



# 2025 Greenhouse Gas Inventory



CITY OF  
TALLAHASSEE



# Greenhouse Gas Inventory

2025

## Table of Contents

Introduction & Purpose .....	2
History of Emissions Tracking in Tallahassee .....	3
Inventory Goal .....	3
Protocol: International Council of Local Environmental Initiatives (ICLEI) ClearPath .....	3
Scope & Boundaries: Tallahassee Community-Wide Inventory .....	4
Base Year: 2022 .....	5
Data Sources .....	5
Total Emissions .....	6
Emissions by Category: Residential .....	7
Emissions by Category: Commercial and Industrial .....	8
Emissions by Category: Transportation & Mobile Sources .....	9
Emissions by Category: Solid Waste .....	10
Emissions by Category: Drinking Water & Wastewater .....	11
Emissions by Category: Fugitive Emissions .....	12
Categories Not Included .....	13
Supporting Information & Statistics .....	13
Acknowledgments .....	14
Appendix I: A Community Carbon Dioxide Scorecard for Leon County 2020 .....	15

## Introduction & Purpose

The journey to clean energy has been underway for years in Tallahassee and healthy, vibrant living is a hallmark of life here. Clean, renewable energy means improved air quality, healthier residents, and green jobs for a stronger, more resilient community. On the path to 100 percent clean, renewable energy, the City's goal is to continue the reduction of greenhouse gas emissions as much as possible (2019 Clean Energy Resolution).

**Tracking greenhouse gas emissions provides data for effective decision making.** Strategic investment, data-driven decisions, community input, and forward-thinking policies will steer the transition to a cleaner, more secure domestic energy future. Greenhouse gas inventories will help us get there.



*Figure 1: Guiding principles as described in the City of Tallahassee Clean Energy Plan*

Greenhouse gas inventories help communities track and measure their greenhouse gas emissions. By conducting multiple inventories over time, trends can be found. The City of Tallahassee intends to conduct multiple inventories over time to track progress of Tallahassee emissions reductions. Therefore, this baseline inventory was carefully developed using a standardized, replicable approach to enable direct comparisons to future inventories to the greatest extent possible.

Following industry standard best practices is essential to improve inventory accuracy and efficacy. This inventory follows the International Council of Local Environmental Initiatives (ICLEI) ClearPath protocol. However, caution is needed when comparing inventories conducted by different communities to each other. Even while following industry standards, inventories are unique. The precise methodology will vary based on community specifics and inventory needs and goals. Therefore, inventories cannot be directly compared across communities without careful consideration.

**Want more info on emissions and clean energy?** The City of Tallahassee maintains a dedicated website at [Talgov.com/CleanEnergyPlan](http://Talgov.com/CleanEnergyPlan) to provide information and online tools to help in the clean energy transition. Questions related to clean energy can be directed to [CleanEnergy@Talgov.com](mailto:CleanEnergy@Talgov.com).

# History of Emissions Tracking in Tallahassee

This inventory builds upon prior works including a Community Carbon Dioxide Scorecard for Leon County in 2020 published in 2022 by Sustainable Tallahassee (Appendix I). The City of Tallahassee last produced a Greenhouse Gas Inventory Report in 2010 (also in 2008 and 2009), and regularly tracks emissions associated with electric generation. More recently, the Tally100 Technical Committee wrote numerous memos on Tallahassee emissions including natural gas consumption and emissions, mobility emissions, Talquin Electric emissions, and U.S. Energy Information Administration (EIA) data culminating in a Carbon Calculator. This inventory draws upon and relies on that work. Many thanks to Tally100 and Sustainable Tallahassee for their instrumental efforts in tracking greenhouse gases.

## Inventory Goal

One goal of Tallahassee's greenhouse gas inventory is to fulfill the requirement of **Clean Energy Plan Action 4.7: Identify and quantify the sources of greenhouse gas emissions in our community and inform the public on a biannual basis of the progress towards the reduction of those emissions beginning in 2025**. As part of fulfilling this goal, the 2025 Inventory is expected to be the first of many. It will provide a baseline by which the City of Tallahassee can track changes to the community's emissions profile and track progress towards implementing the Clean Energy Plan.

## Protocol: International Council of Local Environmental Initiatives (ICLEI) ClearPath

This inventory follows the International Council of Local Environmental Initiative's (ICLEI's) **ClearPath** protocol. It includes the required **five Basic Emissions Generating Activities**:



- 1) **use of electricity** by the community
- 2) **use of fuel** in residential and commercial stationary combustion equipment
- 3) on-road passenger and freight **motor vehicle travel**
- 4) use of **energy in potable water and wastewater treatment and distribution**, and
- 5) generation of **solid waste** by the community.

The inventory also includes **aviation fuel** dispensed at Tallahassee International Airport (TLH) and **natural gas distribution fugitive emissions**.

Inventory note: **CO<sub>2</sub>e stands for carbon dioxide equivalent**. This is a standardized unit that describes the global warming potential of different greenhouse gases as compared to carbon dioxide. That way, one unit can capture the impact of many different gases.



# Scope & Boundaries: Tallahassee Community-Wide Inventory

This is an inventory for the community of Tallahassee, Florida.

- The boundary is Leon County, Florida for most data sets.
- For utility data sets, the boundary is that specific utility's service territory.
  - Utilities: electric, natural gas, drinking water, wastewater

## How did the City of Tallahassee determine the inventory's scope and boundary?

- The City of Tallahassee intends to use this inventory as a baseline to track Clean Energy Plan progress over future years. As such, a "community-wide" inventory was conducted to include emissions generated across the community.

## What's the difference between a "community-wide" vs. an "operational" inventory?

- Community-wide inventories, like the City of Tallahassee's inventory, consider emissions across the Tallahassee community. The Clean Energy Plan action items impact the entire Tallahassee community and so a community-wide inventory was determined to be most effective for meeting inventory goals.
- Operational inventories, another common inventory type, are very effective at tracking the impacts of one company or organization. Operational inventories are much more granular than community-wide inventories.
- Selecting the appropriate inventory type based on inventory needs and goals is critical. Different inventory types are suited for different applications.

## Does this inventory include the purchase of goods and services? How about emissions from the food we eat?

- Not directly. Tracking emissions attributed to the use of goods and services, including food, is called consumption-based accounting. Consumption-based accounting was not incorporated into the inventory to 1) keep the inventory focused on tracking actions identified in the Clean Energy Plan, 2) avoid emissions double counting, and 3) work within data availability limitations.
  - For example, double counting can arise when considering locally produced goods. The emissions from electricity used to produce local products are already included in the inventory. If the good was sold to a Tallahassee resident, attributing more emissions due to the consumption of that good would be a double count.
- If you are interested in consumption-based accounting, the CoolClimate network developed a consumption-based greenhouse gas inventory methodology. The [household carbon footprint by zip code](#) uses this methodology on a community level.
- At an individual household level, consumption-based inventories are often called "carbon footprints." There are many carbon footprint calculators online that you can use to approximate your individual carbon impact.

## Base Year: 2022

Calendar 2022 was selected as the inventory base year. During inventory development starting in January 2025, the latest available transportation factor set from ICLEI was for calendar year 2022. When inventories are conducted in future years, they will likely require a similar base year lag.

