂e. Community-wide GHG emissions have decreased by 2,466,616 MT CO₂e annually.



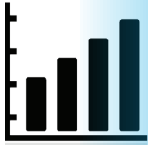
2020 City of Phoenix Greenhouse Gas Emissions Reductions Summary Report

Prepared by the ASU Rob and Melani Walton Sustainability Solutions Service and the NAU School of Informatics, Computing, and Cyber Systems

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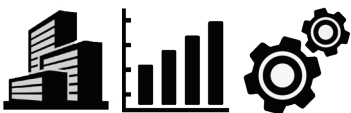
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Background

The city of Phoenix set its first climate action goals 14 years ago in 2008 with the stated goal of reducing greenhouse gas (GHG) emissions from city operations 5% below 2005 levels by 2015.

In 2012, three years ahead of schedule, Phoenix exceeded its goal with a reduction of 7.2%. In response to this accelerated reduction and to continue to position itself as a national leader, the Phoenix City Council adopted a new goal to reduce GHG emissions to 15% below 2005 levels by 2015. The completion of the Phoenix 2015 Greenhouse Gas Emissions Inventory for Government Operations showed that Phoenix exceeded its 15% reduction goal. In 2017, Phoenix updated its government operations GHG emissions reduction goal to 40% below 2005 levels by 2025.

Phoenix's 2021 Climate Action Plan set an even more ambitious goals for reducing GHG emissions from government operations:

Achieve net-zero GHG emissions for municipal operations electricity use by 2030 through renewable energy projects, energy efficiency upgrades, and utility partnerships.



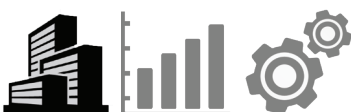
In addition to government operations, Phoenix conducts regular community-scale GHG emissions inventories according to the Global Protocol for Community-Scale GHG emissions Inventories (GPC). The GPC is a worldwide standard for inventorying city-induced GHG emissions and is the standard supported by the Global Covenant of Mayors for Climate and Energy. Phoenix is a member of the C40 Cities Climate Leadership Group and Global Covenant of Mayors for Climate and Energy. At the community scale, Phoenix has a stated goal to reduce community carbon emissions from buildings, transportation, and waste by 50% by 2030 and to move toward becoming a carbon neutral city by 2050.

2020 Overall Findings

- Phoenix government operations emitted 535,675 MT CO₂e, a 25.2% decrease below baseline 2005 levels;
- Community GHG emissions were 15,156,347 MT CO₂e, a 14.0% decrease below baseline 2012 levels.

City Action Highlights

- Phoenix government operations consume 8% less energy compared to 2005 while providing services for nearly 300,000 more residents;
- Electricity consumption by traffic signals and streetlights has fallen nearly 50% since 2005;
- Biogas capture at the 91st Ave Wastewater Treatment Plant decreased facility emissions by 28,949 MT CO₂e.



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City of Phoenix Climate Action Projects

Buildings and Facilities

- Increasing renewable energy to city operations
- \$30 million in building retrofits to increase building efficiency by 20%.
- First city to adopt International Energy Conservation Code's 2018 International Building Code

City Vehicle Fleet

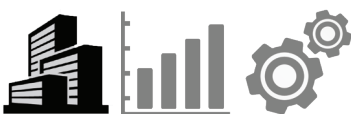
- Alternative Fuel Programs:
 - City Vehicle Fleet continues to transition liquid natural gas and diesel to less GHG-intensive compressed natural gas and biogenic fuels.
 - Public Works, in partnership with Mr. Bults Inc. (MBI), were the recipients of a United States Environmental Protection Agency Diesel Emissions Reduction Act (DERA) grant to replace heavy duty diesel refuse trucks. This project will be implemented using \$1,000,000 in DERA grant funding combined with \$2,194,693 in cost-share funds from Public Works and MBI to replace diesel refuse trucks. This project will replace 9 Class 8 diesel refuse trucks, and 1 MBI long haul refuse truck, with model year 2019 Class 8 trucks powered by compressed natural gas engines certified to meet the California Air Resources Board's most stringent optional low NO_x emission standard.
- Construction of PHX Sky Train, electrically powered, at Phoenix Sky Harbor International Airport at an estimated cost of \$1.5 billion is expected to be completed by 2022 is reducing the need for fleet powered by compressed natural gas.

