
# San Antonio
# Final 2016 GHG Inventory

**August 28, 2018**

- **Inventory Overview**
- Detailed GHG Inventory - Community
- Detailed GHG Inventory - Municipal
- FAQs About the Inventory
- Benchmarking
- Appendix

# Overview: GHG Inventory Methodology

The methodology that serves as the backbone to the 2016 San Antonio GHG Inventory, which is presented in this document, is defined with some small adjustments by the publicly available methodology document, *Overview of SA Climate Ready Methodology*.[1]

**Referenced Protocols:** The community inventory follows the Global Protocol for Community-Scale Emissions (GPC).[2] The municipal inventory follows the. ICLEI Local Government Operations Protocol (LGOP).[3]

**Reporting Tool:** The community inventory utilizes the City Inventory Reporting and Information System (CIRIS) tool,[4] developed by C40 cities. The municipal inventory uses a reporting tool that was developed for the City as part of the 2014 inventory with updates to reflect new data and added sector emissions.

**Reporting Level:** The GPC protocol allows for selection between different reporting levels. Based on the data available, the GHG inventory is reported at the BASIC level. The inventory goes above and beyond the BASIC level by also including the largest industrial process emissions.

[1] http://saclimateready.org/wp-content/uploads/2018/02/SAClimateReady_Methodologies_FINAL.pdf
[2] https://www.wri.org/sites/default/files/global_protocol_for_community_scale_greenhouse_gas_emissions_inventory_executive_summary.pdf
[3] http://www.theclimateregistry.org/tools-resources/reporting-protocols/local-goverment-operations-protocol/
[4] https://staging.c40.org/programmes/city-inventory-reporting-and-information-system-ciris

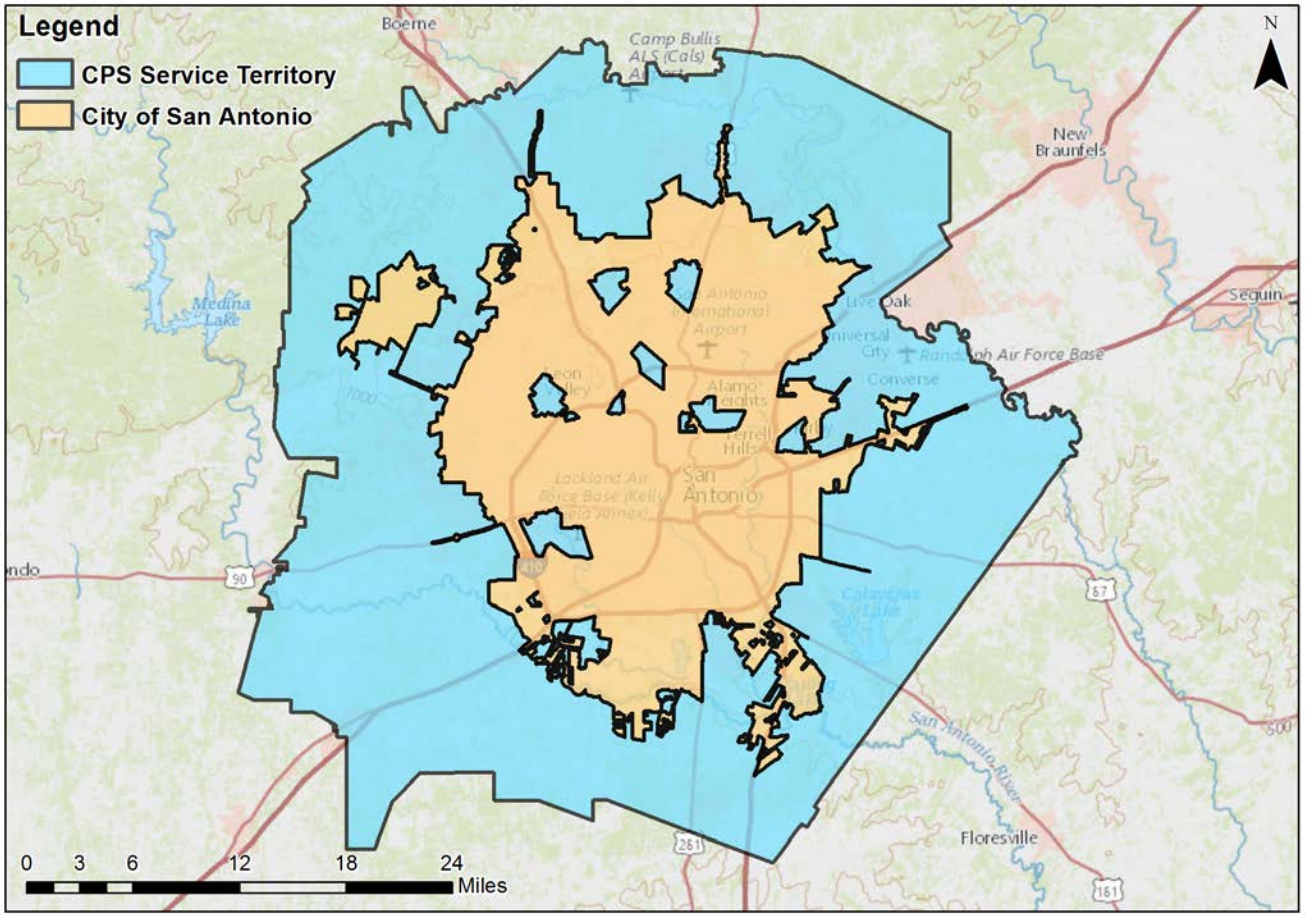
# Overview: Definitions & Units

| | |
|---|---|
| **Community Inventory:** | The San Antonio community inventory encompasses all emissions, considered under the scope of this inventory effort, generated by the City of San Antonio. This includes scope 1 and scope 2 emissions from buildings, energy industries, and transportation, as well as scope 1 and scope 3 emissions from waste. |
| **Emissions Factor:** | A factor that converts activity data into GHG emissions data (e.g., kg CO2 e emitted per liter of fuel consumed, kg CO2e emitted per kilometer traveled, etc.). |
| **Global Warming Potential (GWP):** | A universal unit of measure for GHGs, expressed by relating the global warming impact to one unit of carbon dioxide. Used to evaluate the relative impact of various GHGs. |
| **Municipal Inventory:** | San Antonio's municipal inventory includes emission for sources under direct control of the San Antonio City Government, including: city-owned buildings, city-owned vehicles, and city-owned and operated waste emissions sources. |
| **Scope 1 Emissions:** | Direct GHG emissions generated from sources within the city boundary. |
| **Scope 2 Emissions:** | GHG emissions occurring from the use of grid-supplied electricity, heat, step, and/or cooling within the city boundary. |
| **Scope 3 Emissions:** | All other GHG emissions that occur outside of the city boundary as a result of the activities taking place within the city boundary. |

A note on units: In all possible cases values are reported in metric tons $CO_2$ equivalent ($tCO_2e$), to ensure direct comparison. When direct consumption of resources are presented, i.e. gallons of gasoline or kilowatt hours of electricity, standard units for the component industries are used and are noted as such.

# Overview: GHG Inventory Methodology

**Geographic Boundary:** Both the Community and Municipal inventories use the administrative boundary of the City of San Antonio as their geographic boundary. All emissions included in this inventory relate to actions inside this geographic boundary.



# Overview: GHG Inventory Methodology

As shown by the green cells in the table below, the GPC BASIC reporting level includes:

- Scope 1 and scope 2 emissions from stationary energy and transportation, and
- Scope 1 and scope 3 emissions from waste.

The San Antonio community-wide inventory follows the BASIC reporting level. In addition, the inventory also includes the largest industrial process emissions. All sources included in the San Antonio inventory are marked below with a ★.

| Sectors and sub-sectors | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|
| **Stationary energy** | | | |
| Residential buildings | ✓ ★ | ✓ ★ | ✓ |
| Commercial buildings | ✓ ★ | ✓ ★ | ✓ |
| Institutional buildings | ✓ ★ | ✓ ★ | ✓ |
| Manufacturing industries and construction | ✓ ★ | ✓ ★ | ✓ |
| Energy industries | ✓ ★ | ✓ ★ | ✓ |
| *Energy generation supplied to the grid* | ✓ ** | | |
| Agriculture, forestry, and fishing activities | ✓ ★* | ✓ ★* | ✓ |
| Non-specified sources | ✓ N/A | ✓ N/A | ✓ |
| Fugitive emissions from coal | ✓ N/A | | |
| Fugitive emissions from oil and natural gas systems | ✓ ★ | | |
| **Transportaton** | | | |
| On-road | ✓ ★ | ✓ ★ | ✓ |
| Railways | ✓ N/A | ✓ N/A | ✓ |
| Waterborne navigation | ✓ ★ | ✓ ★ | ✓ |
| Aviation | ✓ N/A | ✓ N/A | ✓ |
| Off-road | ✓ ★ | ✓ ★ | |
| **Waste** | | | |
| Solid waste generated in the city | ✓ ★ | | ✓ ★ |
| *Solid waste generated outside the city* | ✓ | | |
| Biological waste generated in the city | ✓ N/A | | ✓ N/A |
| *Biological waste generated outside the city* | ✓ | | |
| Incinerated and burned waste generated in the city | ✓ N/A | | ✓ N/A |
| *Incinerated and burned waste generated outside city* | ✓ | | |
| Wastewater generated in the city | ✓ ★ | | ✓ ★ |
| *Wastewater generated outside the city* | ✓ | | |

| Sectors and sub-sectors | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|
| **Industrial processes and product use (IPPU)** | | | |
| Industrial processes | ✓ ★ | | |
| Product use | ✓ | | |
| **Agriculture, forestry, and fishing activities (AFOLU)** | | | |
| Livestock | ✓ | | |
| Land | ✓ | | |
| Other agriculture | ✓ | | |
| **Other scope 3** | | | |

**LEGEND**

| | |
|---|---|
| ✓ | = sources required for reporting |
| ✓ | = sources required for BASIC reporting |
| ✓ + ✓ | = sources required for BASIC+ reporting |
| ✓ | = additional scope 1 sources required for territorial reporting |
| | = other scope 3 sources |
| | = non-applicable emission sources |
| ★ | = included in San Antonio community inventory |

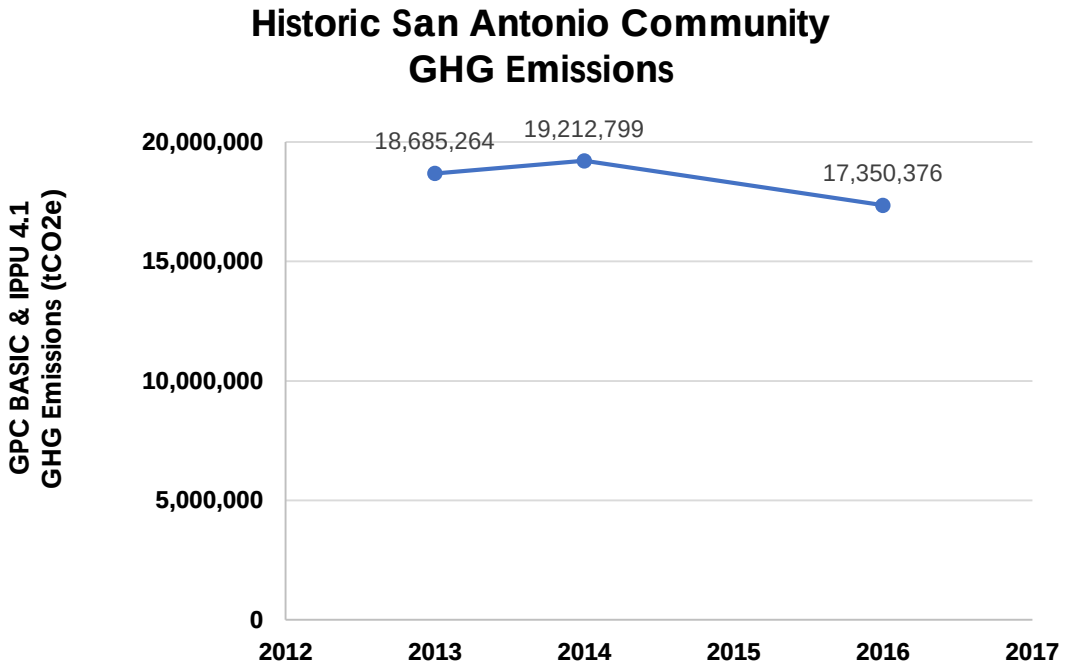
* *These emissions are blended with Commercial and Industrial, due to the way data was provided by CPS Energy and Grey Forest Energy.*

** *Per the GPC Protocol, category 1.4.4 (emissions from CPS Energy's electricity generation) is not included in the BASIC total. Results throughout this presentation show the BASIC total with category 1.4.4 emissions included as a footnote.*



SA CLIMATE READY

# Overview: San Antonio Total Emissions




San Antonio's 2016 GHG emissions mark a 10% decrease from 2014. This decrease is driven primarily by the reduction of CPS Energy's emissions factor.

Data to support this emissions factor reduction can be found in the Appendix.

In 2016, CPS Energy was responsible for total emissions of **11,283,200 $tCO_2e$,** from electricity generation. Per the LGOP reporting method, only the emissions from electricity generation that are accounted for by Scope 2 usage within the City of San Antonio's geographic boundary are included in the GHG inventory totals (**7,064,191 tCO2e**).

See slide 8 for more detail

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

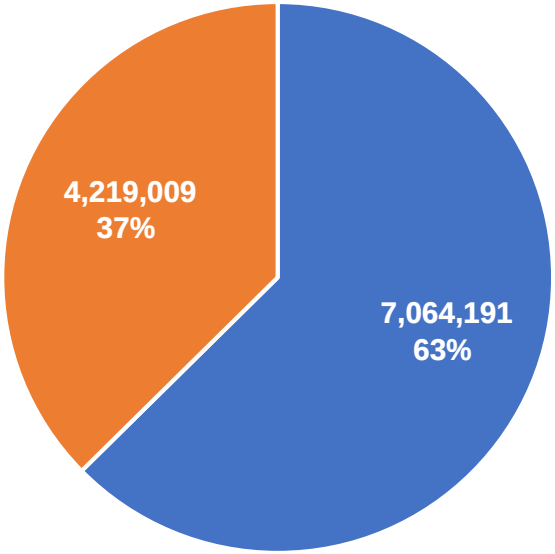
# Overview: CPS Energy's 2016 Total Emissions

**CPS Energy's Total 2016 GHG Emissions from Electricity Generation**

11,283,200 tCO2e

Emissions from the electricity usage of CPS Energy's customers outside the geographic boundary of San Antonio, including:

- Suburban Cities
- Unincorporated Areas
- Wholesale

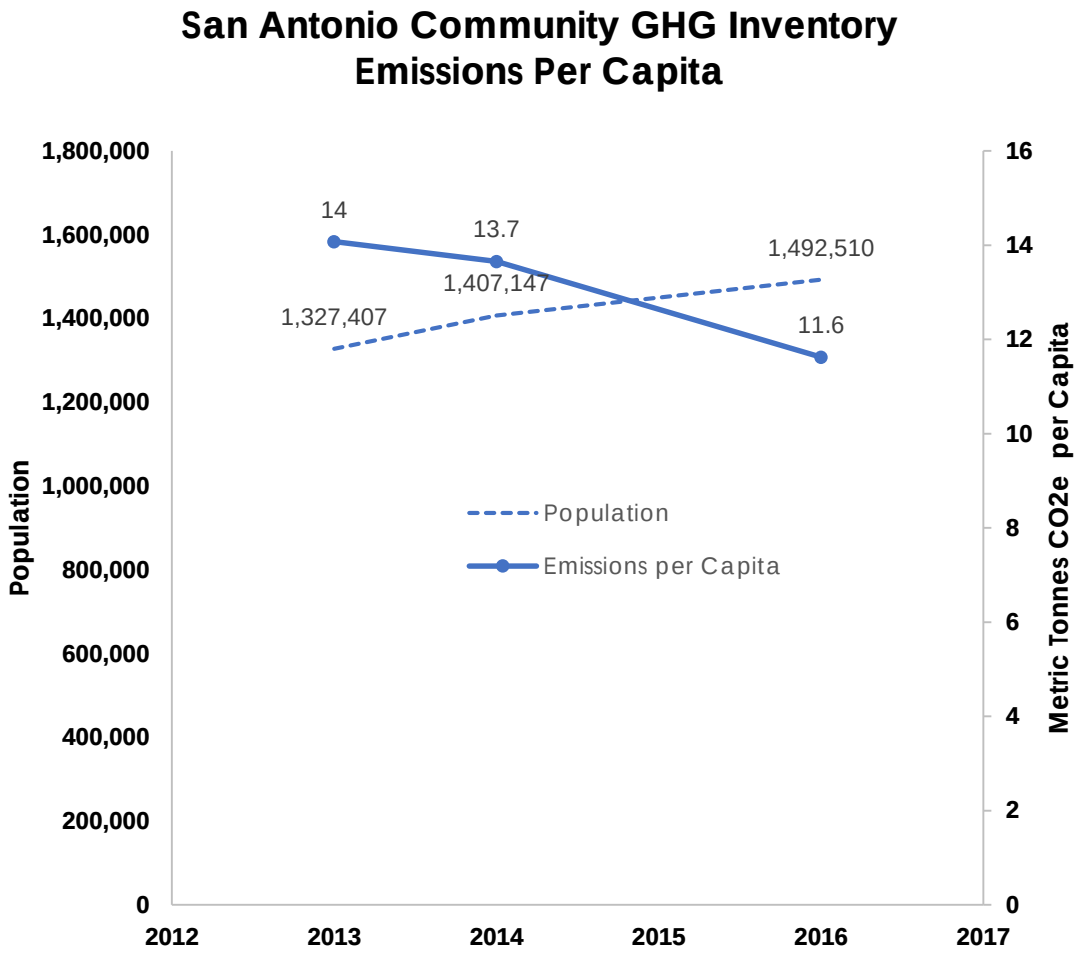



Emissions from the electricity usage of CPS Energy's customers inside the geographic boundary of San Antonio, aka total Scope 2 emissions included in the community inventory.