## Data Sources

This inventory draws upon a variety of data sources. All data is for the calendar year 2022 unless otherwise noted. The data sources are described below:

- ❖ Electricity and natural gas energy usage from City of Tallahassee Electric & Gas Utility
  - Natural Gas Emissions [EPA Flight Data](#)
  - Electric [Ten Year Site Plan](#)
- ❖ Water & wastewater usage from City of Tallahassee Underground Utilities and Public Infrastructure & Customer Operations
- ❖ Transportation & mobile sources
  - Fuel sales (gasoline and diesel) from [Florida Department of Revenue](#)
  - Aviation fuel dispensed at the airport property from TLH Airport
  - Vehicle miles travelled and population from [U.S. Dot Highway Statistics 2022](#)
- ❖ Solid waste: ICLEI default – see factor set section below
- ❖ Landfill gas flaring from the Renewable Natural Gas Screening Study (Aug 2021)
- ❖ Process & fugitive emissions: ICLEI default & EIA data
- ❖ Parameters – used for tracking inventory changes over time
  - Census data: American Community Survey 5-year, 2022
    - [DP02 Selected Social Characteristics](#) Total households: 81,846
    - [DP03 Selected Economic Characteristics](#) In labor force: 113,129
    - [DP05 Demographic and Housing Estimates](#) Total population: 198,259
  - GDP: [Office of Economic Vitality](#)
  - Global Warming Potential: IPCC 6<sup>th</sup> Assessment Report (2023) 100-year values
- ❖ Factor sets – used for calculating emissions
  - Transportation: 2022 US National Defaults (Updated 2024); ICLEI-provided.
  - Waste characterization: 100% Mixed MSW (ICLEI default which uses 2018 data)
  - Grid electricity: Tallahassee Grid Emissions 2022: [EPA E-grid](#) for TAL balancing authority (City of Tallahassee Electric & Gas Utility)
    - Includes all emissions from electric generation for the balancing authority: Generators owned by the City (Hopkins, Purdom, substation 12); generation from two solar farms (power purchase agreements); and off-system wholesale purchases minus off-system wholesale sales
    - [Link](#) describing how EPA determines e-grid emissions
    - Does not directly include behind the meter solar and energy efficiency improvements; however, behind the meter solar and energy efficiency displace the kWh generation requirements.

## Total Emissions

Tallahassee's total emissions were **2.6 million metric tons of CO<sub>2</sub>e** for base year 2022 as shown in Table 1 below.

Table 1: Tallahassee Inventory Base Year 2022

	Metric Tons CO <sub>2</sub> e
Transportation & Mobile Services	1,324,515
Commercial Energy	666,738
Residential Energy	486,543
Solid Waste	69,743
Water & Wastewater	20,119
Fugitive Emissions	4,333
<b>TOTAL</b>	<b>2,571,991</b>

Transportation and mobile services are the largest category of emissions in Tallahassee, followed by commercial energy. The pie chart below shows a breakout of Tallahassee emissions by category.

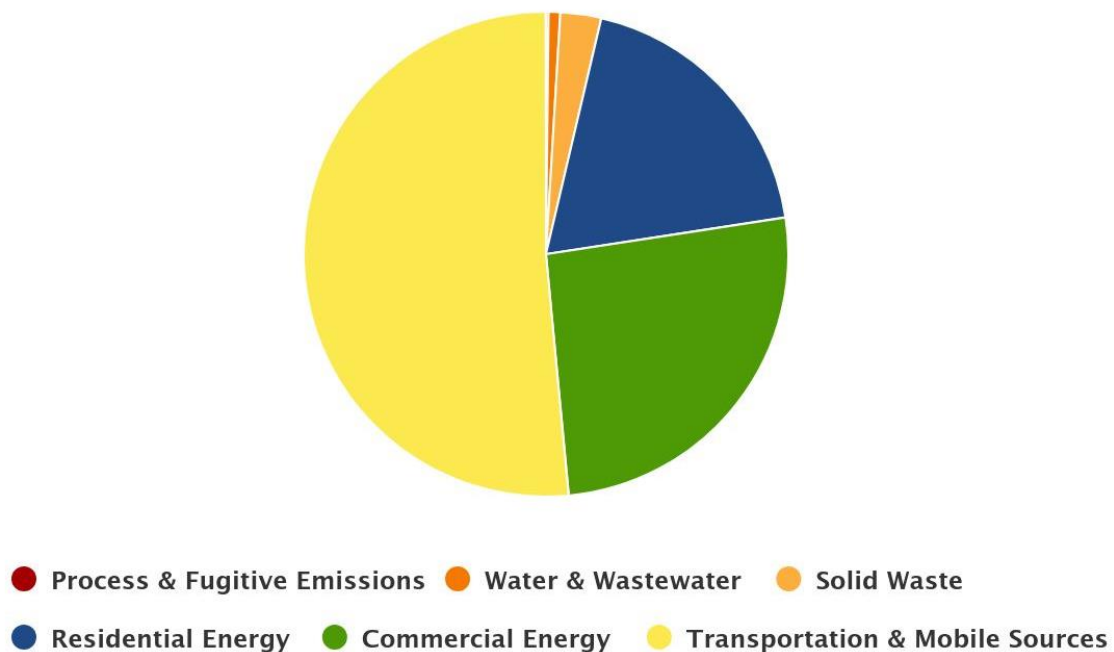


Figure 1: CO<sub>2</sub>e by category

The following sections provide detail on each specific emissions category. Data sources, assumptions, and results are shown.

## Emissions by Category: Residential

The **Residential** category includes two sources of emissions: emissions due to residential electricity use and emissions due to residential natural gas use.

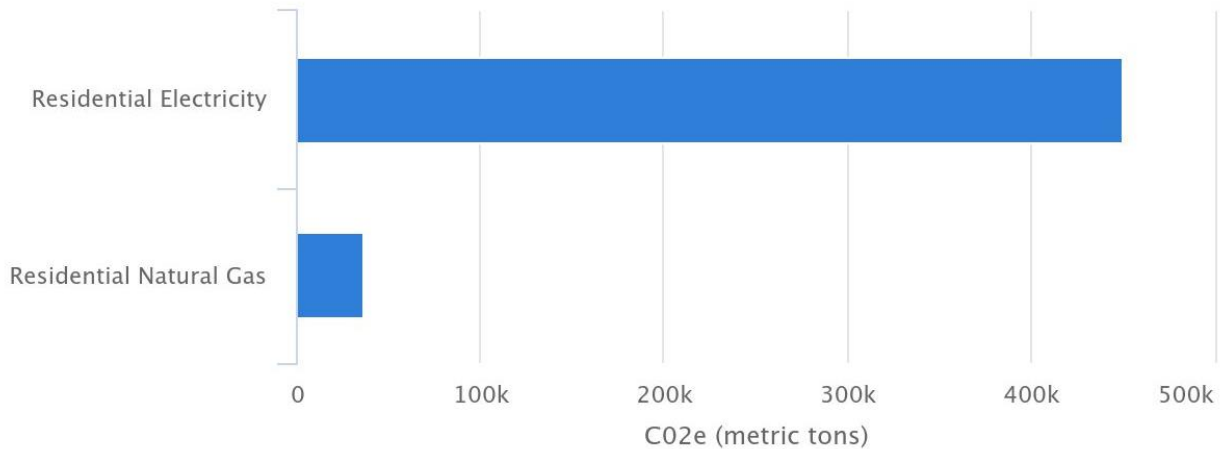


Figure 2: Residential CO2e Emissions

Data for this category was obtained from the City of Tallahassee Electric & Gas Utility including EIA reporting.

Tallahassee’s electricity is generated locally by the City of Tallahassee Electric & Gas Utility. The electric generation fleet consists of natural gas-fueled generating stations plus power purchase agreements with two solar farms located at the Tallahassee International Airport.

The reported natural gas greenhouse gas numbers use default emissions factors, miles of main, number of services, type of equipment, and type of material; they don’t factor in the increased frequency of leak surveys, gas loss from hit gas lines, averted emissions from construction practices, or the City of Tallahassee’s “find it and fix it” methodology regarding leaks.

