



# 2018 Community Greenhouse Gas Emissions Inventory Overview

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# Project Summary

- Community Greenhouse Gas (GHG) Emissions Inventory
  - Non-regulatory
  - Inform cities and serve as baseline
  - Covers entire county, and broken down by municipalities
- Sectors
  - Residential, commercial, industrial, and transportation
- City allocation
  - Population proportion
  - GIS land-use and area

# EPA Community GHG Inventory Tool

- Emission categories
  - Electricity use
  - Mobile sources
  - Stationary fuel use
  - Wastewater
  - Livestock
  - Solid waste
  - Manufacturing gases
  - Imported water
  - Fertilizer use
- GHG uptake
  - Urban forestry (CO<sub>2</sub> photosynthesis uptake)



# EPA Community GHG Inventory Tool

- Greenhouse gases
  - Carbon dioxide ( $\text{CO}_2$ )
  - Nitrous oxide ( $\text{N}_2\text{O}$ )
  - Methane ( $\text{CH}_4$ )
  - Fluorinated gases, e.g. sulfur hexafluoride ( $\text{SF}_6$ )
- Convert to metric tons of  $\text{CO}_2$  equivalents ( $\text{MTCO}_2\text{e}$ ) and is standard unit for all gases

# Electricity Use

- Electricity consumption
  - Municipal data from APS and SRP
  - Residential/Commercial/Industrial
- Sulfur hexafluoride (SF<sub>6</sub>) use
  - Electric system insulator
  - 22,800 times more potent than CO<sub>2</sub>
  - Emissions data from EPA FLIGHT tool
  - Emissions allocated by population and proportion of sector electricity use within each municipality