As a municipal plan, the SA Climate Ready Climate Action and Adaptation Plan (CAAP) will address GHG reductions for CPS Energy emissions within the City of San Antonio jurisdictional boundary. CPS Energy will track emissions for their broader service area and will have comprehensive initiatives to reduce emissions that benefit the entire area. The same emissions factor will be used to calculate all of CPS Energy's emissions, regardless of location.

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

# Overview: San Antonio Emissions per Capita




San Antonio's population grew 6% between 2014 and 2016.

On a per capita basis, San Antonio's 2016 GHG emissions reflect a 15% decrease from 2014. Again, this decrease is driven primarily by the reduction of CPS Energy's emissions factor.

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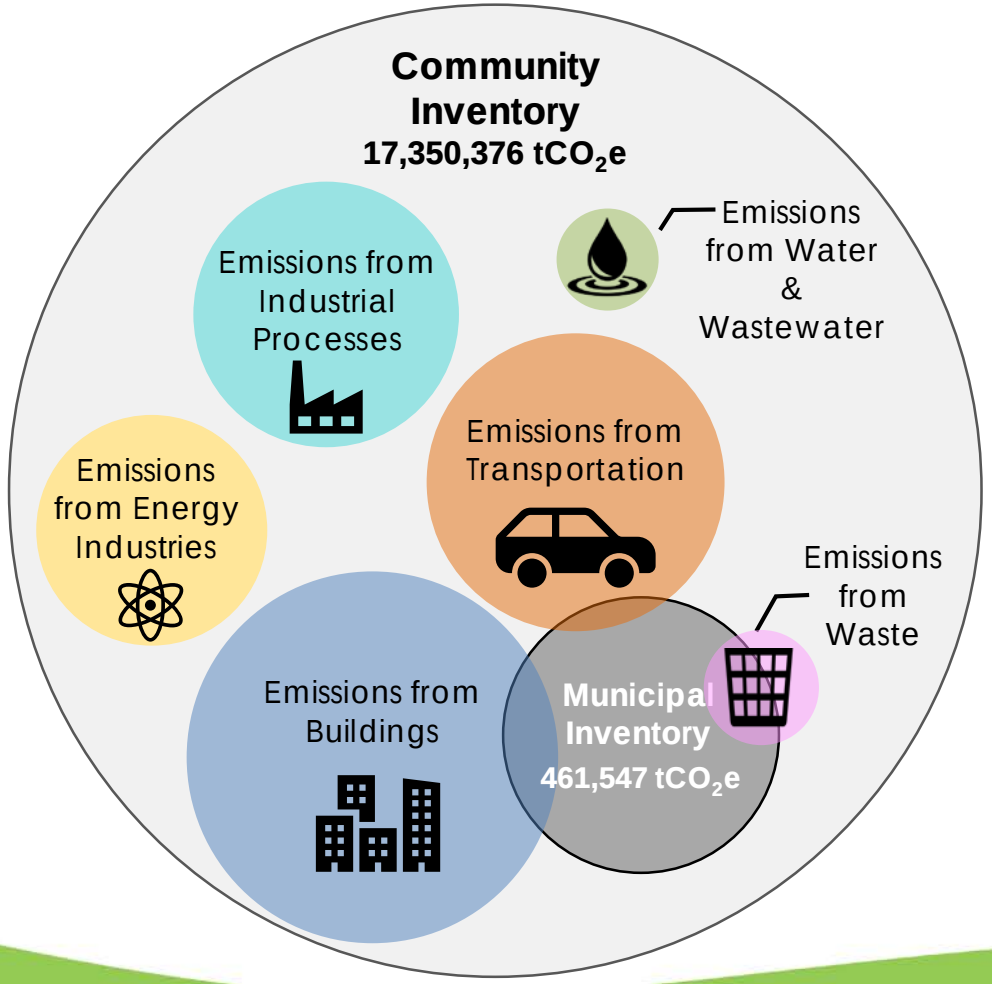
# Definition: Community & Municipal Division

The 2016 San Antonio GHG Inventory is presented at two scales: 1) a community inventory and 2) a municipal inventory. The municipal inventory is a subset of the community inventory. In other words, **all municipal emissions are included in the community-wide inventory.**




**<u>Community Inventory:</u> Includes scope 1 and scope 2 emissions from buildings, energy industries, and transportation, as well as scope 1 and scope 3 emissions from waste for all sources within San Antonio's geographic boundary.**

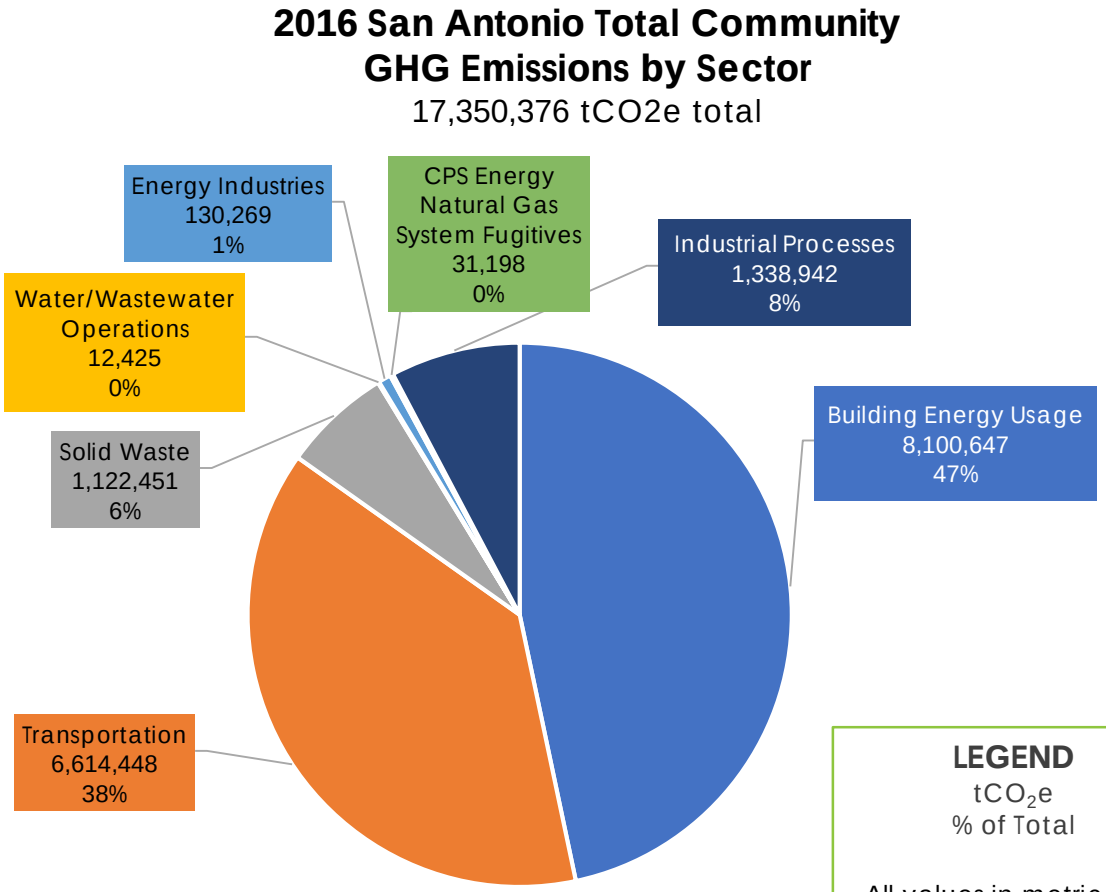
**Municipal Inventory:** Includes emissions for sources under direct control of the San Antonio City Government, including:

- city-owned buildings
- city-owned vehicles
- streetlights and traffic signals
- city-owned and operated landfills

***For San Antonio, the municipal inventory represents 3% of the community inventory.***

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

# Community: 2016 Total Emissions by Sector




**LEGEND**
$tCO_2e$
% of Total

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

**Sector Definitions are included on Slide 13**

In 2016, CPS Energy was responsible for total emissions of **11,283,200 $tCO_2e$,** from electricity generation. Per the LGOP reporting method, only the emissions from electricity generation that are accounted for by Scope 2 usage within the City of San Antonio's geographic boundary are included in the GHG inventory totals (**7,064,191 tCO2e**).

See slide 8 for more detail

# Overview: Definitions of Reporting Sectors

| | |
|---|---|
| **Building Energy Usage:** | Emissions related to the energy use in commercial, residential, and industrial buildings. (Reported under the Stationary Energy sector per GPC.) |
| **Energy Industries:** | Emissions from energy production and energy use in energy industries, i.e. energy used for refining within San Antonio city boundaries. (Reported under the Stationary Energy sector per GPC.) |
| **CPS Fugitives:** | Emissions related to natural gas leakage from pipelines and fittings across CPS Energy's territory. Note fugitives were conservatively included for all of CPS Energy's territory, but do not include an estimate for Grey Forest Energy. (Reported under the Stationary Energy sector per GPC.) |
| **Industrial Processes:** | Emissions related to industrial processes occurring within San Antonio. Note emissions are included only for large facilities, i.e. those that meet EPA reporting thresholds. (Reported under the Industrial Process and Produce Use sector. Emissions related to electricity and natural gas use are captured under the Stationary Energy sector per GPC.) |
| **Solid Waste:** | Emissions from all solid waste generated in San Antonio, whether it is treated inside or outside the city and from landfills located within the city. (Reported under the Waste sector per GPC.) |
| **Transportation:** | Emissions related to fuel combustion for transportation occurring within San Antonio city boundaries and from consumption of grid-supplied electricity for in-boundary transportation. (Reported under the Transportation sector per GPC.) |
| **Water/Wastewater Operations:** | Emissions related to the treatment of water/wastewater. (Reported under the Waste sector per GPC. |

# The Impact of Global Warming Potential

Standard GHG accounting methodologies use the Global Warming Potential (GWP) of gasses to compare the impact of their emissions. Because GHGs differ in their ability to absorb energy and their lifetime in the atmosphere, their impacts are converted to a common unit: carbon dioxide equivalent ($CO_2e$). The larger the GWP, the more a particular GHG warms the earth over a particular timeline. GWP values for this analysis are derived from the IPCC 5th Assessment Report (summary chart to the right).

GWP values are calculated over two timeframes: 100yr and 20yr. For long lived gasses, the 100yr and 20yr GWP potential is very similar, for example Nitrous Oxide which has a 100yr GWP of 265 and a 20yr GWP of 264. However, for short lived gasses such as methane, the 20yr GWP of 84 is significantly higher than the 100yr GWP of 28.

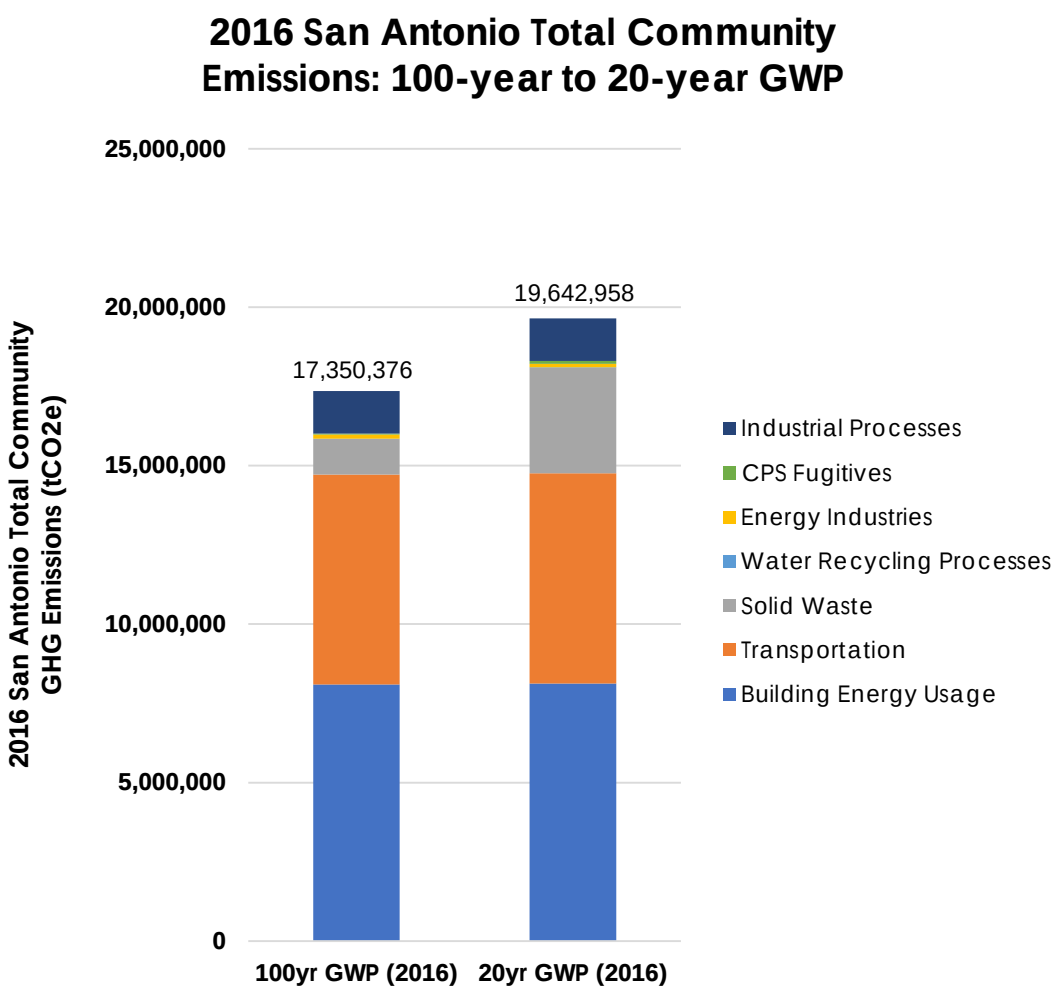
As part of this GHG inventory, San Antonio's emissions were evaluated using both the 100yr and 20yr GWP of GHGs. This comparison can provide San Antonio with more detail when developing short-term versus long-term strategies.

**IPCC 5th Assessment Report GWP of GHGs**

| GHG | 100-YR GWP | 20-YR GWP |
|---|---|---|
| Carbon Dioxide ($CO_2$) | 1 | 1 |
| Methane ($CH_4$) | 28 | 84 |
| Nitrous Oxide ($N_2O$) | 265 | 264 |

https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

# The Impact of Global Warming Potential

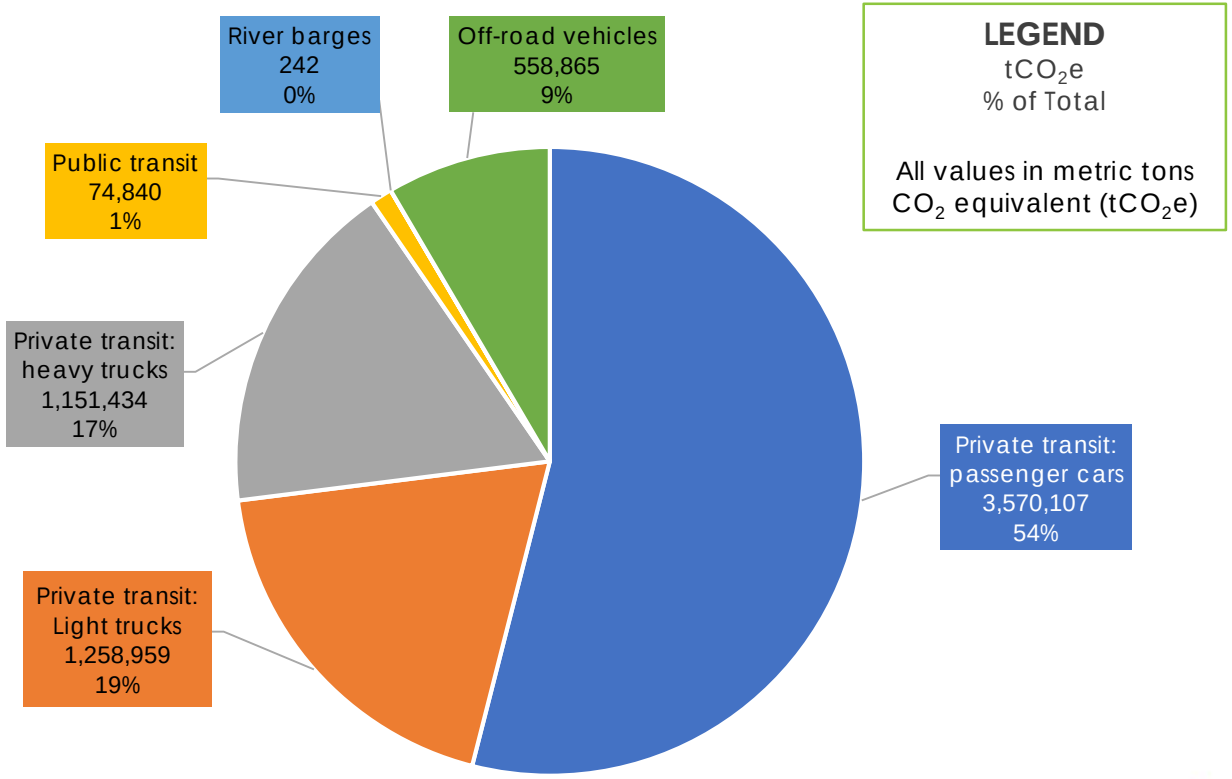



When San Antonio's community GHG emissions are quantified using 20yr GWP values, the total inventory increases by 19%. Key observations from this analysis include:

- Building energy use and transportation remain the largest drivers of San Antonio's community emissions under both scenarios.
- The 20yr timeframe sees significant growth in the emissions from solid waste (6% to 14%) and emissions from energy industries (12% to 16%), driven by methane emissions in both categories.