### Electricity determinants

- 1,157 GWh supplied
- 107,000 households served
- Data source: [Tallahassee Ten Year Site Plan](#)

### Natural gas determinants

- 692,209 MMBtu supplied
  - 678,636 MCF with a 1.02 MCF/MMBTU conversion factor
- 32,740 households served
- Data source: EIA-176 & utility-supplied conversion factor



## Emissions by Category: Commercial and Industrial

The **Commercial and Industrial** category includes two sources of emissions: emissions due to commercial and industrial electricity use and emissions due to commercial and industrial natural gas use.

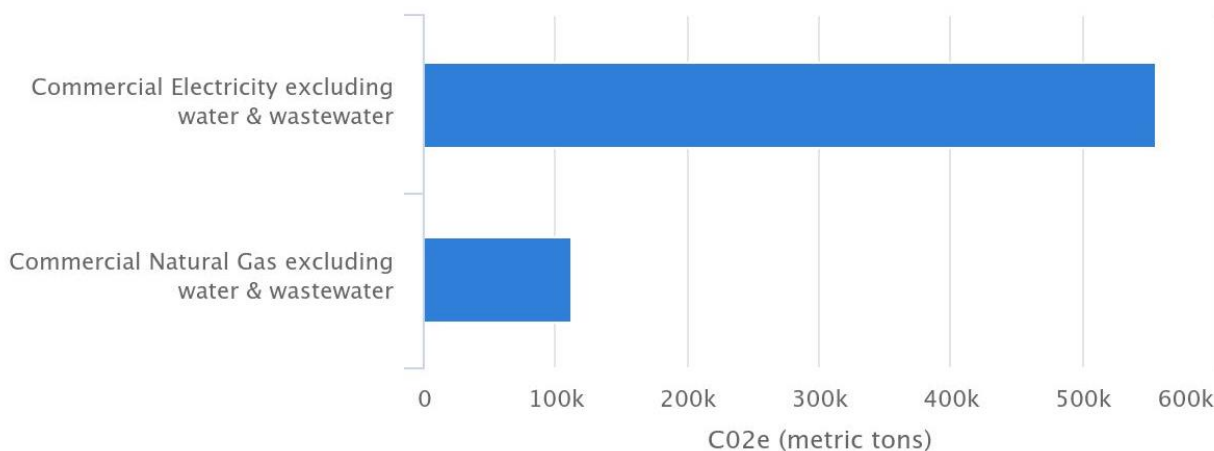


Figure 3: Commercial and Industrial CO2e Emissions

Data for this category was obtained from the City of Tallahassee Electric & Gas Utility including EIA reporting.

The reported natural gas greenhouse gas numbers use default emissions factors, miles of main, number of services, type of equipment, and type of material; they don't factor in the increased frequency of leak surveys, gas loss from hit gas lines, averted emissions from construction practices, or the City of Tallahassee's "find it and fix it" methodology regarding leaks.

Note that emissions attributed to electricity and natural gas usage of the water and wastewater sector are not included in this category to avoid double counting.

### Electricity determinants

- 1,428 GWh supplied
- 19,800 businesses served
- Data source: [Tallahassee Ten Year Site Plan](#)

### Natural gas determinants

- 2,100,761 MMBtu supplied
  - 2,059,569 MCF with 1.02 MCF/ MMBtu conversion factor
- 2,174 businesses served
- Data source: EIA-176 & utility supplied conversion factor

## Emissions by Category: Transportation & Mobile Sources

The **Transportation & Mobile Sources** category includes five sources of emissions:

- Aviation fuel sales (Jet kerosene sales, Aviation gasoline sales)
- Compressed natural gas sales for vehicles (Nopetro Energy)
- Gasoline sales
- Diesel sales

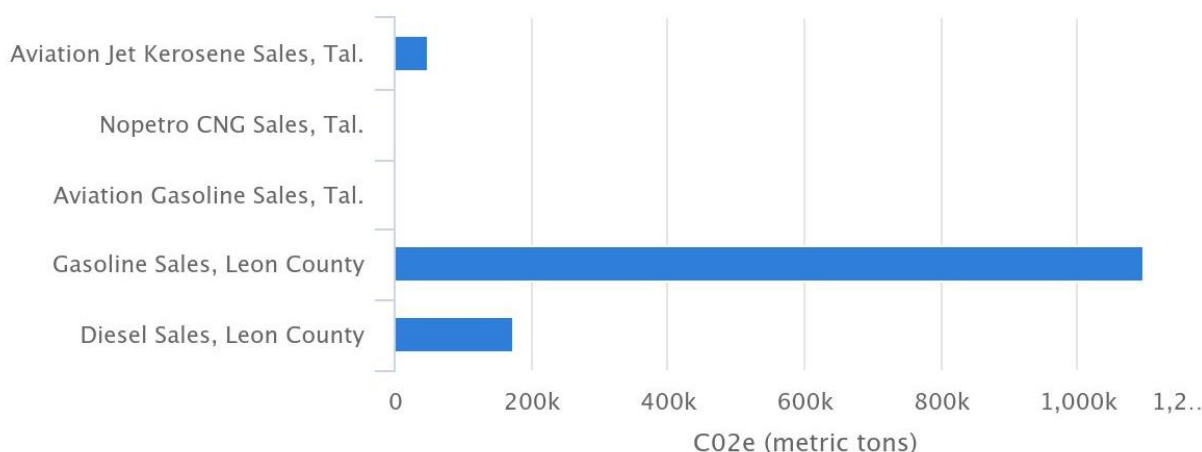


Figure 4: Transportation and Mobile Sources CO2e Emissions

Data for this category was obtained from [Florida Department of Revenue](#) for the gasoline and fuel sales and from TLH Airport for the aviation fuel dispensed at airport property. Many thanks to the Tally100 Technical Committee for the Florida Department of Revenue data source information.

In the City of Tallahassee, compressed natural gas is available for vehicle use via a fueling station owned by Nopetro Energy. City vehicles, Leon County school district buses, and a limited number of private vehicles use this fueling station. The amount of compressed natural gas sold to the Nopetro Energy fueling station was used in this inventory with data from the City of Tallahassee Electric & Gas Utility.

Emissions due to the compressed natural gas category, as well as the aviation gasoline category, are so small they do not appear on the bar chart.

### Aviation determinants

- 5,059,310 gallons jet kerosene sold
- 173,424 gallons aviation gasoline sold
- Source: City of Tallahassee

### Ground vehicle determinants

- Compressed NG: 79,262,000 scf sold
- Gasoline: 124,744,430 gallons sold
- Diesel: 17,045,837 gallons sold
- Source: Florida Dept. of Revenue
- 2,512,660 annual VMT: US DOT Highway statistics

## Emissions by Category: Solid Waste

The **Solid Waste** category includes two sources of emissions: emissions from generated waste and emissions from landfill flaring of the closed Leon County landfill.