Heat Ready City

- Walkable Urban Code is an urban and transit-oriented zoning code.
- Established first-of-its-kind Heat Ready Program that was recognized in the Bloomberg Philanthropies Mayors Challenge Champion City program.
 - Citizen Forester Program 2.0 – The Volunteer Office led the relaunch of the Citizen Forester Program certifying 20 Citizen Foresters and planting more than 200 trees this year. The program continues to grow with support from an AmeriCorps VISTA member working in the City Manager's Office and a \$50,000 Phoenix IDA grant to fund community led heat-mitigation projects to support HeatReady Phoenix.
 - We're Cool 2019 – Volunteer Phoenix led the fourth annual We're Cool campaign, in partnership with the Human Services Department and the Office of Homeland Security and Emergency Management, to connect low-income communities to cooling centers, heat safety information and support during the summer months with the help of 400 youth volunteers.
- Planning and Development revised zoning code to ensure trees are planted and maintained.
- Cool Pavement Program to coat streets in a lighter color to reflect light to reduce temperatures locally.

Solid Waste

- Reimagine Phoenix:
 - Construction of state-of-the-art \$15 million compost facility to divert organic waste.
 - Partnered with Stardust Building Supplies to pursue deconstruction rather than demolition to divert materials from the landfill.
 - 36% of solid waste diverted from landfills with goals of 50% by 2030 and of being a zero waste city by 2050.



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City of Phoenix Climate Action Projects

Sustainable Food Systems

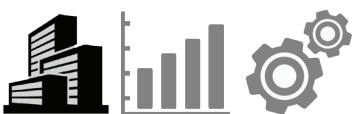
- Healthy food system goal adopted into the General Plan, PlanPHX.
- City Council approved the 2025 Phoenix Food Action Plan to promote a healthy, sustainable, equitable, and thriving local food system with healthy food for all.

Transportation Initiatives

- Transportation 2050
 - Added 2.4 million service miles
 - 16.5 miles of light rail have been constructed
 - 44 RAPID buses have been ordered for use in 6 routes
 - 349 transit shelters installed at bus stops that previously had no shade
 - 20,693 ADA ramps improved/installed through street maintenance
 - 567 solar lighting kits installed on new and existing transit shelters
 - Installed 32.2 miles of bicycle lanes, upgraded 1 mile of existing bike lane miles to protected bike lanes and upgraded 34.5 miles of existing bike lanes to buffered bike lanes
- New Bus and Dial-A-Ride Vehicles – Public Transit has ordered 403 new buses and 122 Dial-a-Ride vehicles to its fleet to replace aging buses. The department adds new vehicles each year to modernize the fleet, which in turn provides the region's bus passengers with an overall more efficient and dependable bus service, as well as vehicles that are more fuel efficient and include the latest clean fuel technology.
- eScooter Pilot Program Launch – The Street Transportation Department launched the Downtown Shared eScooter Pilot Program to provide a micro-mobility solution for our residents and visitors.
- Parking Protected Bicycle Lanes – The Street Transportation Department installed the City's first and second parking protected bicycle lanes through the Accelerated Pavement Maintenance Program.
- Street Landscape Improvements – 700 trees planted along with increased service levels and irrigation audits for street landscaping and irrigation maintenance, which will result in reduced water consumption, save money and help make Phoenix streets more walkable.
- Liberty Lane Street Improvements – A 4.5-foot buffer was added to the bike lanes on Liberty Lane, creating more space between motor vehicles and bicyclists/pedestrians, resulting in improved safety for all users of the roadway.
- The Grand Canalscape, a nearly 12-mile continuous multimodal trail system from Glendale to Tempe, was completed with additional expansion planned.