# Community: 2016 Transportation Emissions

**2016 San Antonio Community Transportation GHG Emissions**
6,614,448 tCO2e



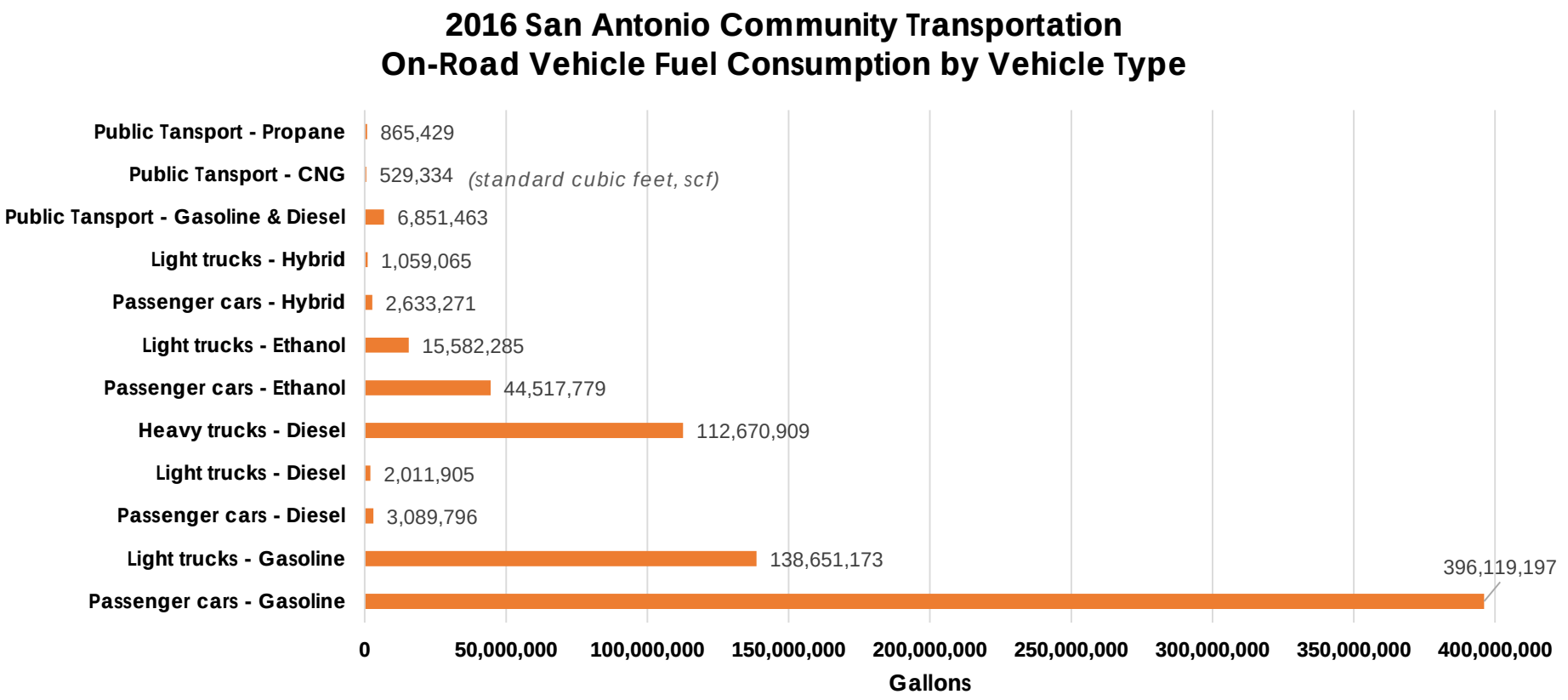

**LEGEND**
$tCO_2e$
% of Total

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

Passenger cars contribute the greatest share of transportation GHG emissions, followed by light trucks.

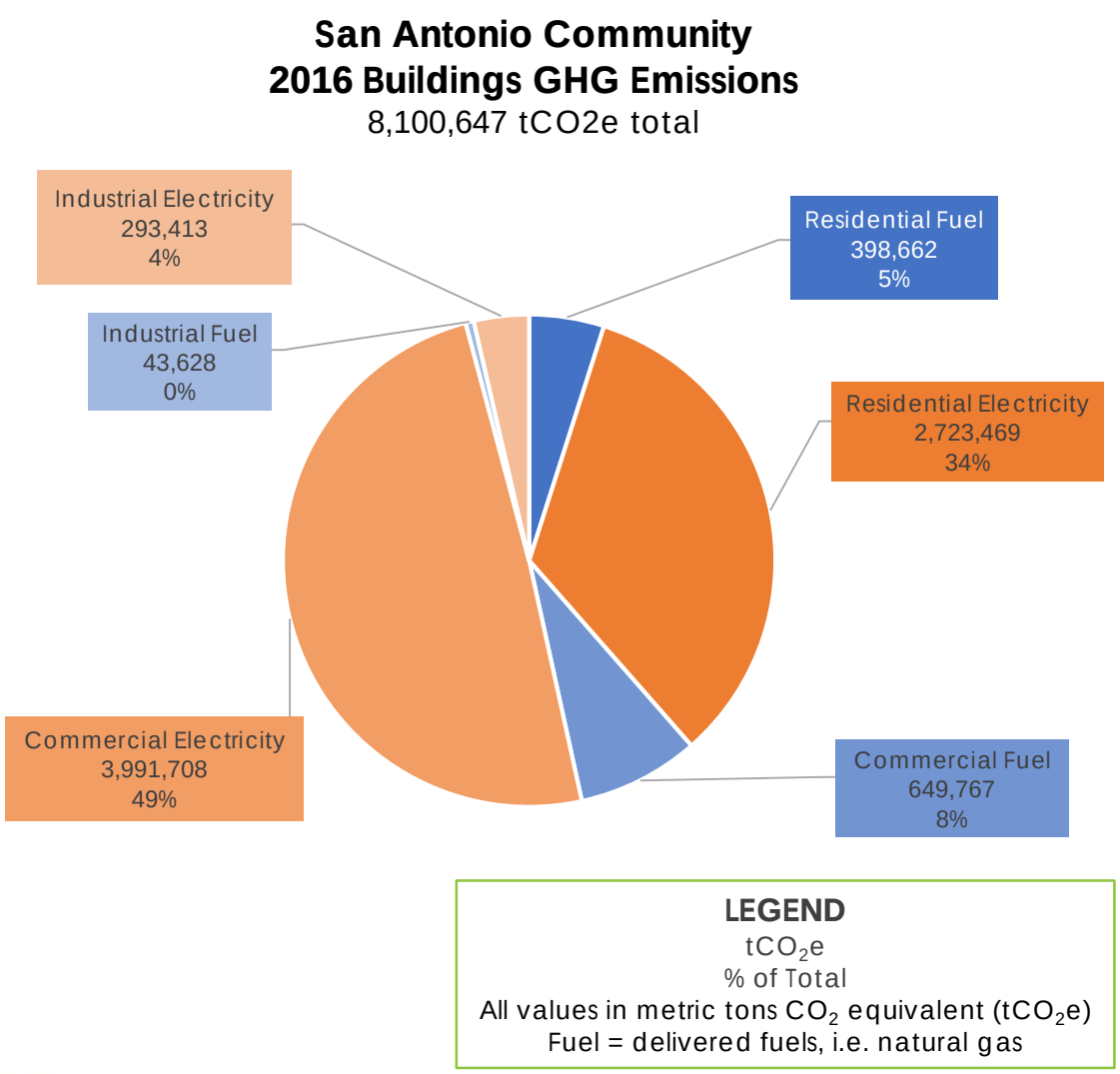
Note: Private transit includes emissions from gasoline (including ethanol), diesel, hybrid, and electric vehicles.

# Community: Transportation, Fuel Consumption




- Gasoline is the primary fuel type for emissions from San Antonio's on-road transportation sector.
- In addition to the fuel consumption shown in the chart above, electric vehicles consumed an estimated **1,863 MWh** of electricity in 2016, which contributes approximately 0.01% to San Antonio's total transportation emissions.

# Community: 2016 Energy & Buildings Emissions

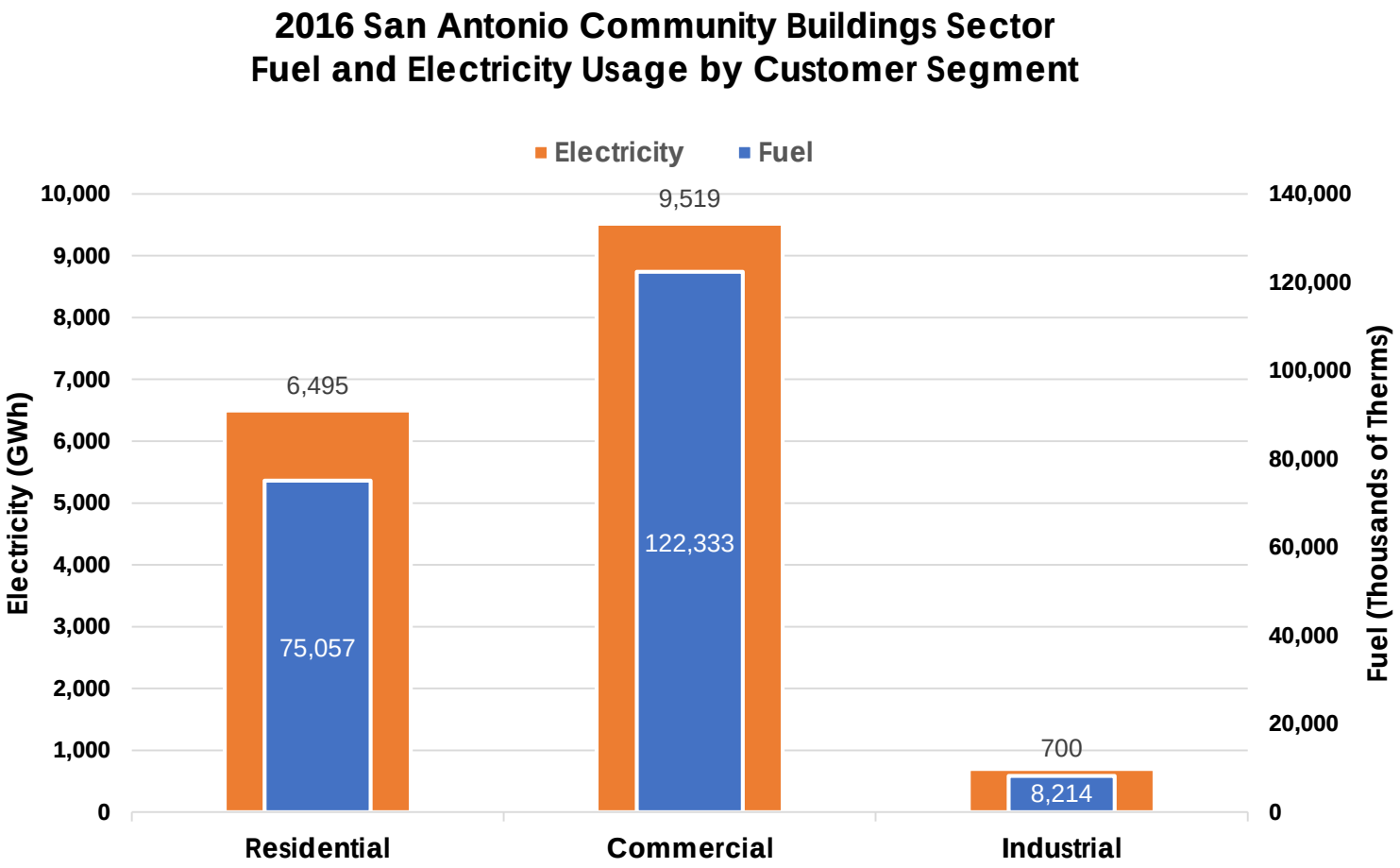



Within San Antonio's building sector, emissions from electricity significantly outweigh emissions from natural gas, accounting for 87% of the total building emissions.

Within the buildings sector, commercial buildings are the largest GHG emissions contributor.

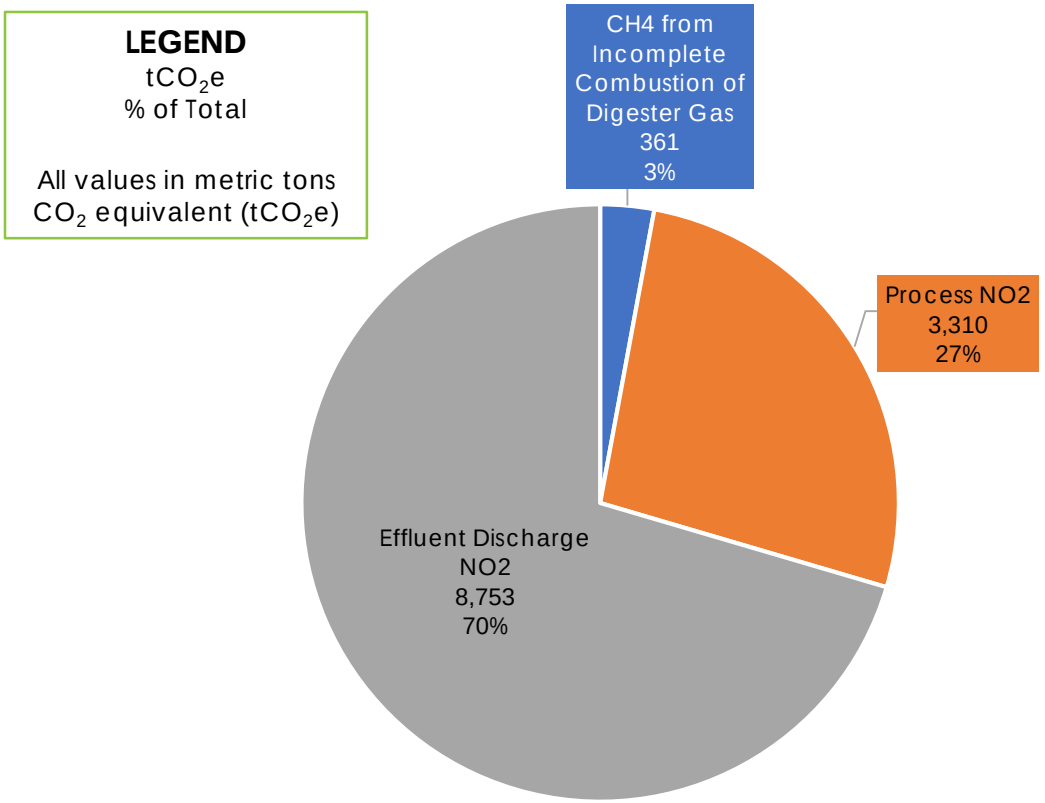
Industrial buildings contribute only 4-5% of community building sector emissions. However, this value only represents emissions from fuel and electricity use and does not include direct emissions from industrial processes, which are included in a separate section of the inventory.