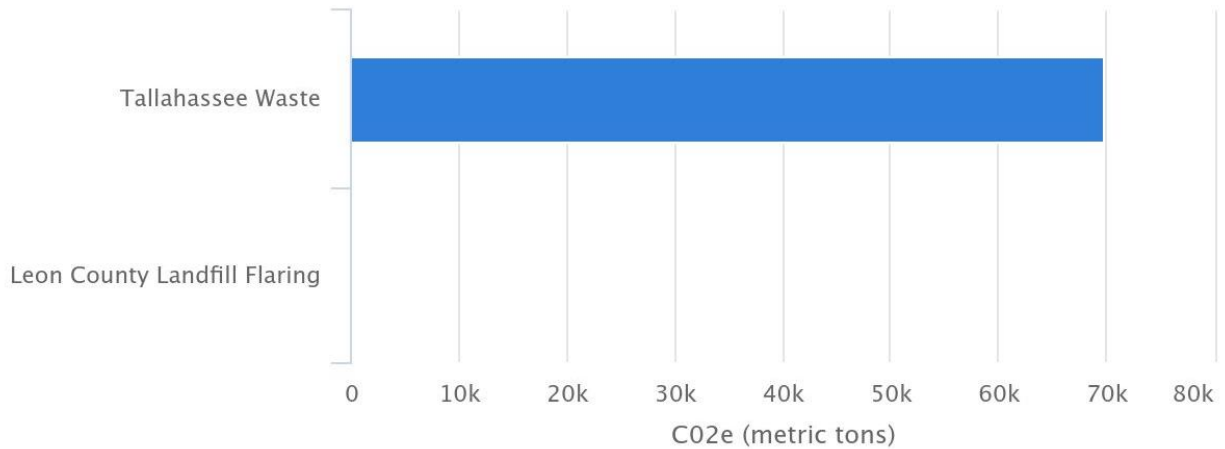


Figure 5: Solid Waste CO2e Emissions

The Tallahassee waste characterization was set at the ICLEI default due to lack of Tallahassee-specific waste data. However, the waste generated by Tallahassee residents is not thought to differ significantly from the national average. Therefore, using the default was considered acceptable.

### Tallahassee waste determinants

- 198,259 population
- Annual per capita waste generation: 0.5544 tons/year (ICLEI default which [uses EPA 2018 data](#))

The amount of flaring conducted due to the closed landfill was estimated at 166,000 cubic feet per day (source: Renewable Natural Gas Screening Study developed by the City of Tallahassee in 2021). This results in 154 metric tons of CO2e emissions. Due to its small size, the Landfill flaring bar is too small to see on the CO2e emissions chart.

### Landfill flaring determinants

- 166,000 cubic feet flared/day
- 154 metric tons CO2e emitted
- Data source: Renewable Natural Gas Screening Study

## Emissions by Category: Drinking Water & Wastewater

The **Water & Wastewater** category includes three sources of emissions: emissions from the wastewater system, emissions from the drinking water system, and wastewater digester gas flaring.

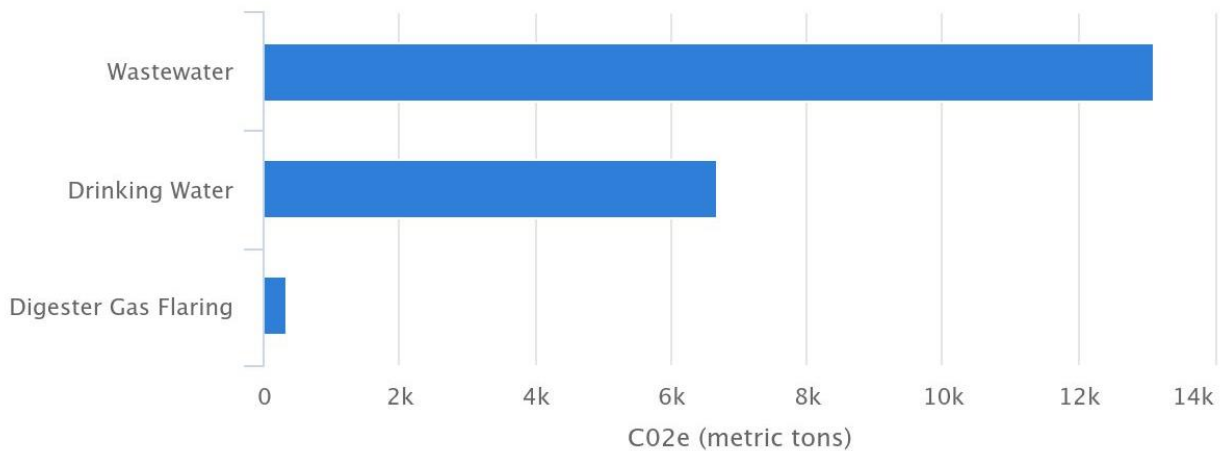


Figure 6: Drinking Water and Wastewater CO2e Emissions

Emissions attributable to the wastewater system include electric and natural gas energy usage to treat and convey wastewater. The dominant energy source for the wastewater system is electricity, which is used both at the wastewater treatment plant Thomas P. Smith Water Reclamation Facility as well as sewer pumps located throughout the wastewater collection system. Natural gas is used at the Water Reclamation Facility to power the boilers and dryers. Emissions attributable to the drinking water system includes primarily electricity to treat and convey drinking water.

Both wastewater and drinking water systems are municipally owned by the City of Tallahassee. This inventory includes all emissions generated by these systems including for customers located outside City boundaries. Emissions generated from City residents using well water and/or septic tanks were not included in this inventory.

This inventory took a top-down approach to electricity and natural gas energy use. Wastewater and drinking water energy usage was identified based on meter number. These amounts were subtracted from total electric and natural gas sales to prevent double counting.

In 2022, the Water Reclamation Facility flared natural gas from three digesters. This flaring was included in the inventory and data was provided by the Underground Utilities and Public Infrastructure department.

### Drinking water determinants

- 17.1 GWh electricity
- 8.4 MMBtu NG

### Wastewater determinants

- 23.6 GWh electricity
- 73,567 MMBtu NG

### Gas flaring determinants

- Digester: 288,000 cubic feet/day

Data source: Utility data including meter data.



## Emissions by Category: Fugitive Emissions

The **Fugitive Emissions** category includes just one source of emissions: fugitive emissions from the natural gas system.

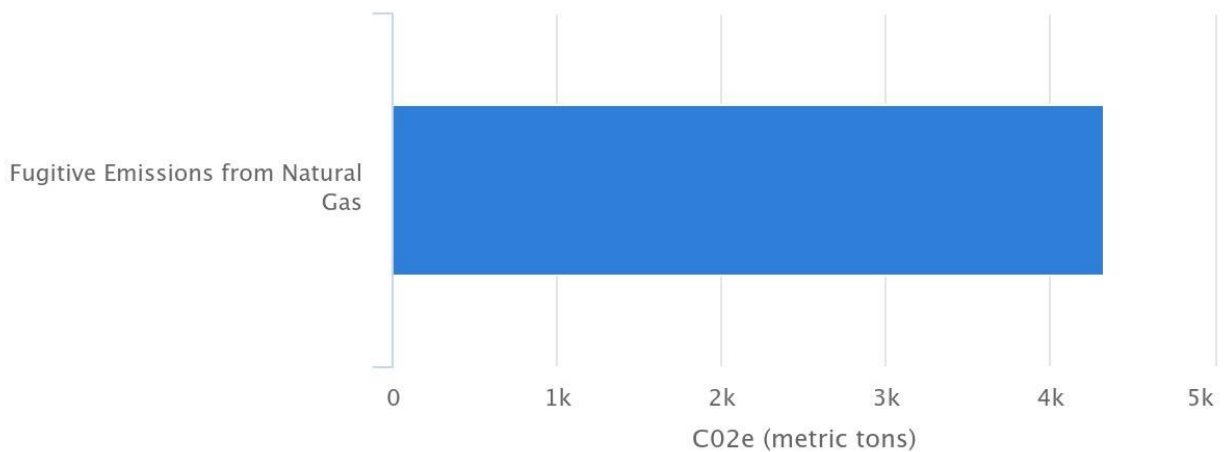


Figure 7: Fugitive CO2e Emissions

Natural gas fugitive emissions are emissions due to leaks in the natural gas distribution pipeline. Fugitive emissions are the emissions from natural gas leaked directly into the atmosphere, unlike flaring where the gas is burned.