Water

- Colorado River Drought Contingency Plan: Phoenix Water Services effectively negotiated in the Arizona implementation of the Colorado River Drought Contingency Plan to maintain protection of existing priority system for Colorado River water in Central Arizona and system conservation in the plan.
- Water Loss Committee: The efforts of the Department's Water Loss Committee resulted in a reduction of our Lost and Unaccounted for Water reported to the Arizona Department of Water Resources of nearly one billion gallons year over year by city operations.
- Partnered with Ameresco to construct a \$25 million facility to treat and sell biogas, which contains renewable natural gas, from 91st Wastewater Treatment Plant.



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City of Phoenix Climate Action Projects

Programs planned or commenced since 2020

City Vehicle Fleet

- A policy will be developed to work toward procuring lower-GHG emissions vehicles where operationally feasible, including electric vehicles.

Heat Ready City

- Cool Corridors Program to plant trees citywide to provide shade to high pedestrian traffic areas with the first Cool Corridor established in 2022 and a goal of 100 by 2030.
- Established the Office of Heat Response and Mitigation, the nation's first municipally office of its kind.
- Heat Response Plan developed to help keep people safe in summer.

Solid Waste

- Phoenix is participating in C40 Cities Reinventing Cities Competition that seeks to transform underutilized sites through sustainability and community focused projects.

Sustainable Food Systems

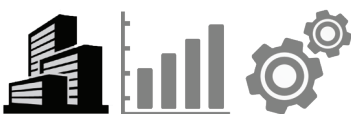
- 2021 – Backyard Garden Program empowers residents to grow healthy food in their own backyards.
- 2022 – Urban Agriculture Fellowship Program designed to train next generation of growers.
- 2022 – Agri-Food Technology Innovation Programs will provide grants to advance projects to produce food in a manner sustainable in Phoenix.
- 2022 – Resilient and Sustainable Agriculture Program provides grants to Phoenix farms to reduce the climate impact of food production and enhance the resiliency of both the farm and local food system in the face of various shocks and disruptions.

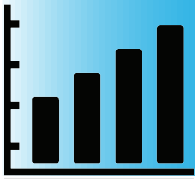
Transportation Initiatives

- 2022 – Road Safety Action Plan Vision Zero approved by City Council.
- 2022 – Active Transportation Plan in development to increase walkability and bikeability.

Water

- The 2021 Water Resource Plan demonstrates Phoenix's robust and diverse water portfolio.
- Phoenix encourages residents to adopt a desert lifestyle that has reduced the number of gallons per capita per day (GPCD) it uses by nearly 30% over the last twenty years, despite an increase of almost 400,000 additional residents.





Government Operations

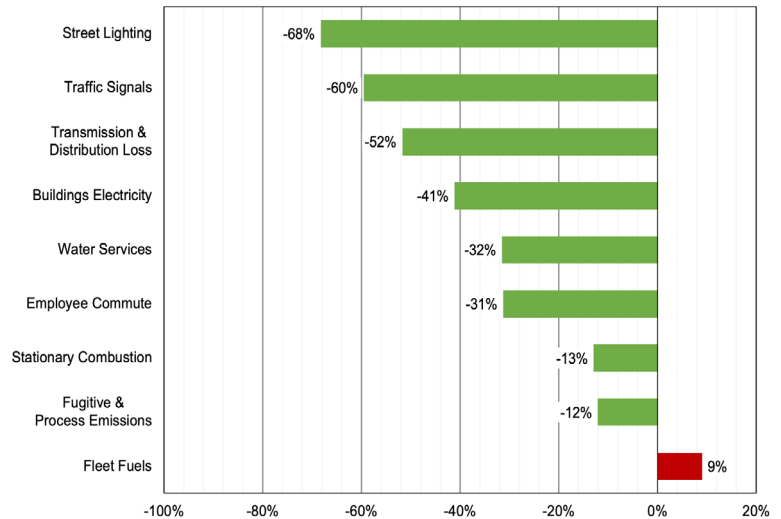
Significant Reductions

Since 2005, GHG emissions from Phoenix government operations have decreased from 716,143 MT CO₂e to 535,675 MT CO₂e, a 25.2% decrease in emissions.