# Community: Energy & Buildings, Consumption



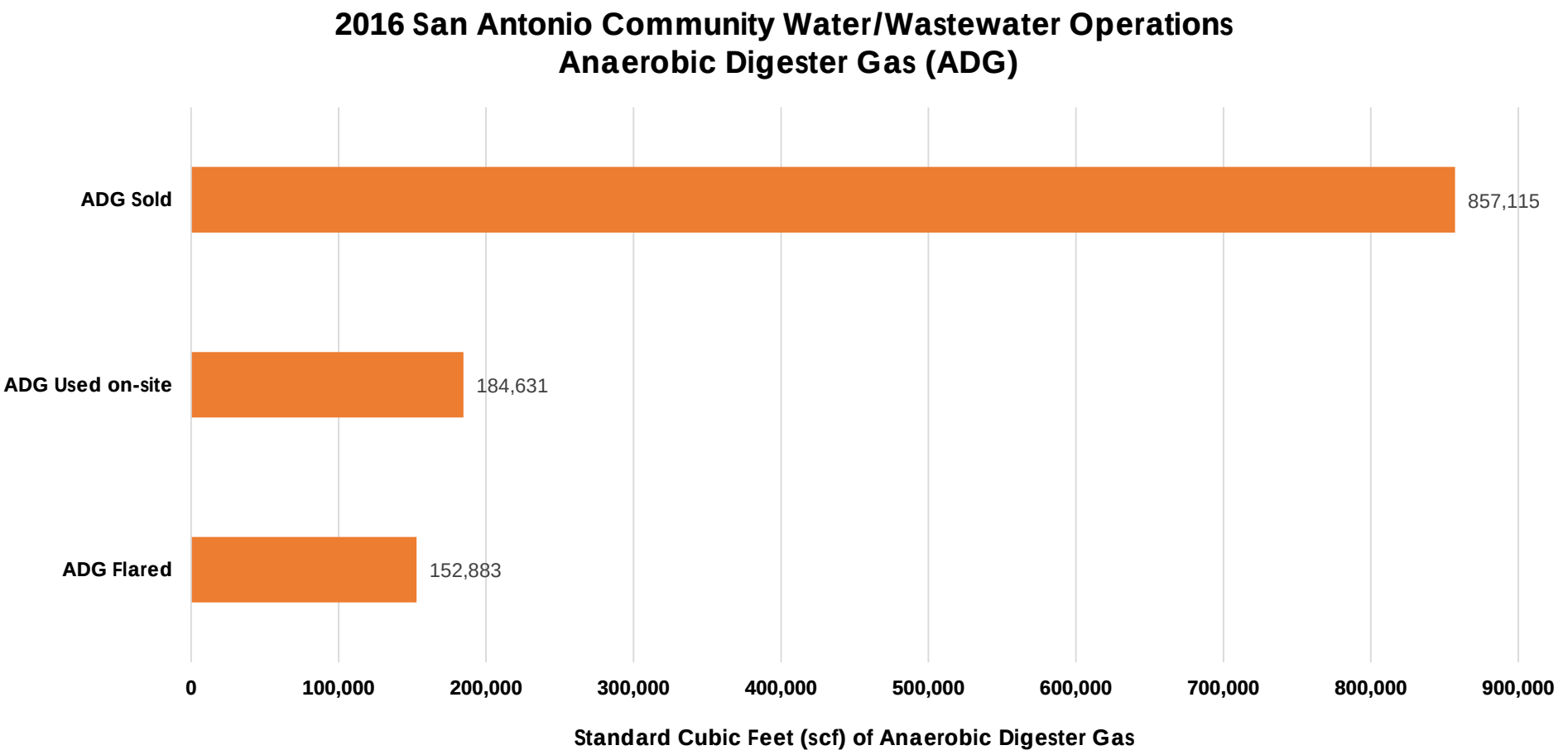
# Community: Water & Natural Resources

**2016 San Antonio Community**
**Water/Wastewater Operations GHG Emissions**
12,425 tCO2e




- In 2016, approximately **145 million gallons** of wastewater was treated per day in San Antonio.
- An additional 2,023 tCO2e was emitted due to wastewater generated outside San Antonio but treated within San Antonio. These emissions are not included in the San Antonio inventory, as they relate to scope 3 emissions (not captured in this inventory).

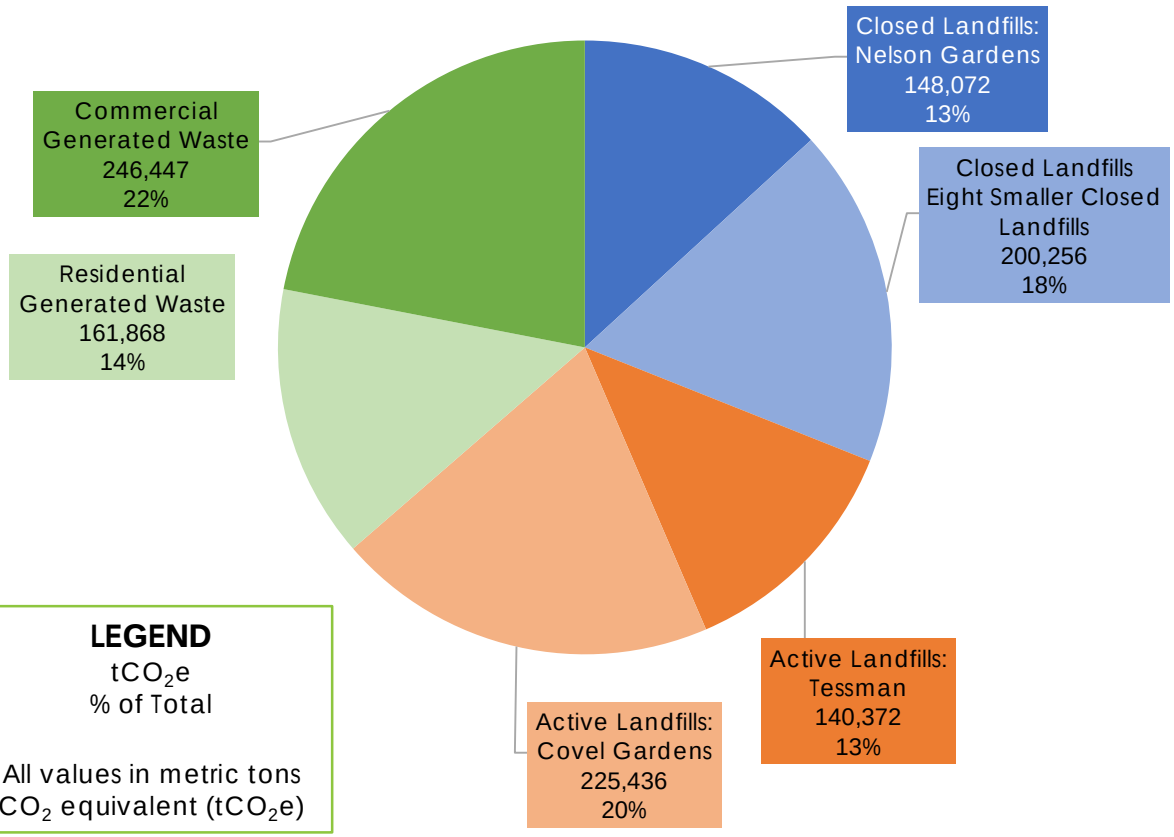
# Community: Water & Natural Resources




Data provided by the San Antonio Water System (SAWS).

# Community: Solid Waste Resources

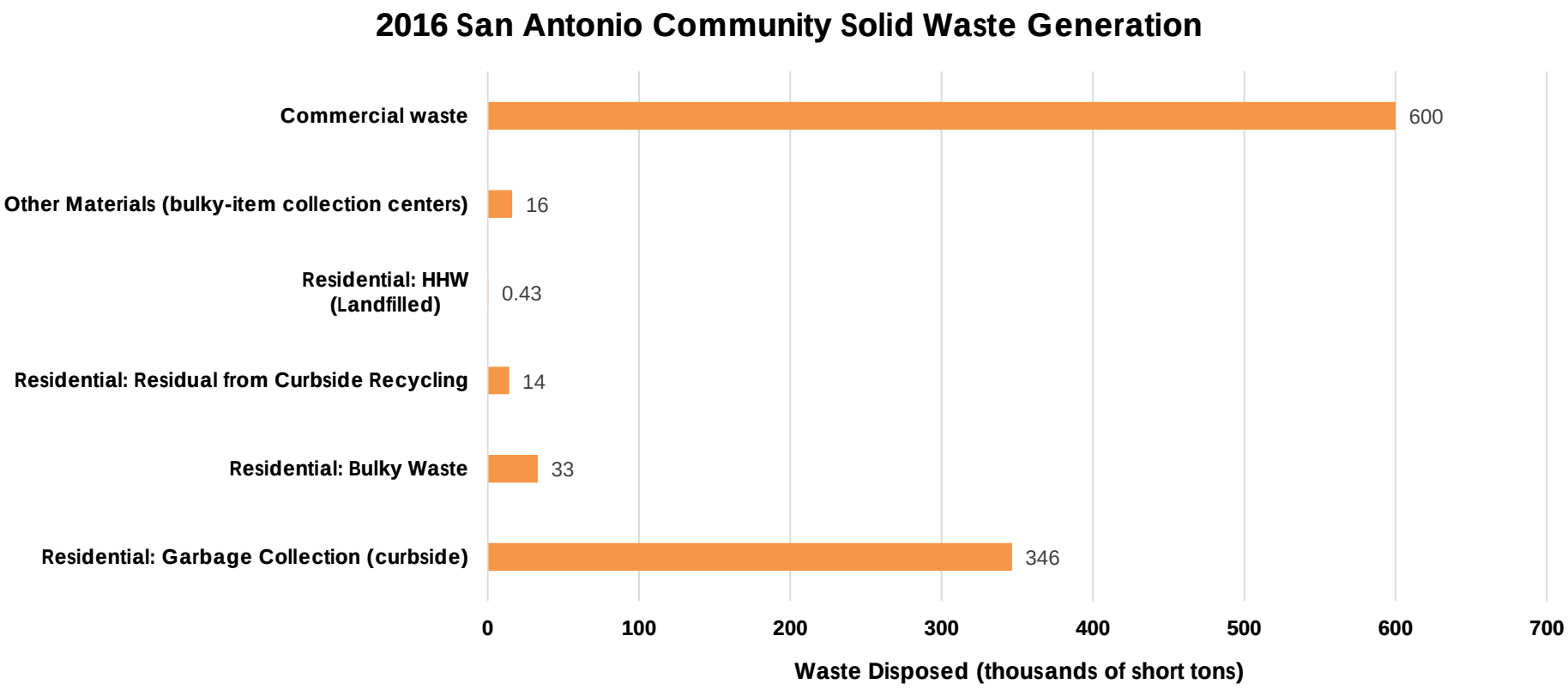
**2016 San Antonio Community Solid Waste GHG Emissions**
1,122,451 tCO2e




San Antonio's emissions from solid waste are associated with waste generated by the city residents and business and both active and closed landfills that are located within city limits.

*NOTE: The 2016 EPA reported emissions for Nelson Gardens, captured here, may overreport the emissions from this landfill, as it may not correctly report for landfill gas capture and combustion. These emissions are reported as captured by the EPA as they should be considered a conservative estimate of the landfills GHG emissions contribution.*

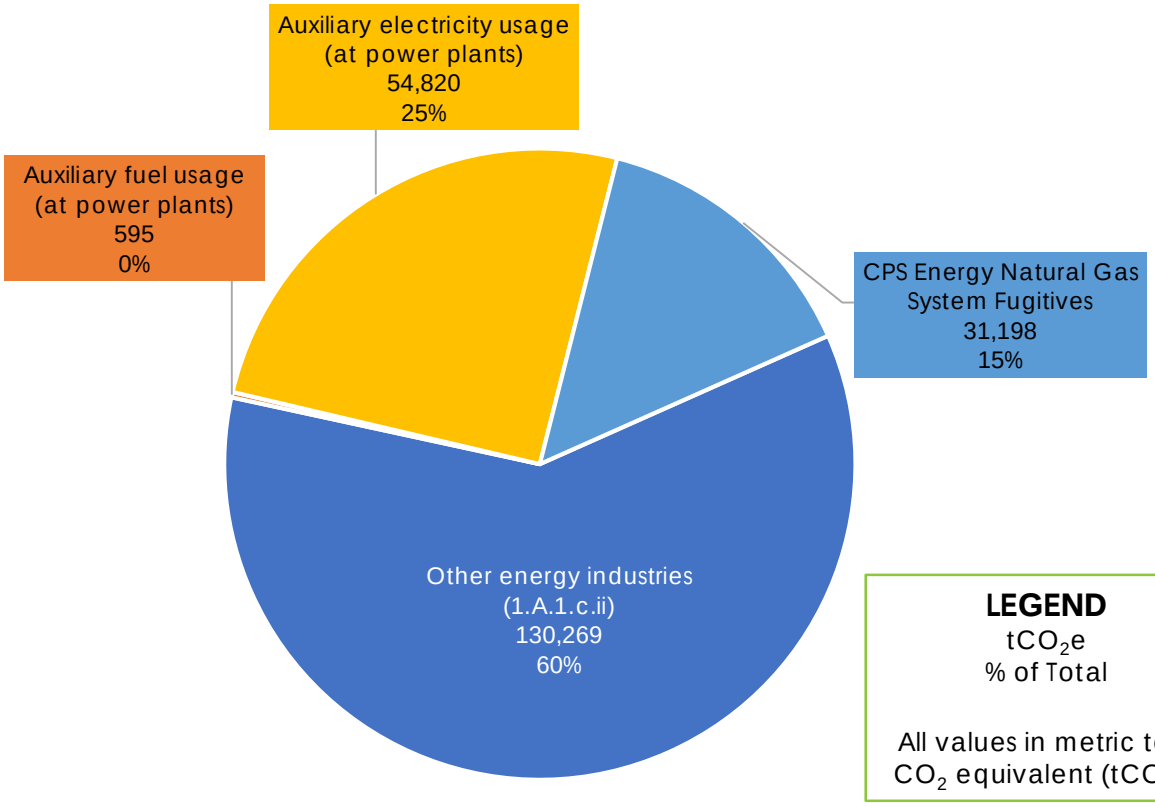
# Community: Solid Waste Resources




Data provided by San Antonio's Solid Waste Management Department (SWMD). Commercial waste quantity was estimated in 2014. The same value is assumed for 2016.

# Community: Other Stationary Sources

**2016 San Antonio Community**
**Other Stationary Sources GHG Emissions**
216,382 tCO2e




Emissions resulting from energy production and energy use in energy industries are reported under the Stationary Energy subsector, per the GPC protocol. Emissions within this category are a combination of those reported by CPS Energy and those reported to the EPA through mandatory reporting requirements.

The subsector *other energy industries* captures emissions related to the industrial production of energy sources within San Antonio's geographic boundary, i.e. the refining of natural gas.

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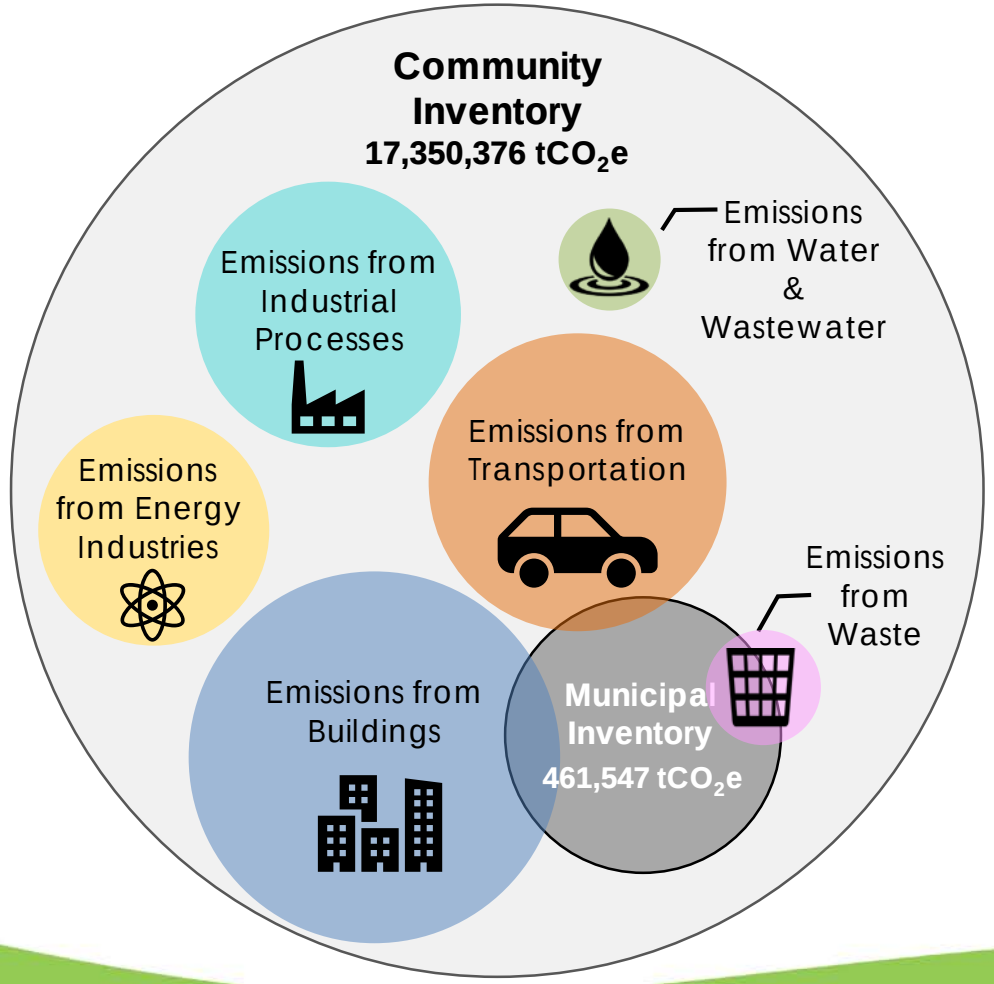



Community Inventory: Includes scope 1 and scope 2 emissions from buildings, energy industries, and transportation, as well as scope 1 and scope 3 emissions from waste for all sources within San Antonio's geographic boundary.