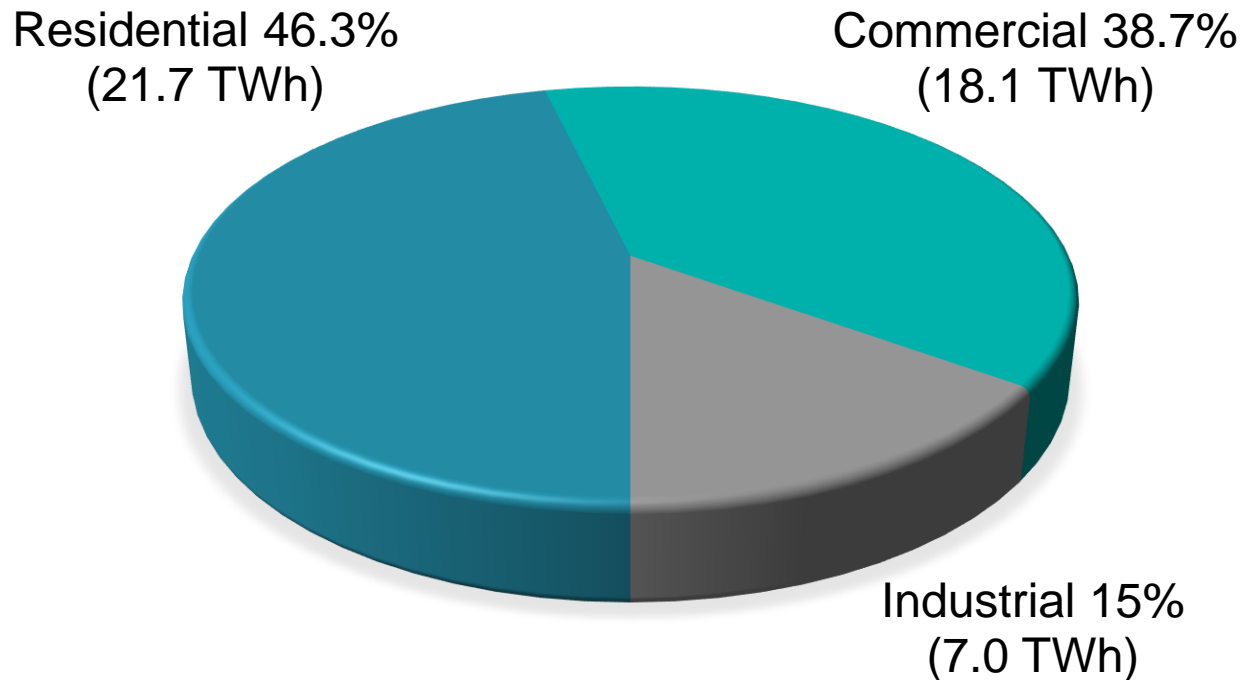
# Electricity Use

- Emission factor
  - 0.466 MTCO<sub>2</sub>/Megawatt-hour (MWh)
  - EPA Southwest U.S. eGRID summary tables 2018
  - <https://www.epa.gov/eGRID/eGRID-summary-tables>
- EPA SF<sub>6</sub> electric utility emissions
  - [https://www.epa.gov/sites/production/files/2019-10/2018\\_data\\_summary\\_spreadsheets.zip](https://www.epa.gov/sites/production/files/2019-10/2018_data_summary_spreadsheets.zip)



# 2018 Electricity Use

## Maricopa County Electricity Use GHG Emissions by Economic Sector



**21,859,902 MTCO<sub>2</sub>e (42.6%)**

# Mobile Sources

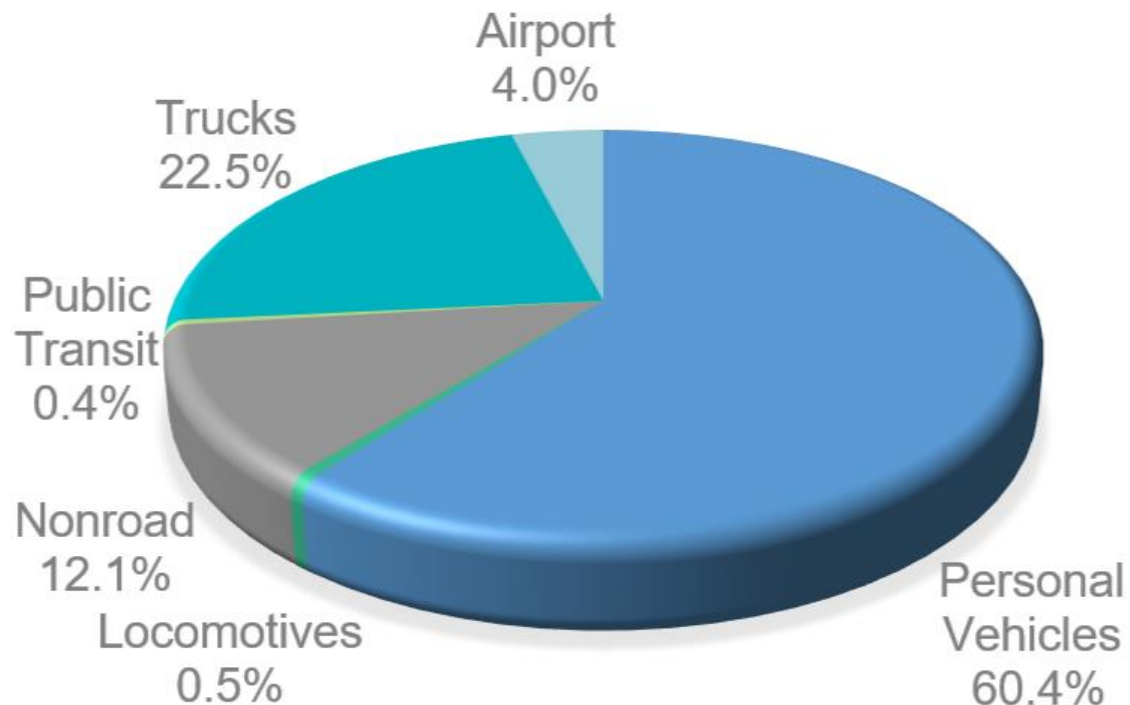
- EPA Motor Vehicle Emissions Simulator (MOVES) model
  - Onroad
  - Nonroad
  - Airport
    - Takeoffs and landings
    - Ground support equipment
  - Run by the Maricopa Association of Governments
- 2017 Ozone Periodic Emissions Inventory (PEI)
  - Locomotives
- Municipal allocation by population





