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$_2$ photosynthesis uptake)
EPA Community GHG Inventory Tool

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

• Electricity consumption
  – Municipal data from APS and SRP
  – Residential/Commercial/Industrial

• Sulfur hexafluoride (SF$_6$) use
  – Electric system insulator
  – 22,800 times more potent than CO$_2$
  – 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$_2$/Megawatt-hour (MWh)
  – EPA Southwest U.S. eGRID summary tables 2018
    – https://www.epa.gov/egrid/egrid-summary-tables
• EPA SF$_6$ electric utility emissions
2018 Electricity Use

Maricopa County Electricity Use GHG Emissions by Economic Sector

- Residential 46.3% (21.7 TWh)
- Commercial 38.7% (18.1 TWh)
- Industrial 15% (7.0 TWh)

21,859,902 MTCO₂e (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

- Personal Vehicles: 60.4%
- Nonroad: 12.1%
- Public Transit: 0.4%
- Locomotives: 0.5%
- Trucks: 22.5%
- Airport: 4.0%

20,857,181 MTCO\textsubscript{2}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 MT CO$_2$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$_2$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$_2$e/animal-year
  - Dairy cattle
    - 7.39 MTCO$_2$e/animal-year
  - Derived from enteric fermentation and manure management emission factors (Wolf, Asrar, & West, 2017)

904,886 MTCO$_2$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$_2$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$_2$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$_2$e (0.5%)
2018 Fertilizer Use

• EPA GHG tool
• Fertilizer use data
  – Farm
  – Nonfarm
  – Linear extrapolation to 2018
• Municipal allocation by GIS land use
  – Crop, residential, parks, and golf courses
  – Maricopa County Assessor data

123,706 MTCO$_2$e (0.2%)
2018 Urban Forestry CO$_2$ Uptake

- EPA EnviroAtlas database
  - Percent tree cover
- CO$_2$ uptake estimated using EPA GHG tool
- Allocated using GIS
  - Municipality
  - Economic Sector

-160,151 MTCO$_2$e
Percent Tree Cover
## Areas With Less Than 100% Tree Cover Data Availability

<table>
<thead>
<tr>
<th>Location</th>
<th>Data Availability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache Junction</td>
<td>0.2</td>
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<tr>
<td>Avondale</td>
<td>46.0</td>
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<tr>
<td>Buckeye</td>
<td>29.9</td>
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<tr>
<td>Carefree</td>
<td>48.2</td>
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<tr>
<td>Cave Creek</td>
<td>5.1</td>
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<tr>
<td>Chandler</td>
<td>97.9</td>
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<tr>
<td>Gila Bend</td>
<td>0.0</td>
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<tr>
<td>Goodyear</td>
<td>31.2</td>
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<tr>
<td>Peoria</td>
<td>44.2</td>
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<tr>
<td>Queen Creek</td>
<td>84.9</td>
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<tr>
<td>Scottsdale</td>
<td>78.3</td>
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<tr>
<td>Surprise</td>
<td>43.8</td>
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<tr>
<td>Wickenburg</td>
<td>0.0</td>
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<tr>
<td>Unincorporated areas</td>
<td>75.9</td>
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</tbody>
</table>
2018 Maricopa County GHG Emissions

Gross GHG Emissions
51,276,462 MTCO$_2$e

GHG Reductions (Urban Forestry)
-160,151 MTCO$_2$e

Net GHG Emissions
51,116,312 MTCO$_2$e

Per Capita Net GHG Emissions
11.9 MTCO$_2$e
2018 Per Capita GHG Emissions

- United States: 20 MT CO₂e
- Maricopa County: 10 MT CO₂e
## 2018 Maricopa County GHG Emissions

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

*Metric tons of carbon dioxide equivalent
2018 Maricopa County GHG Emissions

Maricopa County GHG Emissions by Source Category

- Mobile Sources 40.7%
- Electricity Use 42.6%
- Stationary Fuel Combustion 10%
- Other 6.7%
- Solid Waste 1.3%
- Manufacturing Gases 1.1%
- Imported Water 0.5%
- Livestock 1.8%
- Fertilizer Use 0.2%
- Wastewater 1.8%
Municipal Emission Variation

Sources of Variation
- Electricity
- Livestock
- Fertilizer use
- Urban forestry (CO₂ uptake)

Allocated by population
- Mobile sources
- Stationary fuel combustion
- Wastewater
- Solid waste
- Manufacturing gases
- Imported water
Report and Resources

www.maricopa.gov/5593

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

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