### Fugitive emission determinants

- Total natural gas supplied: 2,947,392 MMBtu
- Emissions from Natural Gas distribution: 4,334 mt CO2e (Source: [EPA Flight Data](#))

The reported greenhouse gas numbers use default emissions factors, miles of main, number of services, type of equipment, and type of material; they don't factor in the increased frequency of leak surveys, gas loss from hit gas lines, averted emissions from construction practices, or the City of Tallahassee's "find it and fix it" methodology regarding leaks.

Energy density is 1020 btu/scf per utility data. Natural gas density and percent CH<sub>4</sub> and CO<sub>2</sub> inputs from EIA-176 and the 2022 Gas Quality Reports. Quantity of natural gas used includes residential and commercial energy use plus use for vehicle fueling. Leakage rate adjusted so CO<sub>2</sub>e reflects [EPA flight data](#).

## Categories Not Included

The following emissions categories were not used in this Tallahassee Greenhouse Gas Inventory:

- Industrial: Industrial emissions were captured in the “commercial and industrial” category
- Agriculture, Forestry and Other Land Uses (AFOLU): This category was not included although it could be included in future inventories
- Upstream impacts of activities: This category was deemed out-of-scope
- Process emissions: This inventory did not identify any significant process emissions in Tallahassee for inventory inclusion
- Consumption based: This was not a consumption-based inventory and consumption-based accounting was not used. The [CoolClimate Consumption-Based Inventory](#) can be used as a supplement for those interested in a consumption-based approach.

## Supporting Information & Statistics

The following information is from the PSC Renewable and Energy Efficiency Report:

- The City offers rebates, grants, and loans (on-bill financing) for a variety of energy efficiency improvements along with free energy audits and education for its customers. Since 2008, DSM incentive programs have resulted in over 900,000 MWh of energy savings for customers.
- Customer participation in 2024 included 2,200+ ENERGY STAR rebates totaling over \$470,000; 174 ENERGY STAR certified new home rebates totaling over \$300,000; 262 energy efficiency grants totaling over \$115,000; 92 commercial energy audits; 4,000+ residential energy audits; and 248 residential loans totaling over \$1.9 million.
- The City’s Solar Net Metering program promotes customer investment in renewable energy generation by allowing residential and commercial customers to return excess generated power to the City at the full retail value. Since 2019, over 1,000 solar permits have been issued by the City, resulting in 11 MWac of customer- and City-owned small-scale solar PV.
- The City maintains two Power Purchase Agreements for a total of 62 MWac of utility scale solar PV. Both projects are located at the Tallahassee International Airport.
- The City continues to operate the renewable energy customer participation program known as “Tallahassee Solar”. The program has nearly 2,000 participating facilities, which includes all City of Tallahassee-owned buildings.
- The City is diligently working toward its goal of converting 100% of its light- duty fleet vehicles to electric or hybrid by 2035. As of early 2025, the City has transitioned over 40 percent of StarMetro transit buses to all-electric and over 30 percent of its light-duty vehicles to all-electric or hybrid. To accommodate the City’s transition to cleaner vehicles, the Fleet department has installed over 80 EV charging stations.
- As of September 2024, Tallahassee’s publicly available electric vehicle (EV) charging network consisted of 119 charging ports at 36 charging stations, including 20 City owned ports and 99 privately-owned, publicly available ports. The City nearly doubled the number of permits for both residential and commercial EV chargers compared to 2023, indicating a sharp increase in local EV adoption and demand for public charging stations.

## Acknowledgments

This greenhouse gas inventory was authored by Sydney Usatine, Electric Utility Engineer III, Integrated System Planning at the City of Tallahassee Electric & Gas Utility. Kaitlin Luciano, Florida State University Sustainability Fellow, was instrumental in establishing the City's first use of the ICLEI ClearPath platform. The project was planned and guided by Michael Ohlsen, Assistant General Manager for Integrated System Planning, who provided leadership throughout. Caleb Crow, Electric Utility Engineer III, Integrated System Planning, provided additional support. Valuable technical input was provided by Laura Mooney and Nicholas Smith from Gas Operations, and collaborative discussions with Alissa Meyers, Lanita Walker, and Russell Wider (Environmental Services), and Adam Jacobs and Kelly Corvin (Housing and Community Resilience) helped ensure the inventory's alignment with broader City sustainability efforts. Members of Sustainable Tallahassee and the Tally 100% Together Coalition (Tally100) Technical Committee, including Patrick Love, Meta Calder, Tim Lynch, Richard Hopkins, Kim Ross, Pam McVety, and Steven Urse, provided steadfast advocacy for emissions tracking, valuable data insights, and feedback on the draft report. Kate Lovett, Leon County Sustainability Manager, contributed helpful coordination and brainstorming as Leon County prepares its own inventory. Additional data support was provided by Thomas Vergo, Superintendent of Airport Operations, for aviation fuel data, and Al Watson, Wastewater Treatment Supervisor, Underground Utilities and Public Infrastructure, for digester gas flaring data. We acknowledge the City Commission for their vision and leadership with the Clean Energy Resolution.

## Appendix I: A Community Carbon Dioxide Scorecard for Leon County 2020



# Appendix I



## A Community Carbon Dioxide Scorecard for Leon County 2020

Fourth Edition

September 15, 2022

Author: Tim Lynch, for Sustainable Tallahassee ([t2lynch@yahoo.com](mailto:t2lynch@yahoo.com)). Sojourn1.com  
Update of the Community Carbon Dioxide Scorecard 2001-2017 by Richard Hopkins

### Executive Summary

This document puts in one place information about carbon dioxide (CO<sub>2</sub>) production in Leon County over more than 20 years. The information can be used to inform planning for a sustainable energy future in Tallahassee/Leon County. It can also be used to monitor progress toward related objectives and goals adopted as part of a community planning process. While specific goals have not been set yet, they are likely to be ambitious having a 17- to 30-year time horizon for approaching or reaching 100% net renewable energy use community-wide.

On February 20, 2019, the Tallahassee City Commission took the step of committing to transitioning Tallahassee city-wide to a 100% clean, renewable energy future by 2050, thanks to the unanimous adoption of Clean Energy Resolution 19-R-04. Tallahassee is now one of over 160 cities in the U.S., and one of only 10 cities in Florida, to set this ambitious and important goal.<sup>1</sup>

In 2020, mobile sources accounted for 41.2% of the combined total of CO<sub>2</sub> production and stationary sources accounted for 56.6%, shifting only slightly from 40.1% mobile and 57% stationary in 2001. The slight difference is due to a small uptick in the estimated amount of Leon County expended jet fuel.

While total residential and commercial utility customers in Leon County increased by 28% and population by 22.9% over the 2001–2020 timeframe, stationary CO<sub>2</sub> emissions have declined, and combined stationary and mobile CO<sub>2</sub> production has increased by a mere 1.7% from 2001 thru 2019 (and actually fell -1% in 2020 - an atypical year due to COVID travel reductions).

Commercial customers account for 54% of Leon County CO<sub>2</sub> production from electricity and natural gas use and residential customers for 46%. CO<sub>2</sub> releases attributable to residential gas use decreased by about 34% on a per-customer basis over the 2003-2019 period (37% due to atypical COVID driven reductions in 2020).

Meanwhile per capita CO<sub>2</sub> emissions per year have declined by 16.3%, from 12.1 to 9.8 tons, over the 2003-2019 period. This decline is almost entirely due to reductions in CO<sub>2</sub> production from stationary sources (City

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<sup>1</sup> <https://www.talgov.com/sustainability/cleanenergyplan.aspx>:

of Tallahassee electric and gas plus Leon County customers of Talquin Electrical Cooperative). Although total CO<sub>2</sub> production from stationary sources rose steadily from 2001 to 2008, it has since fallen below 2001 levels.