The most substantial decrease in GHG emissions were associated with electricity consumption, where efficiency upgrades and changes to the regional energy mix have driven significant decreases. Fleet fuels have increased as service miles increased to meet T2050 goals. The use of alternative fuels, like CNG and biodiesel, decreased emissions (Right).

The 2020 inventory update enables Phoenix to evaluate its progress towards lowering emissions from its operations to reach the goals of 40% reduction by 2025 and net zero by 2050.

% Change in GHG Emissions From 2005 Levels

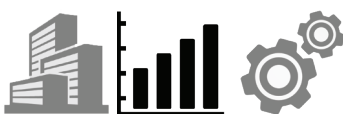
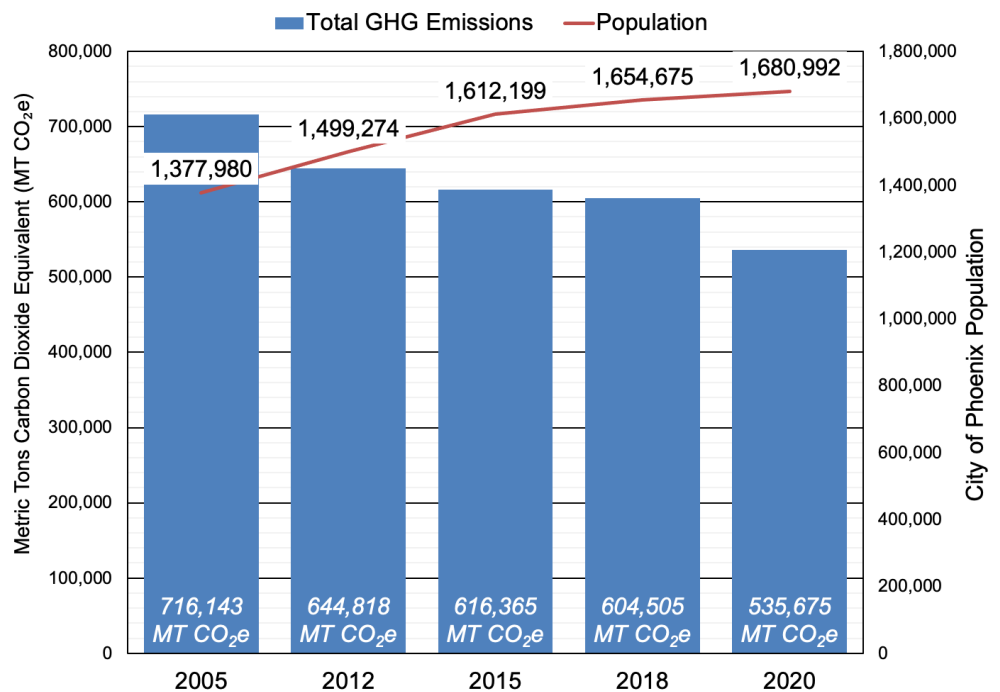


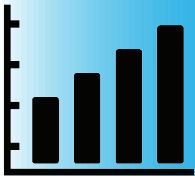
City of Phoenix government operations total GHG emissions have decreased despite significant population growth

In 2020, Phoenix government operations emitted 38.7% fewer GHG's per resident than in 2005.

GHG emissions from Phoenix government operations have decreased due to multiple factors:

- 40.6% fewer emissions from electricity consumption;
- 12.9% fewer emissions from natural gas combustion;
- 12.1% fewer emissions from landfills and wastewater treatment.