# 2018 Mobile Sources

Maricopa County Mobile Source  
GHG Emissions



**20,857,181 MTCO<sub>2</sub>e (40.7%)**

# Stationary Fuel Use

- EPA GHG Tool
- 2017 Ozone PEI
  - Generators
  - Boilers
  - Heaters
  - Industrial processes
- Fuel types
  - Fuel oil
  - Liquefied propane gas (LPG)
  - Natural gas
- Municipal allocation by population

**5,123,377 MTCO<sub>2</sub>e (10%)**

# 2018 Wastewater

- EPA GHG Tool
- Treatment plants
  - Survey data
- Septic systems
  - Estimate based on survey data and census information
- Municipal allocation by population



**947,506 MTCO<sub>2</sub>e (1.8%)**

# 2018 Livestock

- Livestock population
  - Beef cattle
  - Dairy cattle
  - National Agricultural Statistics Service
- Municipal allocation by GIS land use for cattle
- Emission Factors
  - Beef cattle
    - 1.53 MTCO<sub>2</sub>e/animal-year
  - Dairy cattle
    - 7.39 MTCO<sub>2</sub>e/animal-year
  - Derived from enteric fermentation and manure management emission factors ([Wolf, Asrar, & West, 2017](#))

**904,886 MTCO<sub>2</sub>e (1.8%)**

# 2018 Solid Waste

- Landfills
  - Survey & EPA FLIGHT data
- EPA Facility Level Information on Greenhouse Gases Tool (FLIGHT)
- Municipal allocation by population



**656,745 MTCO<sub>2</sub>e (1.3%)**



# 2018 Manufacturing Gases

- EPA FLIGHT tool manufacturing gas emissions
- Municipal allocation by population

Methane  
Nitrous oxide  
Nitrogen trifluoride  
Hydrofluorocarbons  
Perfluorocarbons  
Hydrofluoroethers  
Very short-lived compounds  
Other fully fluorinated GHGs

**565,059 MTCO<sub>2</sub>e (1.1%)**



# 2018 Imported Water

- Central Arizona Project (CAP) pumps water into Maricopa county
  - 335,000 acre-feet (ac-ft) in 2018
  - 1,525 kWh/ac-ft
  - Source: ASU Decision Center for a Desert City
  - Same emission factor used for electricity
- Municipal allocation by population



**238,101 MTCO<sub>2</sub>e (0.5%)**

# 2018 Fertilizer Use

- EPA GHG tool
- Fertilizer use data
  - Farm
  - Nonfarm
  - [United States Geological Survey \(2012\)](#)
  - Linear extrapolation to 2018
- Municipal allocation by GIS land use
  - Crop, residential, parks, and golf courses
  - Maricopa County Assessor data