The declines in per-capita Leon County CO<sub>2</sub> electricity emissions are largely attributable to improvements in utility generation efficiency and drops in annual average customer kWh consumption. The City of Tallahassee has also achieved some savings through a wide variety of demand reduction interventions with individual commercial and residential customers, plus Talquin Electrical Cooperative has an active energy audit program.

Because of efficiency improvements at City of Tallahassee generating stations and a switch to natural gas as the only fuel,<sup>2</sup> the CO<sub>2</sub> produced per megawatt-hour of electricity generation fell steadily from 1991 to 2013. More recent declines are in part attributable to recent growth in private and public solar generating capacity and will hopefully continue as more efficient generators and solar generation are brought online in the future. Talquin Electric Cooperative is also expected to bring some photovoltaic generating capacity online soon.<sup>3</sup>

Adding up “degree-days” is a way to summarize demand for heating and cooling. Each day is assigned a number of degree-days according to how much its average temperature is below (heating degree days or HDD) or above (cooling degree days or CDD) 65 degrees. From 2000 to 2020, Tallahassee experienced a dramatic 24% reduction in the number of heating degree days due to warmer temperatures. In fact, 5 of the lowest (warmest) HDD years across the 21-year record examined here happened in the past 7 years!

This discernable warming trend has resulted in a significant 23% drop in the annual average City of Tallahassee utility customer consumption of natural gas. Average residential customer annual use dropped from 33.8 MCF<sup>4</sup> in 2000 to 21.2 in 2020. This has resulted in a decrease in average residential natural gas CO<sub>2</sub> emissions per customer across the system.

Comparably, one would anticipate a gradual increase in average residential customer electrical utility consumption from cooling homes across Leon County due to a gradual “warming” of summers too. However, this has *not* occurred and is examined later in this report.

Miles driven and gallons of gasoline consumed have risen as population and number of vehicles have risen, with little or no change in miles or gallons per vehicle or per capita. Thus, mobile sources show no change in per capita CO<sub>2</sub> production, but do show a total modest increase consistent with increases in population and number of vehicles.

Electric vehicle sales have risen dramatically nationally and across Florida over the past few years. Florida annual sales of all electric and plug-in hybrid electric vehicles together have skyrocketed almost 600% over the past 5 years, growing from 6,111 in 2016 to 42,754 in 2021.<sup>5</sup> According to the Southern Alliance for Clean Energy, electric cars made up nearly 3% of all cars sold in Florida last year and Florida has the second-most registered electric cars in the country, with a little over 58,000 as of February 2022. According to vehicle

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<sup>2</sup> Some of the generators are also able to burn oil.

<sup>3</sup> <https://www.talquinelectric.com/2022/01/13/press-release-solar-projects/>

<sup>4</sup> One MCF is equivalent to 1,000 cubic feet (or 1 million BTUs) of natural gas.

<sup>5</sup> <https://wusfnews.wusf.usf.edu/environment/2022-02-13/florida-no-2-in-nation-for-electric-cars-about-to-get-a-boost-to-its-charger-network>

registration data, Leon County had 893 privately-owned EVs on the road as of July 2021.<sup>6</sup> National sales constituted 2.2% of all vehicles purchased, led by Californians purchasing more than 250,000 electric light-duty vehicles in 2021, constituting more than 12% of all new car purchases that year.

Ridership on Star Metro peaked in 2011 and has since declined, dropping precipitously during the 2019-2020 COVID period. The percentage of the Leon County workforce commuting alone in a car was just over 80% throughout 2001-2016, then dropping slightly in 2020 to 78.8% (again likely due to COVID reducing the number of automobile commuters). About 2.8% of Leon County workers commuted on foot or bicycle in 2020 consistent with earlier 2000-2016 results.

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<sup>6</sup> *Electric Vehicle Readiness*, report prepared for the Tallahassee City Commission, July 13, 2022; <http://go.boarddocs.com/fla/talgov/Board.nsf/goto?open&id=CG3SGY72B043>

## Table of Contents

<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>INTRODUCTION .....</b>	<b>5</b>
<b>SOURCES OF CO<sub>2</sub> PRODUCTION IN LEON COUNTY .....</b>	<b>7</b>
TOTAL CO <sub>2</sub> PRODUCTION .....	10
<b>STATIONARY SOURCES .....</b>	<b>13</b>
ELECTRICAL USAGE .....	15
<i>Carbon Intensity</i> .....	15
CO <sub>2</sub> PRODUCTION ATTRIBUTABLE TO ELECTRICAL USAGE .....	17
<i>Residential Usage</i> .....	18
<i>Commercial Usage</i> .....	18
NATURAL GAS USAGE .....	20
<i>Tallahassee Heating and Cooling Degree Days (HDD/CDD)</i> .....	22
SOLAR ENERGY .....	24
<i>Solar Energy Capacity</i> .....	24
<i>CO<sub>2</sub> Offset</i> .....	29
DEMAND SIDE MANAGEMENT .....	31
<b>MOBILE SOURCES .....</b>	<b>35</b>
CO <sub>2</sub> PRODUCTION ATTRIBUTABLE TO LEON COUNTY MOTOR VEHICLES .....	35
<i>Electric Vehicle Sales</i> .....	37
<i>Bus Travel</i> .....	38
<i>Carpooling</i> .....	41
<i>Bicycle Infrastructure</i> .....	42
<b>DATA SOURCES, ASSUMPTIONS &amp; CONVERSION FACTORS .....</b>	<b>43</b>



## Introduction

**Purpose:** To collect in one place information about carbon dioxide production in Leon County to help guide planning by local governments and community partners. Such planning would assist us in identifying a path acceptable to our community and consistent with other sustainability efforts to reduce CO<sub>2</sub> emissions as our contribution to the global effort to minimize human-caused climate change. This document can be used to monitor progress toward related objectives and goals adopted as part of a community planning process. On February 20, 2019, the Tallahassee City Commission took the step of committing to transition Tallahassee city-wide to a 100% clean, renewable energy future by 2050. A Clean Energy Plan for reaching this goal is under development.

**Perspective:** The focus of this report is on total CO<sub>2</sub> emissions attributable to energy use by Leon County residents, governments, businesses, and other institutions and the key factors contributing to those emissions. Two major domains are included:

- Stationary sources (homes, businesses, factories)
- Mobile sources (cars, trucks, busses, motorcycles)

Reductions in CO<sub>2</sub> production can result from less use of energy to do useful work (e.g., driving fewer miles or resetting thermostats for heating and cooling), more efficient use of energy (e.g., more efficient light bulbs, electric power generators, or automobiles) and/or changes in the mix of energy sources (e.g., from natural gas to solar or wind). The optimal path for Leon County's reduction of CO<sub>2</sub> emissions over a 28-year period will include contributions from all three of these approaches, but their relative importance remains to be determined by and for our community.

Because the "percent of energy from renewable sources" bears an inverse relationship to CO<sub>2</sub> emissions, we believe the focus should be on reducing net CO<sub>2</sub> production, ideally to zero. CO<sub>2</sub> emissions account for about 88% of all greenhouse gas emissions in Florida.<sup>7</sup>

**Time frame:** All measures are calculated with as long a baseline as possible (at least ten years) and should be recalculated annually going forward.