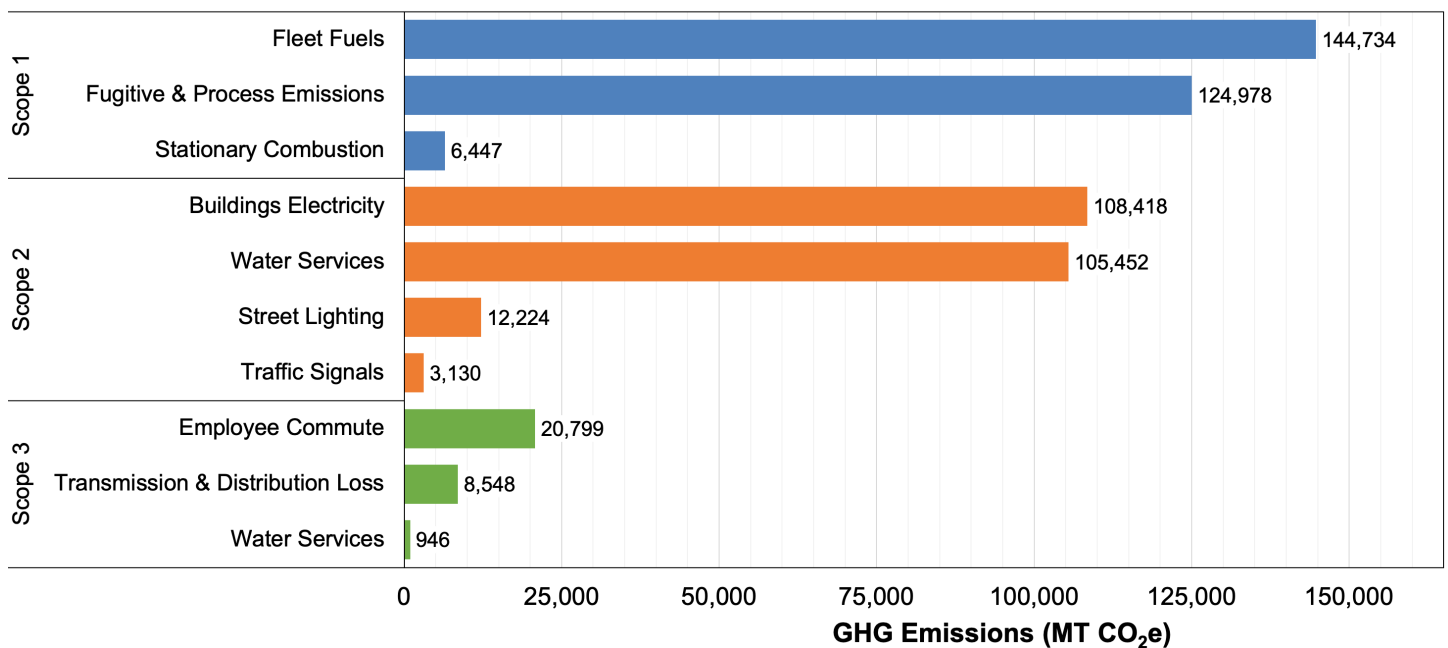
Government Operations

What's the source?

The Phoenix 2020 Greenhouse Gas Emissions Inventory for Government Operations identified sources of greenhouse gas emissions in city operations by both scope and sector:

- Scope 1 GHG emissions are those generated directly by city operations;
- Scope 2 GHG emissions are indirect sources of emissions from electricity consumption;
- Scope 3 GHG emissions are related to city operations but not owned or controlled by Phoenix.

The sectors—buildings and facilities, city vehicle fleet, water services, solid waste and employee commuting— were chosen to make the findings more relevant to Phoenix's policy making and project management.



Top Sectors

Wastewater Treatment

Biogas capture at the 91st Avenue Wastewater Treatment Plant reduced GHG emissions 28,949 MT CO₂e below 2018 levels.

Employee Commute

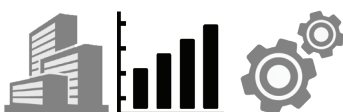
Telecommuting programs have contributed to a decrease in employee commuting emissions by 9,473 MT CO₂e since 2005.

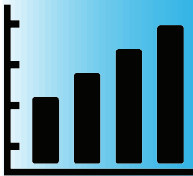
Buildings and Facilities

GHG emissions from Buildings & Facilities have fallen 124,837 MT CO₂e due to a less carbon intensive electricity grid.