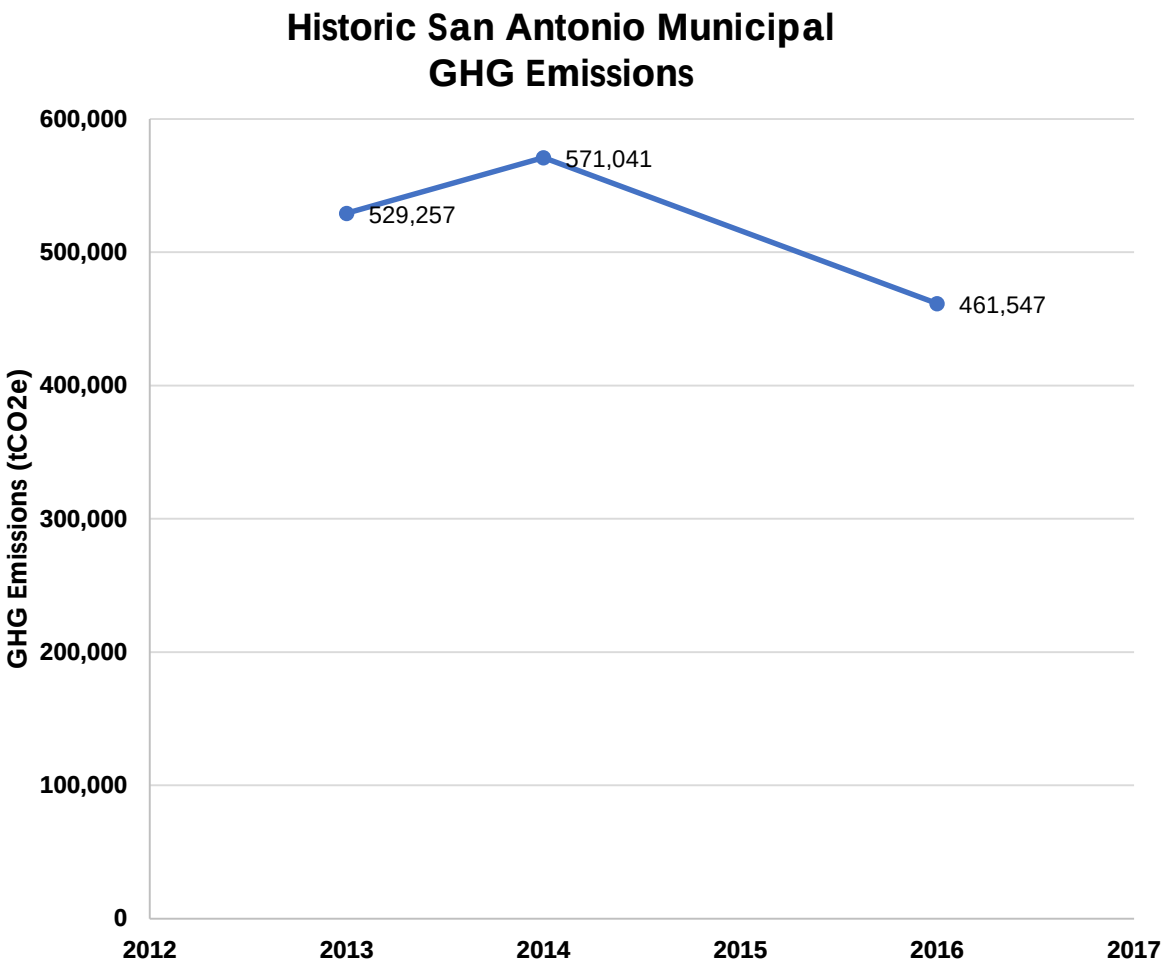
**Municipal Inventory: Includes emissions for sources under direct control of the San Antonio City Government, including:**

- city-owned buildings
- city-owned vehicles
- streetlights and traffic signals
- city-owned and operated landfills

***For San Antonio, the municipal inventory represents 3% of the community inventory.***

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

# Municipal: 2016 Total Emissions

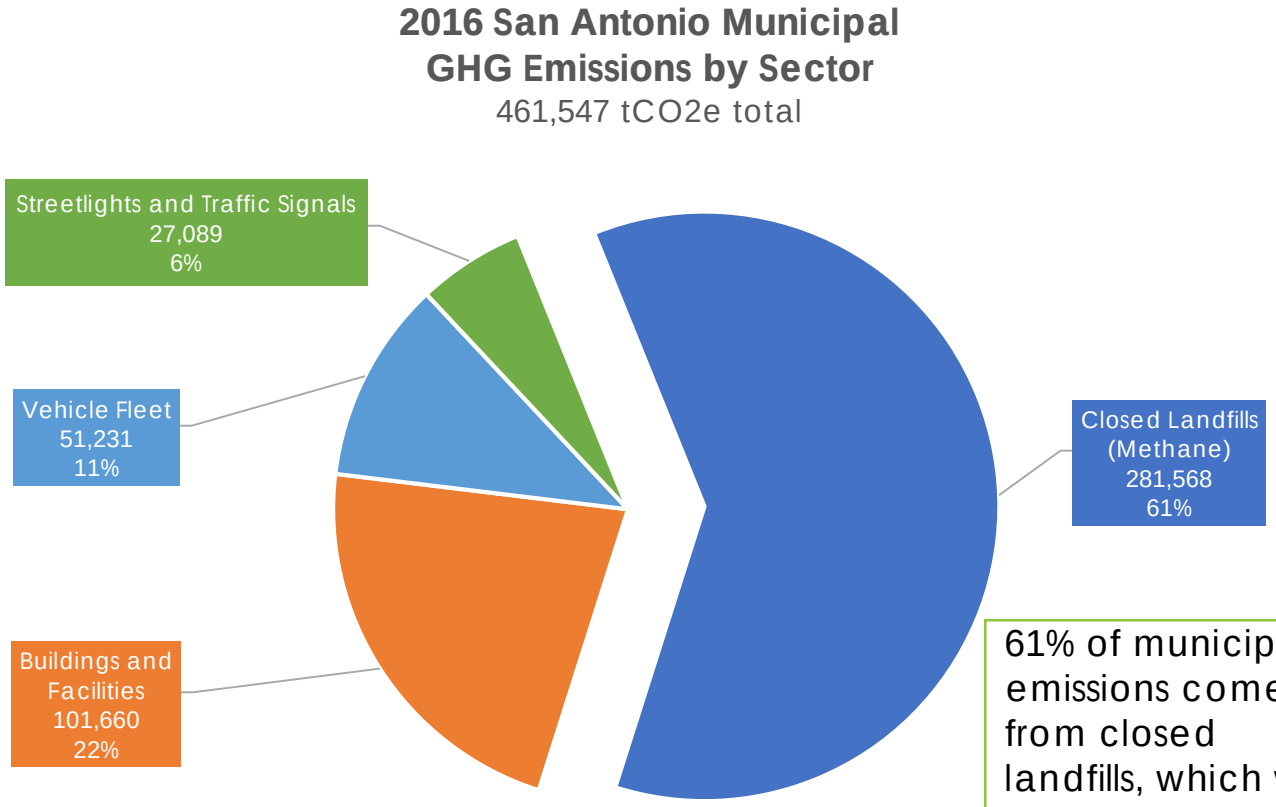



San Antonio's 2016 municipal GHG emissions mark a 19% decrease from 2014. This decrease is driven primarily by the reduction of CPS Energy's emissions factor and reduced emissions from landfills.

Data to support this emissions factor reduction can be found in the Appendix.

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

# Municipal: 2016 Emissions by Sector




**LEGEND**
$tCO_2e$
% of Total

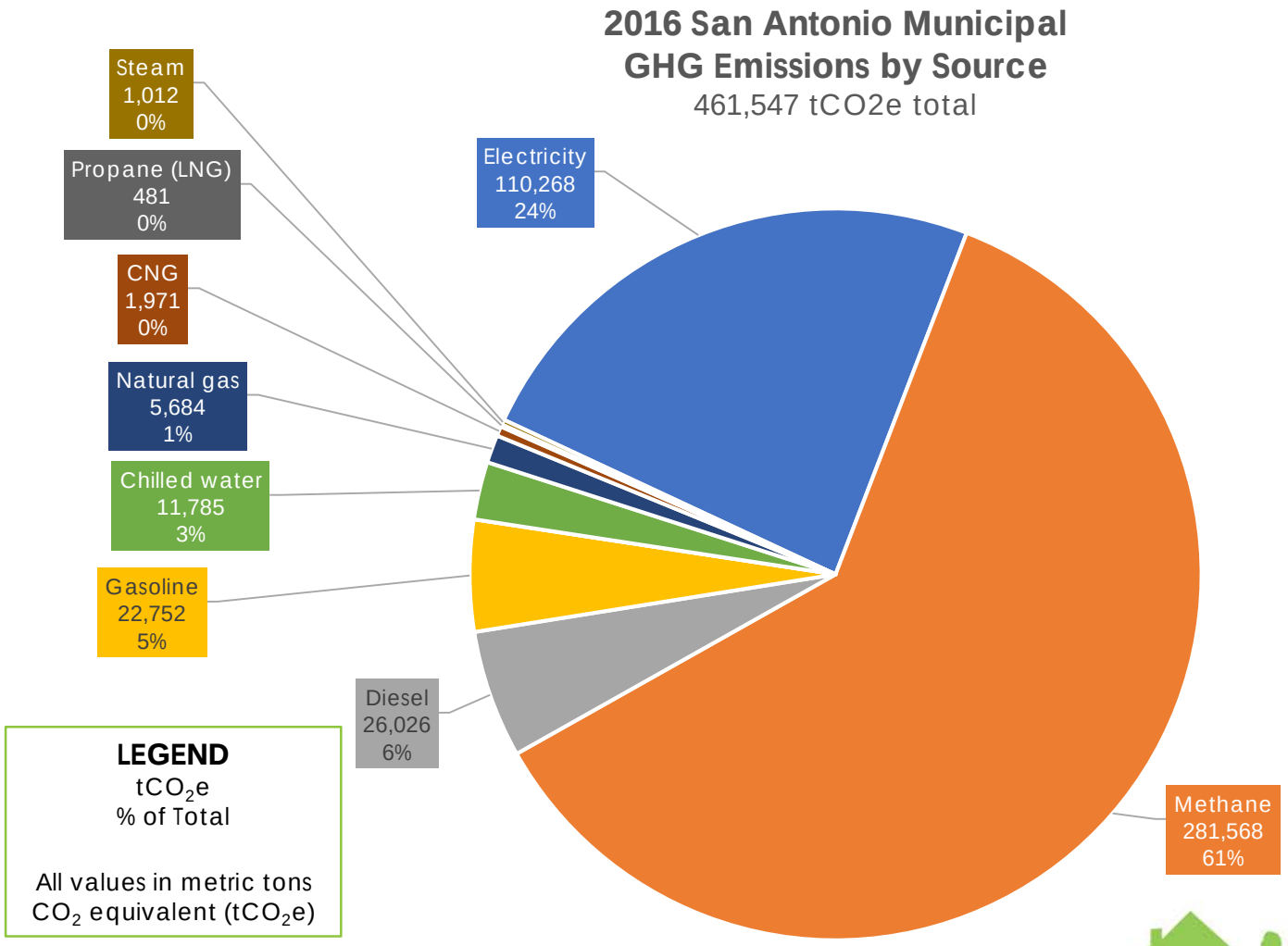
All values in metric tons $CO_2$ equivalent ($tCO_2e$)

Closed landfills account for such a high proportion of government operations' emissions because methane has a global warming potential (GWP) 28x greater than $CO_2$.

61% of municipal emissions come from closed landfills, which will decrease with time, but have limited reduction potential today.

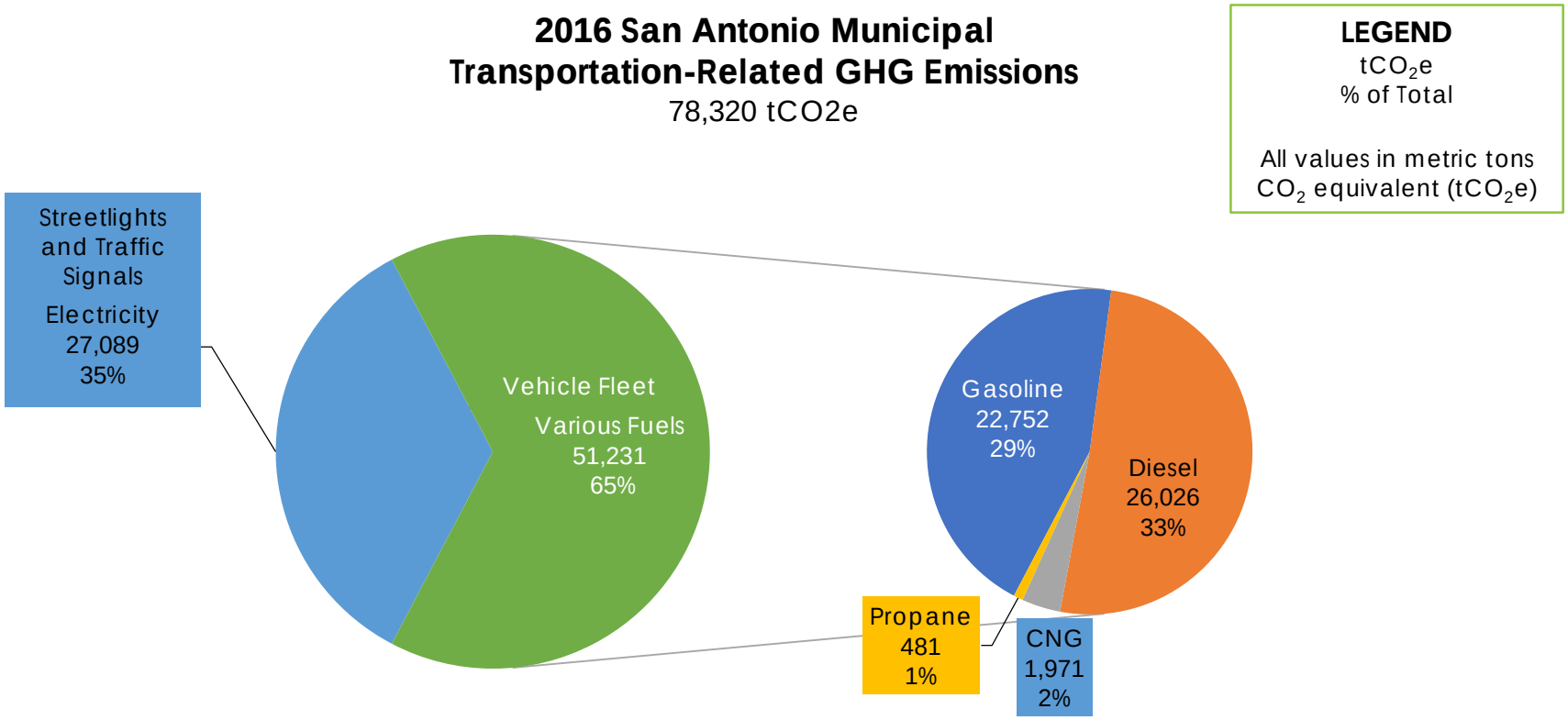
39% of municipal emissions can be effectively reduced by actions today (streetlights, vehicles, and buildings)

# Municipal: 2016 Emissions by Source



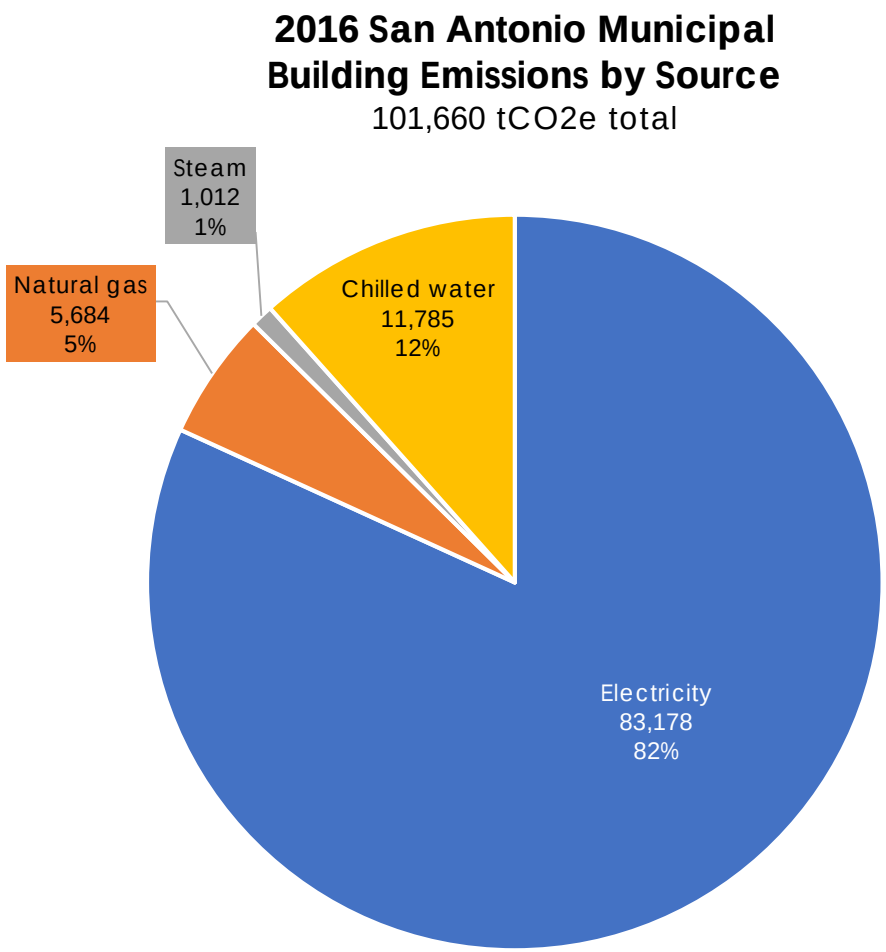

The primary sources for San Antonio's 2016 municipal GHG emissions are methane (61%) and electricity (24%). Methane from landfills accounts for such a high proportion of municipal emissions because methane has a global warming potential (GWP) 28x greater than $CO_2$.