**Geographic scope:** Leon County. This report includes all relevant data from both the City of Tallahassee (COT) utility and Talquin Electric Cooperative (TEC) and other available Leon County private and public sources. The data includes electricity and natural gas provided to COT customers in Leon County both within and outside the city, and electricity provided by TEC to customers within Leon County.<sup>8</sup>

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<sup>7</sup> The Florida Department of Environmental Protection estimated that in 2010, greenhouse gasses other than CO<sub>2</sub> (methane, sulfur and nitrogen oxides, and hydrofluorocarbons) accounted for the remaining 12% of CO<sub>2</sub>-equivalents released in the state. The non-CO<sub>2</sub> sources includes releases from wastewater treatment and landfills, refrigerants, and burning of wood for fuel and from wildfires. Except for landfills, the contribution from these other greenhouse gasses is not accounted for in this report. Since an update has not been issued, we assume that this relationship is relatively constant.

<sup>8</sup> Information about MWh of electricity sold by Talquin Electric Cooperative, and number of customers, by year, for commercial and residential customers: Florida Public Service Commission annual documents entitled Statistics of the Florida Electric Utility Industry, accessible from <http://www.psc.state.fl.us/Publications/Reports#>.

**Data sources:** Data are obtained from a wide variety of publicly available sources: US Energy Information Administration, Florida Department of Transportation, Florida Department of Highway Safety, Florida Department of Revenue, Florida Public Service Commission, City of Tallahassee annual reports to bondholders and ten-year site plans, Star Metro transit authority in Tallahassee, Talquin Electric, and various individual staff members in these agencies. Conversion factors are obtained from websites supported by the US Environmental Protection Agency. See Data Source Section at end for more detail.

**Organization of This document:** This document addresses three domains: stationary sources (buildings); mobile sources (vehicles); and the combination of these two. As more and more electric vehicles enter service, the distinction between stationary and mobile sources will become less sharp given that EVs are powered by electricity from a stationary source.

**Limitations:** Some relatively small contributors to greenhouse gas emissions do not have time trend data available or only have data available for the whole of Florida: LPG gas (propane), jet fuel, and methane and other non-CO<sub>2</sub> greenhouse gasses. Some aspects of energy demand reduction and of bicycle infrastructure have limited baseline data.

Future iterations will likely account for greenhouse gas releases occurring during the extraction, processing, or distribution of natural gas used in Leon County to generate electricity or to heat buildings but are not accounted for here. The following are not accounted for in this document:

- CO<sub>2</sub> produced elsewhere associated with goods and services consumed in Leon County.
- CO<sub>2</sub> and methane releases associated with waste management and wastewater treatment.
- Life cycle CO<sub>2</sub> costs of energy production, infrastructure, and distribution, or any additional industrial emissions of greenhouse gasses.

## Sources of CO<sub>2</sub> Production in Leon County

<b>CO<sub>2</sub> Produced in Leon County in Tons and Percentage by Category, 2018 and 2020</b>				
<b>Sources</b>	<b>Tons of CO<sub>2</sub></b>	<b>% of CO<sub>2</sub></b>	<b>Tons of CO<sub>2</sub></b>	<b>% of CO<sub>2</sub></b>
	<b>2018</b>	<b>2018</b>	<b>2020</b>	<b>2020</b>
<b>Commercial Electric, City of Tallahassee</b>	721,533	21.2%	622,614	19.6%
<b>Residential Electric, City of Tallahassee</b>	510,456	15.0%	502,950	15.9%
<b>Commercial Gas, City of Tallahassee</b>	105,256	3.1%	99,007	3.1%
<b>Residential Gas, City of Tallahassee</b>	35,673	1.0%	34,075	1.1%
<b>Commercial Electric, Talquin Electric Co-op</b>	86,189	2.5%	86,735	2.7%
<b>Residential Electric, Talquin Electric Co-op</b>	266,827	7.9%	276,254	8.7%
<b>Mobile Sources (cars, trucks, buses etc.)</b>	1,431,401	42.1%	1,307,078	41.2%
<b>Propane sold in Leon County and City of Tallahassee</b>	15,281	0.45%	15,359	0.48%
<b>Jet Fuel (0.42% of state total)</b>	120,512	3.5%	128,833	4.1%
<b>Methane from Leon County Landfill, City Gas Utility, &amp; FSU (CO<sub>2</sub>e)*</b>	105,596	3.1%	98,093	3.1%
<b>Totals</b>	<b>3,398,723</b>	<b>100%</b>	<b>3,170,997</b>	<b>100%</b>
<b>*ghgdata.epa.gov</b>				

In addition to CO<sub>2</sub> released from stationary and mobile sources, the table also includes CO<sub>2</sub> released from burning propane sold in Leon County and the City of Tallahassee; CO<sub>2</sub> released from Leon County's state share of jet fuel; and CO<sub>2</sub>e equivalents for methane released from the Leon County landfill, the City of Tallahassee's natural gas distribution system, and FSU. Propane, jet fuel, and methane sources shown here are not addressed in later sections of the document.

The City of Tallahassee and Leon County each assess a 10% Public Service Tax on the value of propane sold in their jurisdiction. In 2018, collectively all Leon County residents and businesses purchased 2,406,427 gallons of propane; and in 2020, the volume of 2,418,799 gallons was only slightly larger.<sup>9</sup>

Using the value of 12.7 pounds of CO<sub>2</sub> released per gallon of propane burned, we estimate that the total propane sold in 2018 contributed 15,281 tons of CO<sub>2</sub> to the atmosphere, or 0.45% of the total, while the 2020 total increased slightly to 15,359 tons representing only 0.48%. However, the total thereafter increased significantly to 24,476 tons as propane sales increased in 2021.

<sup>9</sup> Provided by City of Tallahassee and Leon County staff.

Jet fuel use accounts for 16% of fossil fuel energy used in Florida.<sup>10</sup> Its use is concentrated in the top 10 Florida airports, which account for 95% of passengers. Tallahassee's airport accounts for just under half of a percent of Florida passengers. If Leon County's share of jet fuel use is also 0.5%, then in 2018 CO<sub>2</sub> from jet fuel was 120,512 tons - the equivalent of nearly 4% of Leon County CO<sub>2</sub> production for that year. Using the same .5% of all passengers in 2019 this value increased slightly to 128,833 tons representing not quite 4% of Leon County total emissions. Since 2020 values are not yet available 2019 reported values are used for 2020 in this analysis. However, volumes likely declined as did other transportation modes, due to COVID travel reductions.