Solid Waste

The 27th Avenue Compost Facility will reduce future GHG emissions at the SR-85 Landfill.

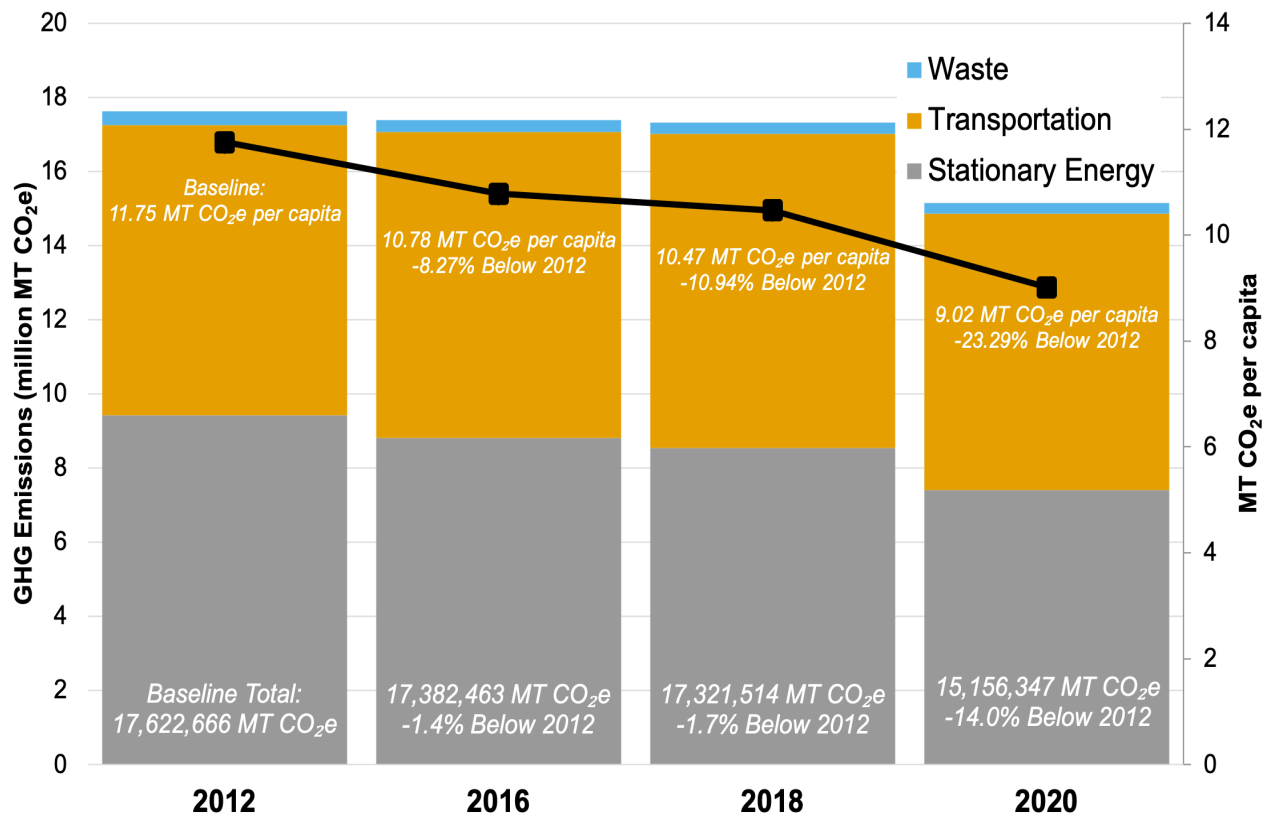




Community Emissions

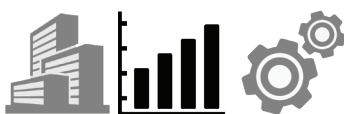
The city of Phoenix completed its fourth community greenhouse gas emissions inventory for calendar year 2020 using the Global Protocol for Community-Scale GHG Emission Inventories (GPC). Calendar year 2012 is the baseline for Phoenix-wide GHG emissions. A community inventory estimates GHG emissions from the entire Phoenix community, not just government operations, for all stationary energy consumption, transportation activities and waste generation. The GPC is the international standard for conducting community GHG emissions inventories.