# Municipal: 2016 Transportation-Related Emissions




San Antonio's vehicle fleet is the primary contributor to transportation-related municipal GHG emissions; within the fleet, diesel is the largest emission source.

# Municipal: 2016 Building Emissions by Source




**LEGEND**
$tCO_2e$
% of Total

All values in metric tons $CO_2$ equivalent ($tCO_2e$)

Electricity consumed by San Antonio's municipal buildings is the largest contributor the stationary municipal emissions.

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# FAQs: General

**Q:** How are greenhouse gases coming in from locations outside of the City of San Antonio (CoSA) control accounted for?

**A:** Emissions that affect CoSA but are not generated in CoSA are not included in the GHG inventory. GHGs do, of course, have a global impact, but given that CoSA can have the greatest impact on emissions generated within city limits, it is best practice (and aligned with the GPC and LGOP protocols) to only quantify emissions generated within the city.

**Q:** Will targets be developed based on our 2016 baseline?

**A:** Yes. CoSA's 2016 GHG inventory will be the baseline for the GHG reduction targets set through this process.

# FAQs: General

**Q:** Are strategies to take $CO_2$ out of the air under consideration in this Climate Action and Adaptation Plan (CAAP)?

**A:** Typically, $CO_2$ sequestration (taking $CO_2$ out of the air) is not as cost effective as other GHG abatement measures, such as energy efficiency and renewable energy. However, we will confirm that this is the case for San Antonio as part of this process. $CO_2$ sequestration may be a strategy that CoSA uses in the longer-term.

**Q:** But won't sequestration be needed to achieve Paris Accord reductions in San Antonio?

**A:** Not necessarily. The Paris Accord and target guidance mandate certain GHG reductions to stay in line with a 2 degree Celsius global average temperature rise. Cities and companies are free to reduce GHGs through whatever strategies they choose, and will typically prioritize GHG reduction actions according to cost effectiveness and reduction potential.

# FAQs: General

**Q:** Does the inventory include direct emissions from industry, such as the cement plant?

**A:** The inventory includes process emissions from CoSA's largest industrial GHG emitters, including two cement plants. The emissions came from publicly available data reported to the EPA for 2016. That data is available here: https://ghgdata.epa.gov/ghgp/main.do. The inventory does not include process emissions from smaller industrial sources within the city limits, due to data availability issues. Given the commitment to report at the BASIC Reporting Level, the inclusion of the largest industrial process emissions goes above and beyond the reporting requirements. Please note that the inventory also *does* include emissions associated with the electricity and fuel used at industrial facilities.

# FAQs: General

**Q:** Does the carbon dioxide equivalent ($CO_2e$) value for methane used in the inventory include the effect of feedback loops?

**A:** The 2016 GHG inventory uses the standard global warming potential values for all GHGs that do not include the effect of feedback loops. This follows the guiding protocol document, the Global Protocol for Community-Scale Emissions (GPC), which references only the GWP values that do not include feedback loops. The difference between the GWP values both with and without accounting for feedback loops are presented on the next slide.

Additionally, this is consistent with carbon accounting of other cities, which allows for comparison across cities.

# FAQs: General

**A:** (continued) Summary table from the GPC protocol:





**Table 8.7 |** GWP and GTP with and without inclusion of climate–carbon feedbacks (cc fb) in response to emissions of the indicated non-$CO_2$ gases (climate-carbon feedbacks in response to the reference gas $CO_2$ are always included).

| | Lifetime (years) | | $GWP_{20}$ | $GWP_{100}$ | $GTP_{20}$ | $GTP_{100}$ |
|---|---|---|---|---|---|---|
| $CH_4$[b] | 12.4[a] | No cc fb | 84 | 28 | 67 | 4 |
| | | With cc fb | 86 | 34 | 70 | 11 |
| HFC-134a | 13.4 | No cc fb | 3710 | 1300 | 3050 | 201 |
| | | With cc fb | 3790 | 1550 | 3170 | 530 |
| CFC-11 | 45.0 | No cc fb | 6900 | 4660 | 6890 | 2340 |
| | | With cc fb | 7020 | 5350 | 7080 | 3490 |
| $N_2O$ | 121.0[a] | No cc fb | 264 | 265 | 277 | 234 |
| | | With cc fb | 268 | 298 | 284 | 297 |
| $CF_4$ | 50,000.0 | No cc fb | 4880 | 6630 | 5270 | 8040 |
| | | With cc fb | 4950 | 7350 | 5400 | 9560 |

Notes:

Uncertainties related to the climate–carbon feedback are large, comparable in magnitude to the strength of the feedback for a single gas.

[a] Perturbation lifetime is used in the calculation of metrics.

[b] These values do not include $CO_2$ from methane oxidation. Values for fossil methane are higher by 1 and 2 for the 20 and 100 year metrics, respectively (Table 8.A.1).

# FAQs: General

**Q:** Why does the inventory not use a multiplier for natural gas to account for fugitive methane emissions that are released throughout the supply chain (extraction, processing and transportation)?

**A:** The inventory does include fugitive emissions from CPS Energy's processing and transportation of oil and natural gas. Per GPC Table 6.2, the definition of "Fugitive emissions from fuel:" "Fugitive emissions from all oil and natural gas activities *occurring in the city*. The primary sources of these emissions may include fugitive equipment leaks, evaporation losses, venting, flaring and accidental releases." CPS Energy provided emissions for their entire service territory, all of which has been included in the inventory, despite the fact that some of these emissions occur outside the city boundary. This ensures a conservative representation of fugitive emissions in the inventory.

Fugitive methane emissions (or Scope 3 emissions) released through the remainder of the natural gas supply chain will not be ignored entirely. Scope 3 natural gas emissions will be explored as part of a future inventory update that will include a comprehensive analysis of Scope 3 emissions.

# FAQs: Buildings

**Q:** Has inventory of actual buildings increased? Are the number of buildings evaluated in 2014 the same as 2016?

**A:** The energy usage and resulting GHG emissions shown for buildings are portfolio-wide numbers provided by CPS Energy (community inventory) and CoSA (municipal inventory). The number of buildings isn't tracked, but it is likely to have increased from 2014 to 2016.

# FAQs: Transportation

**Q:** Are hybrid vehicles included in the car/vehicle inventory, or are they counted in EV inventory?

**A:** The Community (city-wide) Inventory estimates private vehicle GHG impacts from gasoline (with ethanol), diesel, and electricity usage for passenger cars, light trucks, and heavy trucks. Fuel types and vehicle types included in the analysis are shown in the table below.

| Fuel Type | Vehicle Type |
|---|---|
| Gasoline | Passenger cars |
| Gasoline | Light trucks |
| Diesel | Passenger cars |
| Diesel | Light trucks |
| Diesel | Heavy trucks |
| Ethanol | Passenger cars |
| Ethanol | Light trucks |
| Electric | Passenger cars |
| Electric | Light trucks |
| Hybrid | Passenger cars |
| Hybrid | Light trucks |

# FAQs: Electricity

**Q:** Does CPS Energy have a projection for renewables in the future?
What does the fuel mix look like moving forward?
What does the $CO_2e$/kWh look like over the next 5, 10+ years?

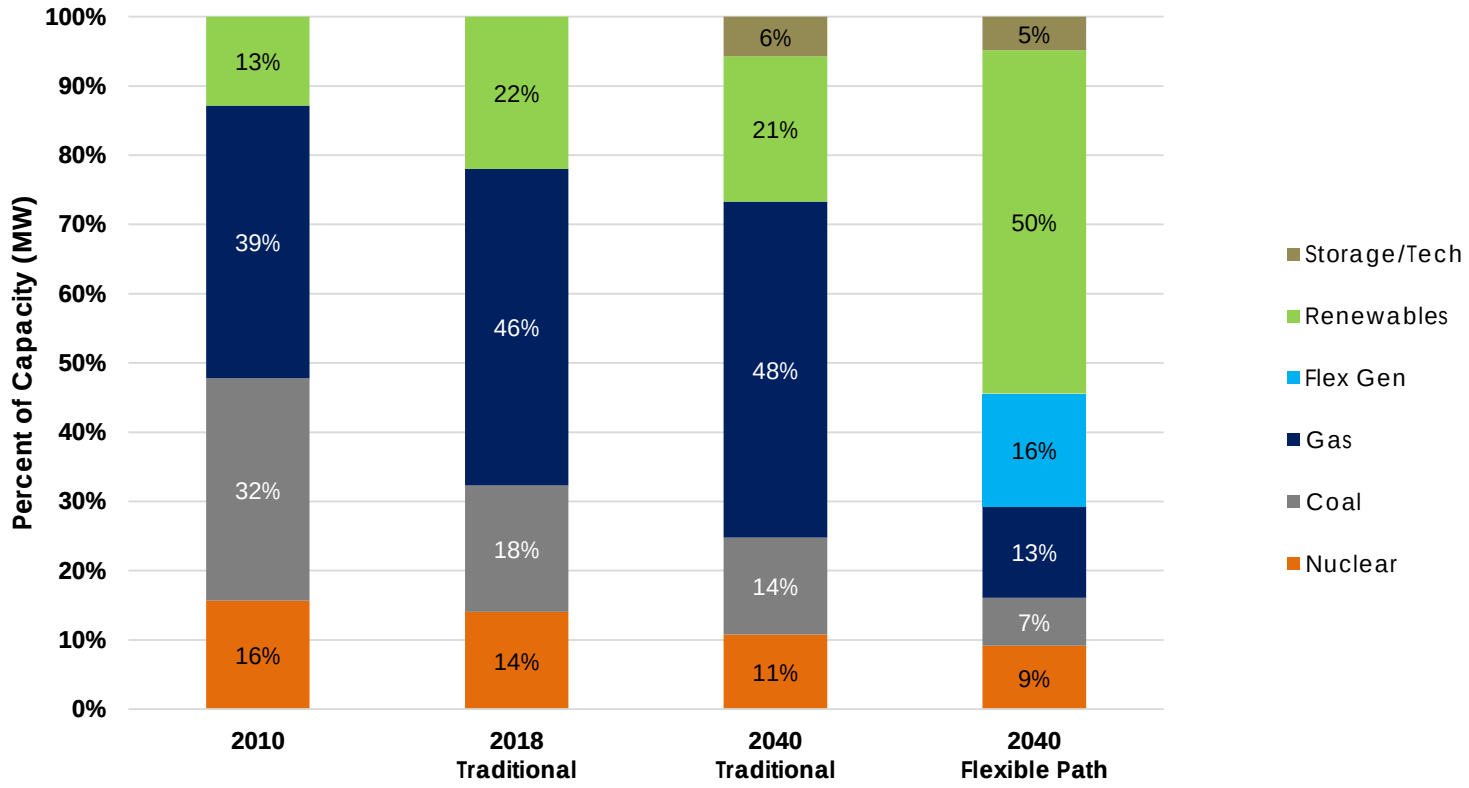
**A:** CoSA, Navigant, and CPS Energy are working together to define how CPS Energy's projections will be incorporated into the GHG projection targets as part of the next phase of this project. CPS Energy's current renewable energy and GHG reduction targets are outlined in their Flexible Path.[1] Greater detail on this question is presented in the next two slides, but CPS Energy's current goals include the following:

- Close two older coal plants (Deely) in 2018
- Position to integrate new and emerging technologies like battery storage and electric vehicles
- Continue to expand solar and wind resources
- Add more programs and services like energy efficiency and demand response

[1] Accessible here: https://www.cpsenergy.com/en/about-us/environment/flexpath.html

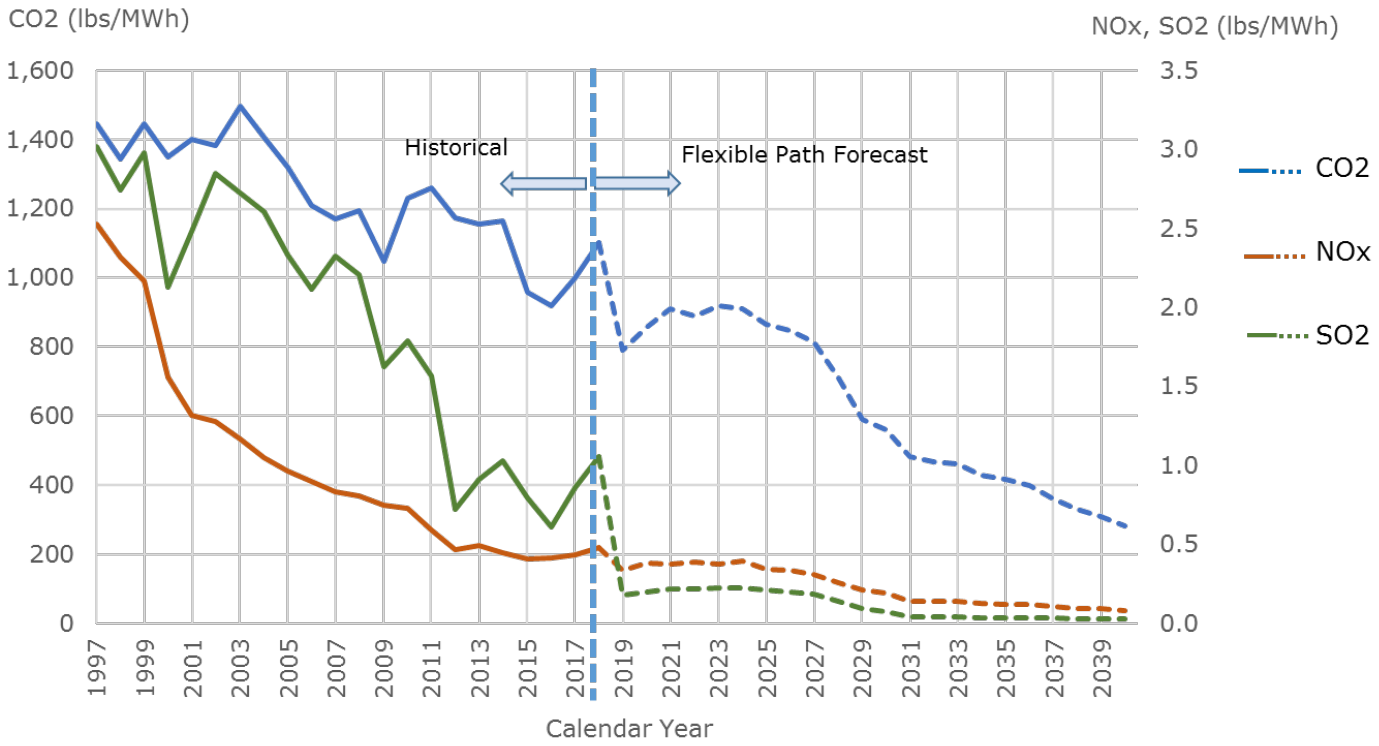
# FAQs: Electricity

**A:** (continued)



# FAQs: Electricity

**A:** (continued). The Flexible Path reduces the intensity of $CO_2$, $NO_x$, and $SO_2$ emissions by 80%, 97% and 99% respectively.