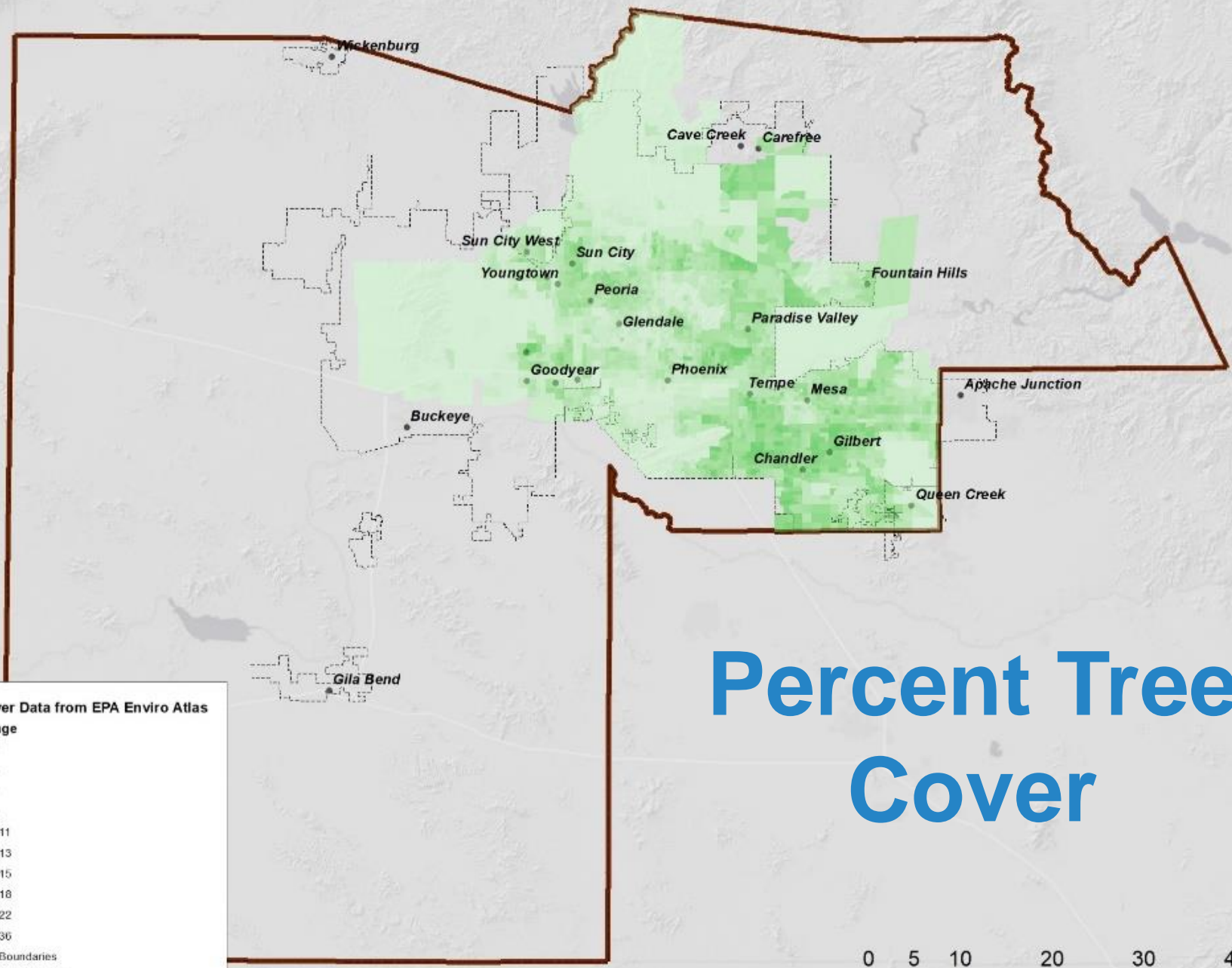
**123,706 MTCO<sub>2</sub>e (0.2%)**

# 2018 Urban Forestry CO<sub>2</sub> Uptake

- EPA EnviroAtlas database
  - Percent tree cover
- CO<sub>2</sub> uptake estimated using EPA GHG tool
- Allocated using GIS
  - Municipality
  - Economic Sector



**-160,151 MTCO<sub>2</sub>e**



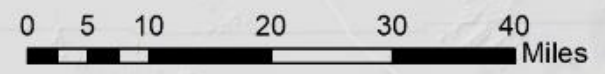
**Tree Cover Data from EPA Enviro Atlas**

**% Coverage**

- 0 - 2
- 3 - 5
- 6 - 7
- 8 - 9
- 10 - 11
- 12 - 13
- 14 - 15
- 16 - 18
- 19 - 22
- 23 - 36

- City Boundaries
- Maricopa County

# Percent Tree Cover



# Areas With Less Than 100% Tree Cover Data Availability

Location	Data Availability (%)
Apache Junction	0.2
Avondale	46.0
Buckeye	29.9
Carefree	48.2
Cave Creek	5.1
Chandler	97.9
Gila Bend	0.0
Goodyear	31.2
Peoria	44.2
Queen Creek	84.9
Scottsdale	78.3
Surprise	43.8
Wickenburg	0.0
Unincorporated areas	75.9