Phoenix community GHG emissions between 2012 and 2020



Key Findings:

- In 2020, community-scale GHG emissions were 15,156,347 MT CO₂e, representing a 14.0% decrease below the 2012 baseline level of 17,622,666 MT CO₂e.
- GHG emissions decreased across Phoenix while Phoenix's population grew 12.1% and the metro area economy grew significantly, indicating that Phoenix can reduce emissions while experiencing economic growth.
- The Phoenix per capita GHG emissions rate fell 23.3% from 11.75 MT CO₂e to 9.02 MT CO₂e between 2012 and 2020.
- For the first time since 2012, transportation-related activities became the largest source of GHG emissions across Phoenix, comprising 49.2% of emissions, and will likely increasingly be the dominant source of GHG emissions as the regional electricity grid becomes less carbon intensive.





Actions

Recommended Measures

We recommend that the city of Phoenix continue to take bold actions to identify and reduce GHG emissions, to update and evaluate the effectiveness of mitigation programs, and to take the necessary climate adaptation steps to ensure a resilient metropolitan region in a warmer, drier future. The following recommended measures can be accomplished in consultation with the City and its departments, under the leadership of the City Council and City Manager's Office.

1. Conduct a Consumption-Based GHG Emissions Inventory

GHG emissions are not contained by city boundaries. Phoenix should be cognizant of the GHG emissions impacts of its purchasing decisions to bolster and increase the impact of sustainable purchasing policies. By conducting this consumption-based inventory, the GHG emissions resulting from the production, shipping, use, and disposal of items and services purchased by the City can be included in resulting municipal operations emissions inventories to gain a better picture of the GHG emissions. This information can then be used to make decisions to reduce the financial and environmental costs of city purchasing.

2. Create a city of Phoenix GHG Emissions Dashboard

Transparency and accountability are critical in ensuring that emissions reduction efforts remain active. As the City continues to develop robust data on its GHG emissions, it should pursue developing an online GHG dashboard to be displayed on the City's Open Data portal to present the results of emissions inventories in an easily accessible way for city staff, other municipalities and the public.

3. Innovate Methods for Estimating the GHG Emissions Impact of Land Use

During the 2020 GHG emissions inventory cycle, Phoenix conducted its first GHG emissions inventory of Agriculture, Forestry, and Other Land Use (AFOLU) and city-wide food consumption. The initial AFOLU GHG emissions inventory process identified several shortcomings for tabulating these emissions for a city with Phoenix's climate. It is recommended to invest in efforts to develop new methods for tabulating AFOLU GHG emissions for cities in hot deserts, reinforcing Phoenix's leadership role in understanding and mitigating community-scale GHG emissions.

4. Coordinate the Development of a Regional GHG Emissions Inventory and Resiliency Plan

Develop a plan that will address greenhouse gas emissions and increase the resilience of the greater Phoenix metropolitan area through regional coordination under the Maricopa Association of Governments. Regional cooperation will lead to increased economic opportunities by leveraging public and private investments that can be used to ensure long-term economic growth. The plan will also build public awareness of climate-related risks and allow for improved collaboration to seek solutions.

5. Set the Standard for Comprehensive City GHG Emissions Inventorying

The Local Government Operations Protocol and GPC are internationally-recognized standards for conducting city-level GHG inventories. However, these standard protocols may inadequately inventory unique aspects of a city and its operations. To address this, we recommend the following actions. First, we recommend conducting a GHG inventory of Phoenix-specific systems, like Phoenix's water system from raw water sources to wastewater discharge. Second, we recommend evaluating technologies to increase the spatial and temporal resolution of GHG inventories. Finally, we recommend setting up a system for the third-party verification of the government operations and community-scale GHG inventories.