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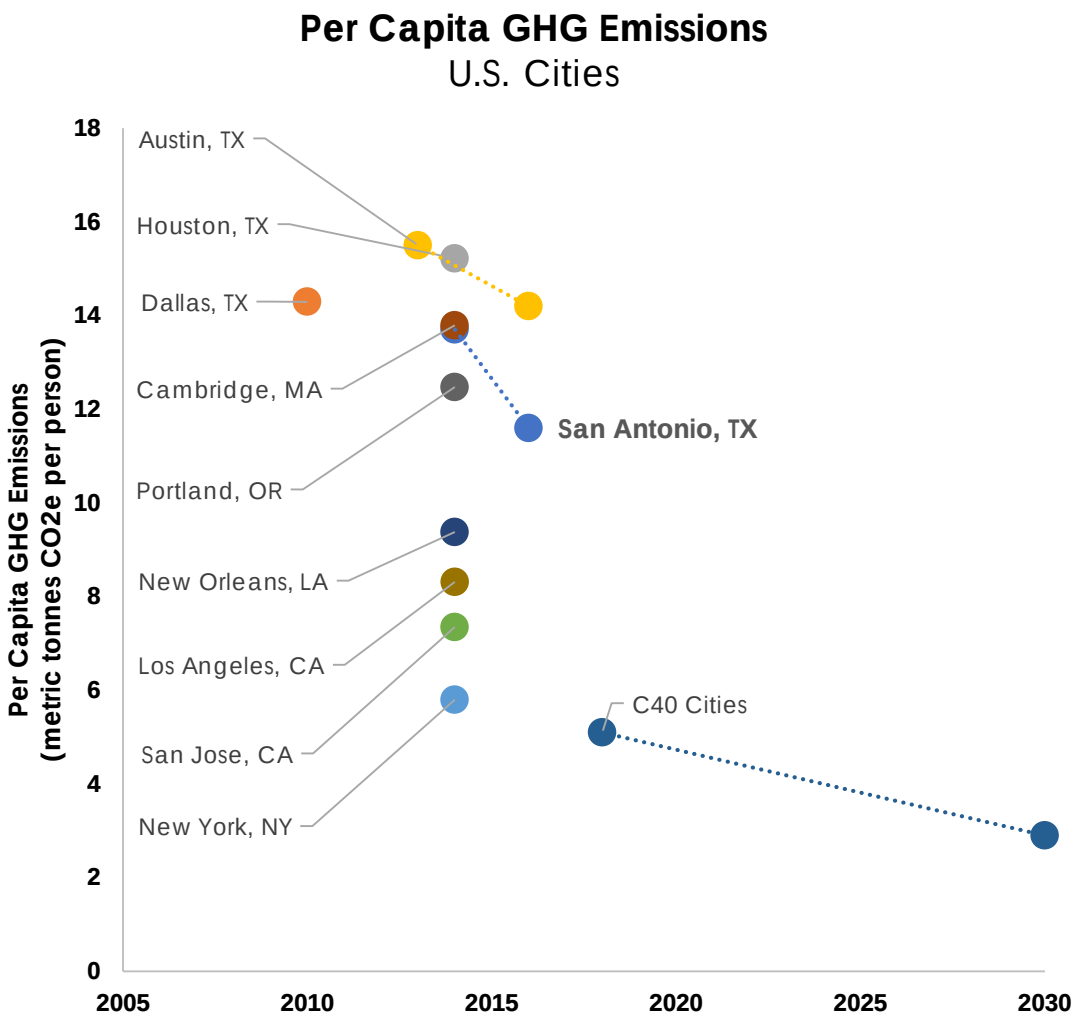
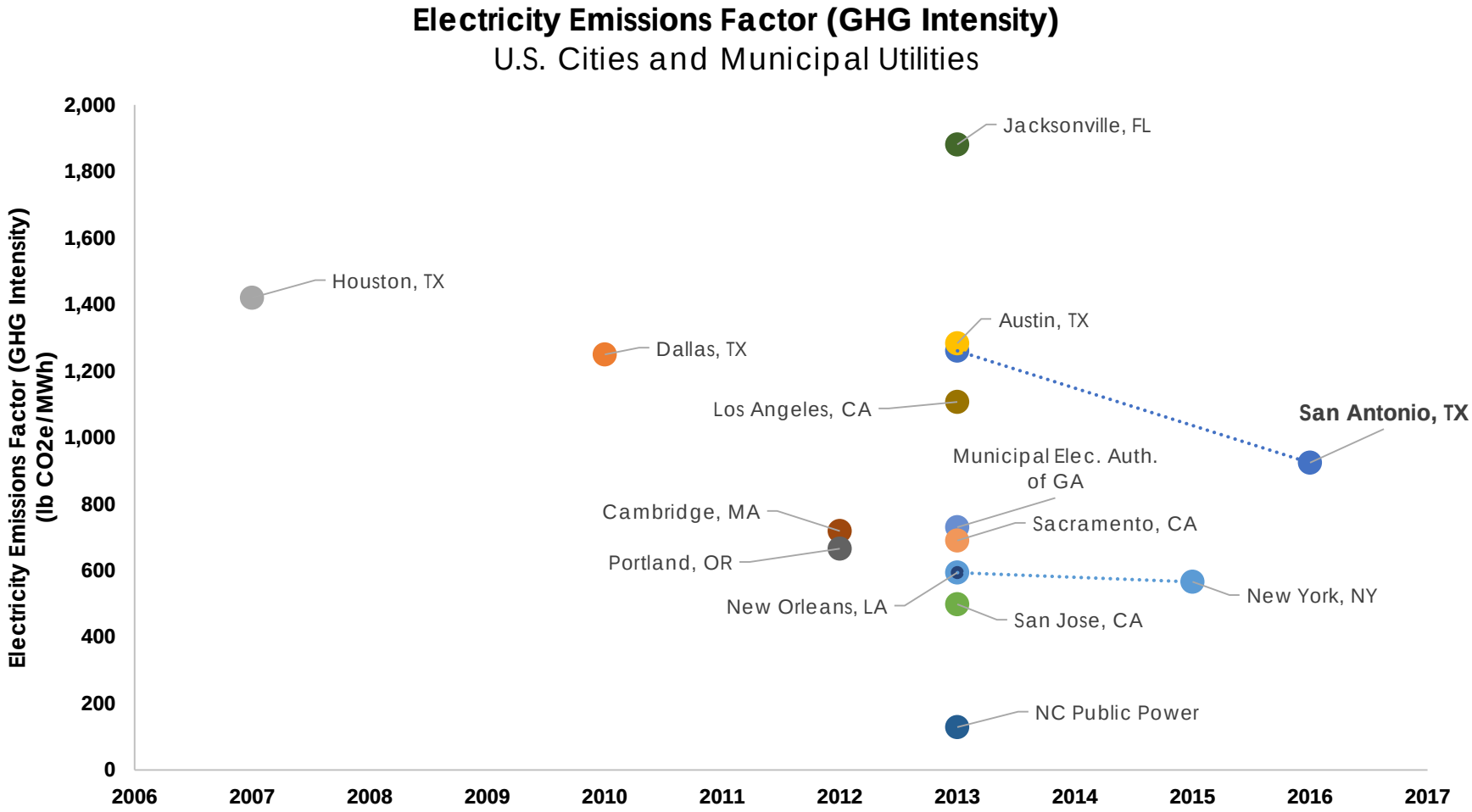
- **Benchmarking**
- Appendix

# Benchmarking: Per Capita Emissions




| City | GHG Emissions per Capita (tCO2e/person) | |
|---|---|---|
| | Value | Year |
| San Antonio, TX | 14.0<br>13.7<br>11.6 | 2013<br>2014<br>2016 |
| Dallas, TX | 14.3 | 2010 |
| Houston, TX | 15.2 | 2014 |
| Austin, TX | 15.5<br>14.2 | 2013<br>2016 |
| New York, NY | 5.8 | 2014 |
| San Jose, CA | 7.4 | 2014 |
| New Orleans, LA | 9.4 | 2014 |
| Cambridge, MA | 13.8 | 2014 |
| Portland, OR | 12.5 | 2014 |
| Los Angeles, CA | 8.3 | 2014 |
| C40 Cities average | 5.1<br>2.9 | 2018<br>2030 |

# Benchmarking: Electricity Emissions Factor



# Benchmarking: Electricity Emissions Factor

| City / Region Served | Utility | GHG Emission Factor (lb CO2e/MWh) | |
|---|---|---|---|
| | | Value | Year |
| San Antonio, TX | CPS Energy | 1,261<br>924 | 2013<br>2016 |
| Dallas, TX | Multiple providers | 1,250 | 2010 |
| Houston, TX | Multiple providers | 1,420 | 2007 |
| Austin, TX | Austin Energy | 1,283 | 2013 |
| New York, NY | Public Power | 594<br>566 | 2013<br>2015 |
| San Jose, CA | Pacific Gas and Electric | 499 | 2013 |
| New Orleans, LA | Entergy New Orleans | 594 | 2013 |
| Cambridge, MA | Eversource | 719 | 2012 |
| Portland, OR | Portland General Electric | 666 | 2012 |
| Los Angeles, CA | LA City | 1,107 | 2013 |
| Multiple cities in NC | NC Public Power | 129 | 2013 |
| Jacksonville, FL | JEA | 1,881 | 2013 |
| Multiple cities in GA | Municipal Elec. Auth. of GA | 730 | 2013 |
| Sacramento, CA | Sacramento Municipal Util Dist | 690 | 2013 |

# Benchmarking: Global Warming Potential

| City | GWP Values Used in City's Climate Action Plan or other GHG inventory | | |
|---|---|---|---|
| | IPCC AR# | GWP value time horizon | Notes |
| San Antonio, TX | AR5 | 100-year | Including comparison of results using 20-year GWP. |
| Dallas, TX | Details not available in plan or elsewhere. | | - |
| Houston, TX | - | - | - |
| Austin, TX | AR2 | 100-year | Included comparison of results using 20-year GWP. (details on following slides) |
| New York, NY | AR4 | 100-year | Included comparison of results using 20-year GWP. (details on following slides) |
| San Jose, CA | AR4 | 100-year | - |
| New Orleans, LA | Details not available in plan or elsewhere. | | GPC was used as guidance. (could be AR2-AR5) |
| Cambridge, MA | Details not available in plan or elsewhere. | | GPC was used as guidance. (could be AR2-AR5) |
| Portland, OR | AR4 | 100-year | - |
| Los Angeles, CA | Details not available in plan or elsewhere. | | GPC was used as guidance. (could be AR2-AR5) |

# Benchmarking: Global Warming Potential

The New York City 1.5ºC Plan discussion of 20-year Global Warming Potential (GWP) is shown here.

## 20 YEAR GLOBAL WARMING POTENTIAL

Standard GHG accounting methods track 6 key GHGs ($CO_2$, $CH_4$, $N_2O$, PFCs, HFCs, $SF_6$). Each of these gases differs in their ability to absorb energy ("radiative efficiency"), and how long they live in the atmosphere ("lifetime"). The Global Warming Potential (GWP) of a GHG is a multiplier used to allow comparisons of the impacts of emissions of various GHGs on global warming by converting them to a common unit: tons of carbon dioxide equivalent ($CO_2e$). The larger the GWP the more a particular GHG warms the earth over a given timeframe. The most commonly used timeframe is 100 years. For instance, methane ($CH_4$) is estimated to have a GWP of 25 over 100 years.

In addition to the 100 year timeframe, New York City has also calculated GHG emissions using 20-year GWPs. These GWPs do not consider impacts that happen more than 20 years after emissions occur and therefore prioritize gases with shorter lifetimes. In the case of methane (which has a short lifetime), 100 year GWP of methane is 25, but its 20-year GWP is much higher at 84. This view of GHG emissions can provide the City with more detail when assessing short term vs long term strategies.

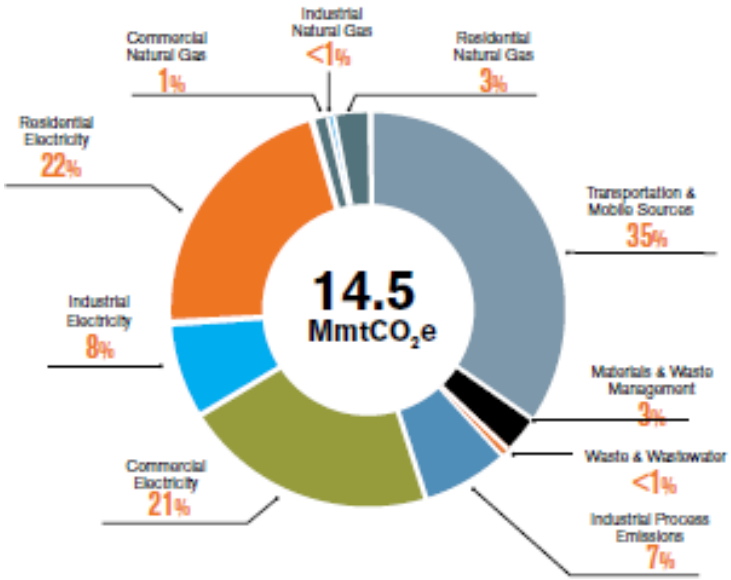
Key observations from this analysis include:

- Emissions from buildings remain the largest driver of Citywide emissions in both the 20 and 100 year timeframes
- The 20 year timeframe view shows that emissions from waste sectors are larger drivers of short term emissions than in the 100 year timeframe.
  - » Citywide GHG emissions from the waste sector are over twice as large as a proportion of total emissions (9% of total on 20 year timeframe, 4% on 100 year timframe).
  - » City Government GHG emissions from solid waste facilities are more than double as a proportion of total emissions. (8% of total on 20 year timeframe, 3% on 100 year timeframe).
  - » City government's wastewater treatment emissions are 25% larger (8% of total on 20 year timeframe, 3% on 100 year timeframe).
- Under a 20-year GWP framework, City government GHG emissions dropped by 29.8% relative to 2006 (compared to 24.7% under a 100-year GWP framework).

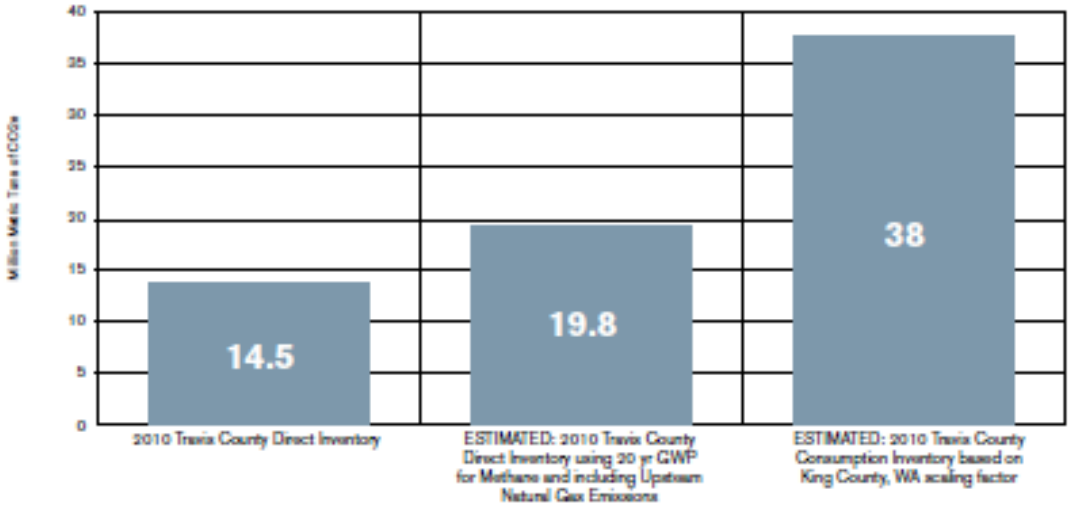
# Benchmarking: Global Warming Potential

These charts show the 20-year and 100-year GWP comparison conducted for the Austin, TX Climate Plan.

## 2010 Estimated Travis County GHG Inventory




## Comparing Inventory Approaches and Estimated Results




The chart above compares the relative magnitude of other approaches to completing a community-wide greenhouse gas inventory.