# 2018 Maricopa County GHG Emissions

Gross GHG Emissions

**51,276,462 MTCO<sub>2</sub>e**

GHG Reductions (Urban Forestry)

**-160,151 MTCO<sub>2</sub>e**

Net GHG Emissions

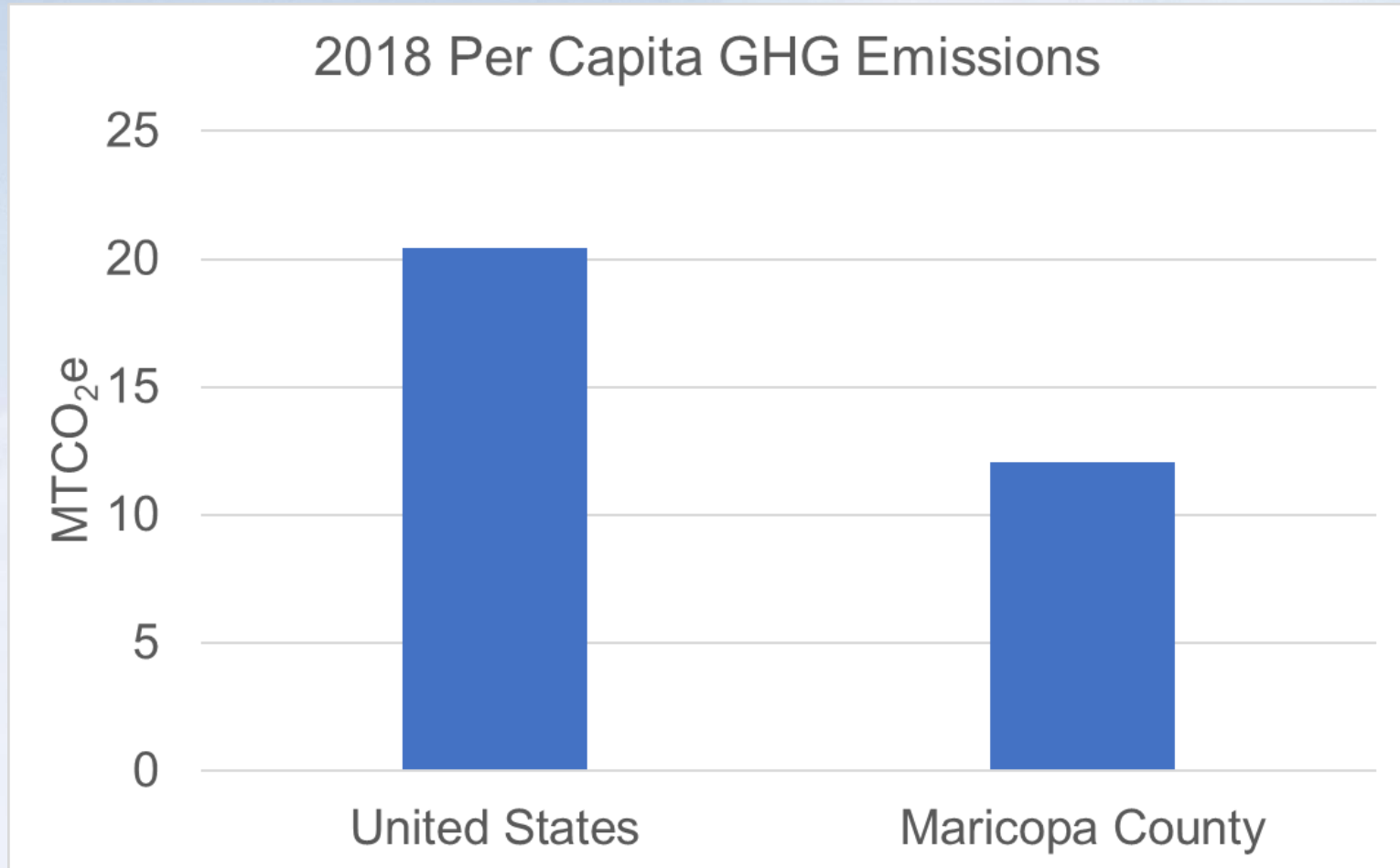
**51,116,312 MTCO<sub>2</sub>e**

Per Capita Net GHG Emissions

**11.9 MTCO<sub>2</sub>e**



# Benchmarking



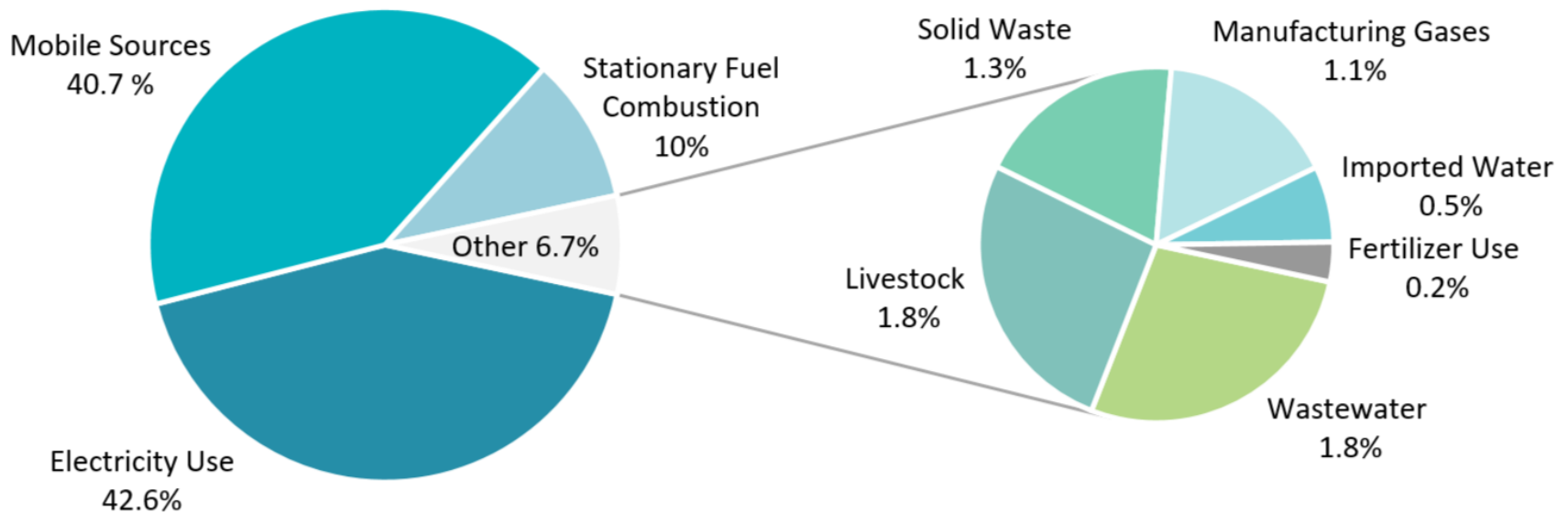
# 2018 Maricopa County GHG Emissions

Source Category	GHG Emissions	
	*MTCO <sub>2</sub> e	Percent
Electricity Use	21,859,902	42.6
Mobile Sources	20,857,181	40.7
Stationary Fuel Combustion	5,123,377	10
Wastewater	947,506	1.8
Livestock (Cattle)	904,886	1.8
Solid Waste	656,745	1.3
Manufacturing (Fluorinated Gas Use)	565,059	1.1
Imported Water (Electricity Used)	238,101	0.5
Fertilizer Use	123,706	0.2

*\*Metric tons of carbon dioxide equivalent*

# 2018 Maricopa County GHG Emissions

Maricopa County GHG Emissions by Source Category



# Municipal Emission Variation

## Sources of Variation

- Electricity
- Livestock
- Fertilizer use
- Urban forestry (CO<sub>2</sub> uptake)

## Allocated by population

- Mobile sources
- Stationary fuel combustion
- Wastewater
- Solid waste
- Manufacturing gases
- Imported water



# Report and Resources

[www.maricopa.gov/5593](http://www.maricopa.gov/5593)

- Emission profiles for municipalities
- Master data file
- Examples of emission reduction programs

**Thank you.**

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