# Benchmarking: GHG Targets

| City | GHG Target Details | | | | | Compact of Mayors |
|---|---|---|---|---|---|---|
| | Aligned with Paris Agreement (2ºC scenario+) | Base year | Target year | % Reduction | Notes | |
| San Antonio, TX | Yes | | TBD | | - | Yes |
| Dallas, TX | - | | No citywide target | | - | Yes |
| Houston, TX | - | | No citywide target | | - | Yes |
| Austin, TX | - | 2010 | 2050 | 100% | - | Yes |
| New York, NY | Yes | 2005 | 2030<br>2050 | 40%<br>80% | In line with 1.5ºC scenario. | Yes |
| San Jose, CA | Yes | 1990 | 2030<br>2050 | 40%<br>80% | In line with CA-mandated GHG reduction | Yes |
| New Orleans, LA | - | 2014 | 2030 | 50% | - | Yes |
| Cambridge, MA | - | 2010 | 2002 | 20% | Target was not met by 2010 | Yes |
| Portland, OR | - | 1990 | 2050 | 80% | - | Yes |
| Los Angeles, CA | - | 2009<br>1990<br>1990 | 2025<br>2035<br>2050 | 45%<br>60%<br>80% | - | Yes |

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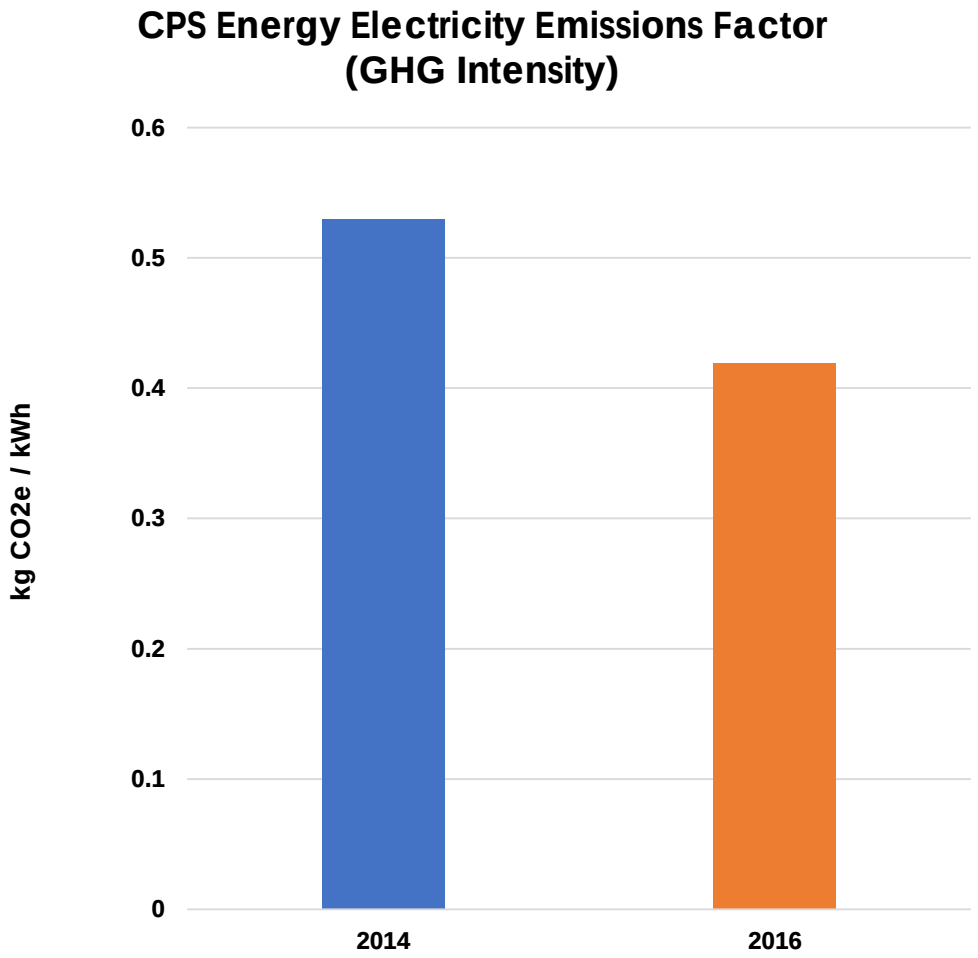
# CPS Energy Electricity Emissions Factor

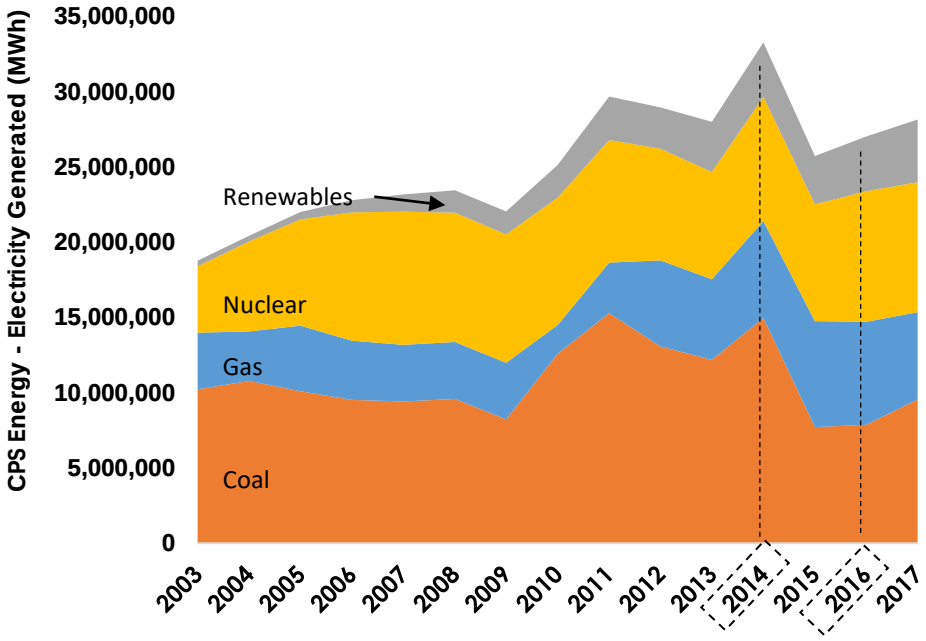



The GHG intensity, or emissions factor, of the electricity delivered by CPS Energy to the City of San Antonio decreased by 21% between 2014 and 2016.

This decrease is due to a cleaner fuel mix and increased use of renewables (shown on following slides).

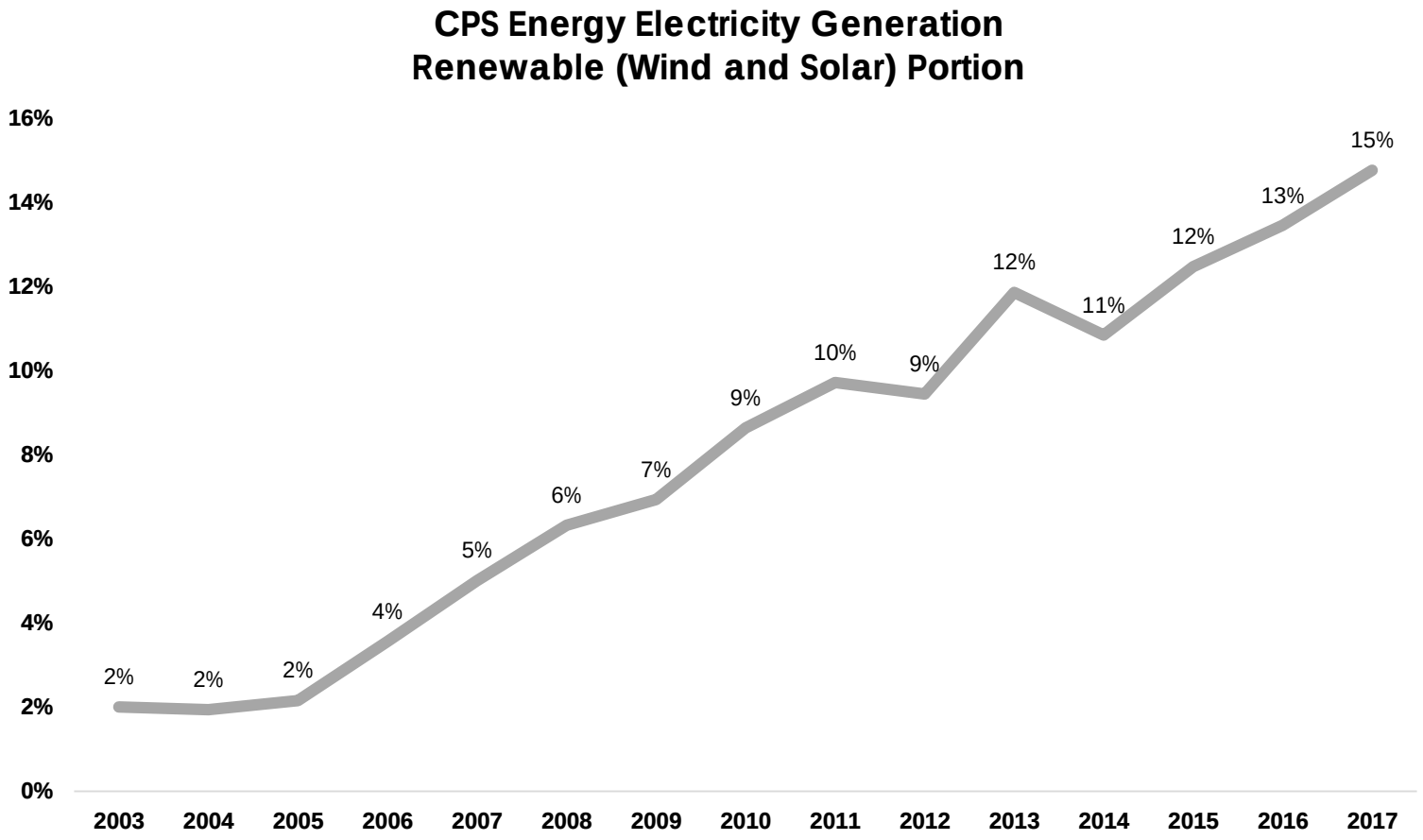
# CPS Energy Electricity Generation

## CPS Energy Electricity Generation
by Source

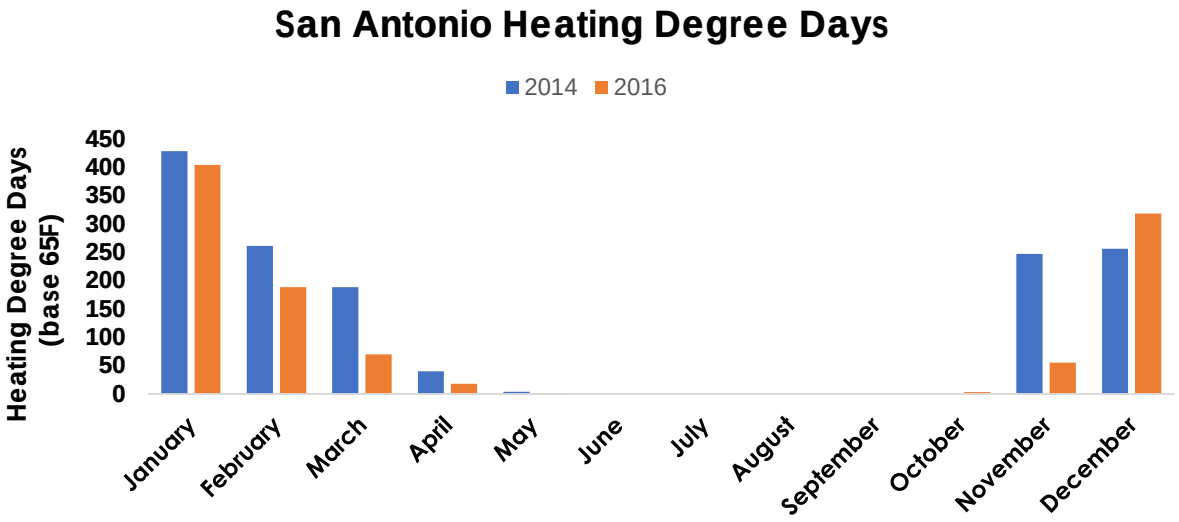



| Source | Percent of Generation | |
|---|---|---|
| | 2014 | 2016 |
| Renewables (solar and wind) | 11% | 13% |
| Nuclear | 25% | 32% |
| Gas | 19% | 25% |
| Coal | 45% | 29% |

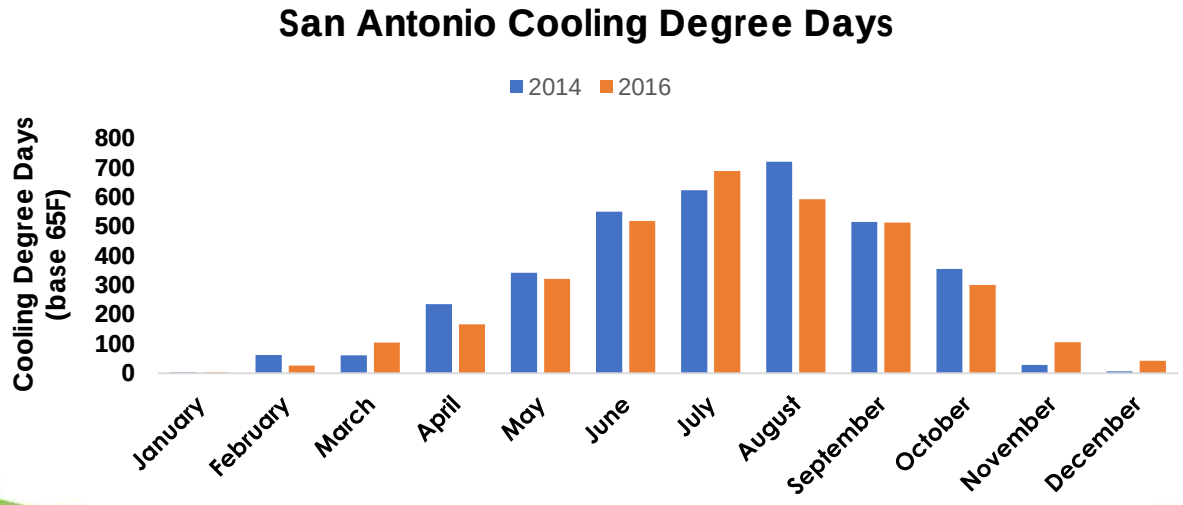
# CPS Energy Electricity Generation, Renewables



# Weather Impacts

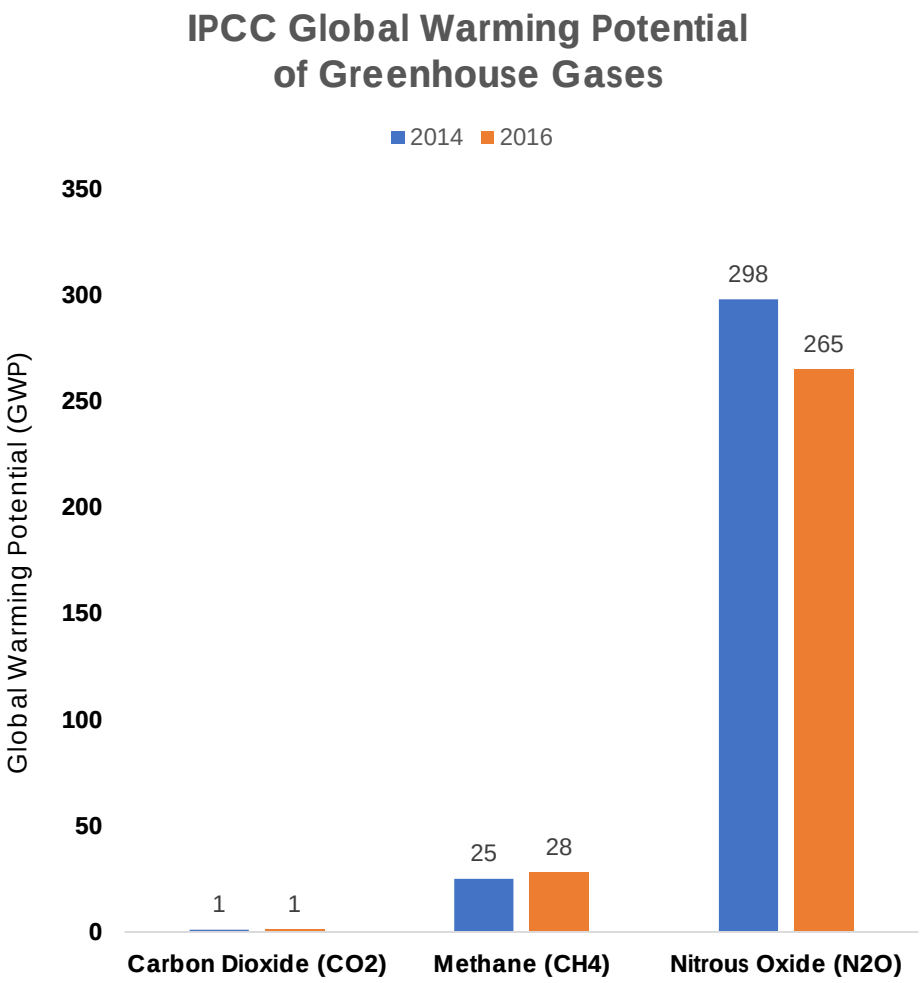



San Antonio's winter in 2016 was significantly milder than 2014, with 26% fewer heating degree days. This was especially notable for November 2016.




San Antonio's cooling season in 2016 was just slightly milder than 2014, with 3% fewer cooling degree days.

# GHG Global Warming Potential




The Global Warming Potential (GWP) of greenhouse gases have been revised by the leading authority on the subject: the Intergovernmental Panel on Climate Change (IPCC).

San Antonio's 2014 inventory used the GWPs from the IPCC AR4. San Antonio's 2016 inventory uses the GWPs from the IPCC AR5, which reflect this recent revision.

All GWP values shown here are for the 100-year time horizon.

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