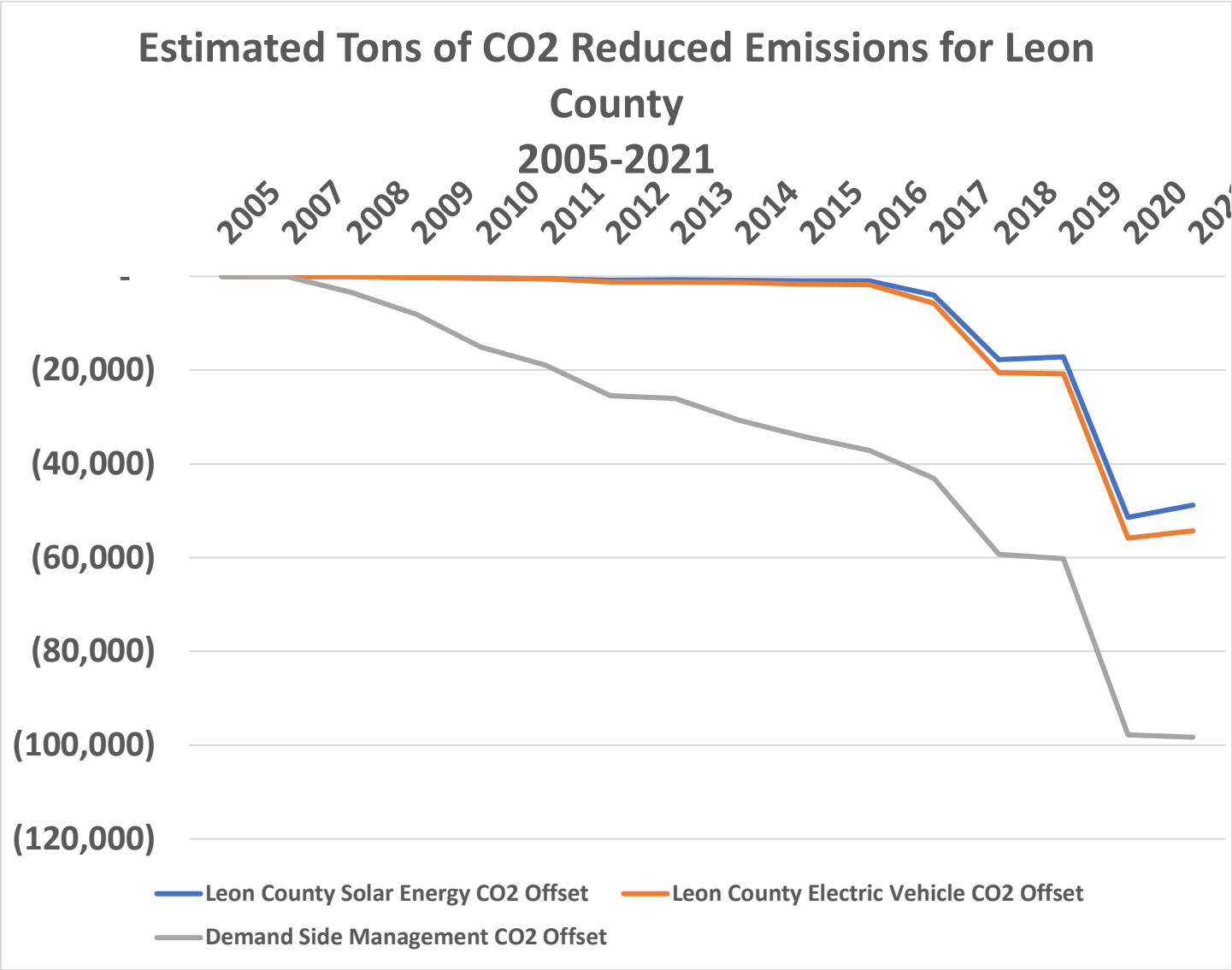
Total combined City of Tallahassee and Leon County annual CO<sub>2</sub> emissions are estimated to have amounted to 3,398,723 tons in 2018 and have declined by 6.7% to 3,170,997 tons by 2020. As noted throughout this report however, these measured declines likely represent substantial decreases in mobile and fixed sources generation driven by the COVID pandemic related travel reductions, personal confinement, and social interaction restrictions in place over much of 2020. Another full year without these restrictions is necessary for full consideration of meaningful intertemporal trends over time.

However, as the following graph provides, some of the significant downward movement in the annual estimates of CO<sub>2</sub> production is also attributable to forecast reductions in the tons of CO<sub>2</sub> emissions for Leon County resulting from specific local initiatives carried out over the past 17 years. These initiatives included purchase and operation of electric vehicles, installation of solar energy generating technologies, and implementing demand side management strategies.

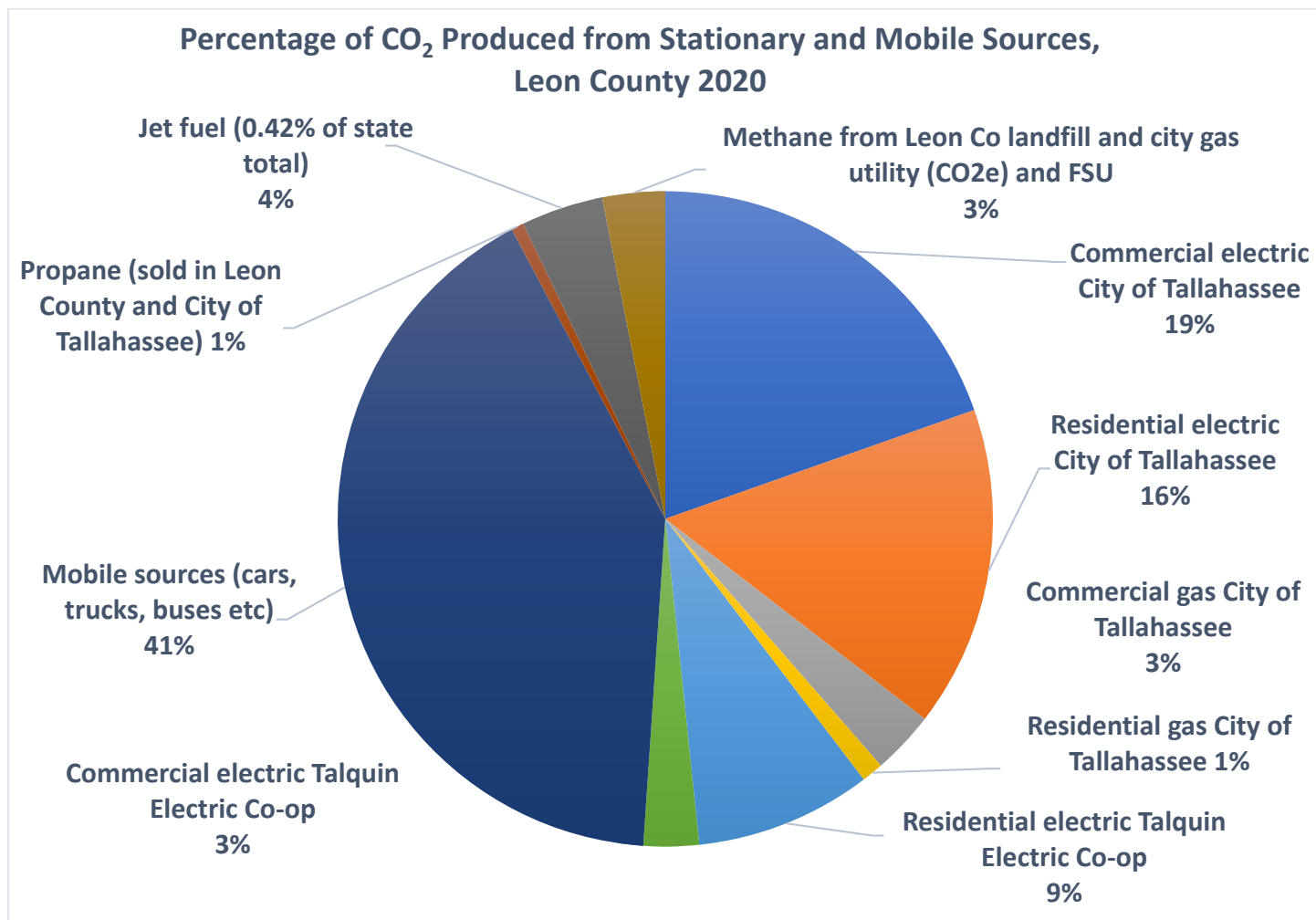
These activities were undertaken by local governments, energy providers, individuals, business, and other institutions. Taken together these actions are estimated to have reduced total annual Leon County CO<sub>2</sub> emissions by almost 100,000 tons or 3.1% by 2021. While this is a small percent of the total, we can all agree that much needs to be done by all of us to accomplish the city's lofty goal of city-wide 100% clean, renewable energy use by 2050. Nevertheless, our community should take a moment to reflect and be proud that it has made a conscious and significant start. We are on the right path. Let us all continue to move forward and together with reenergized determination. Further details on these reductions are included later in this report.

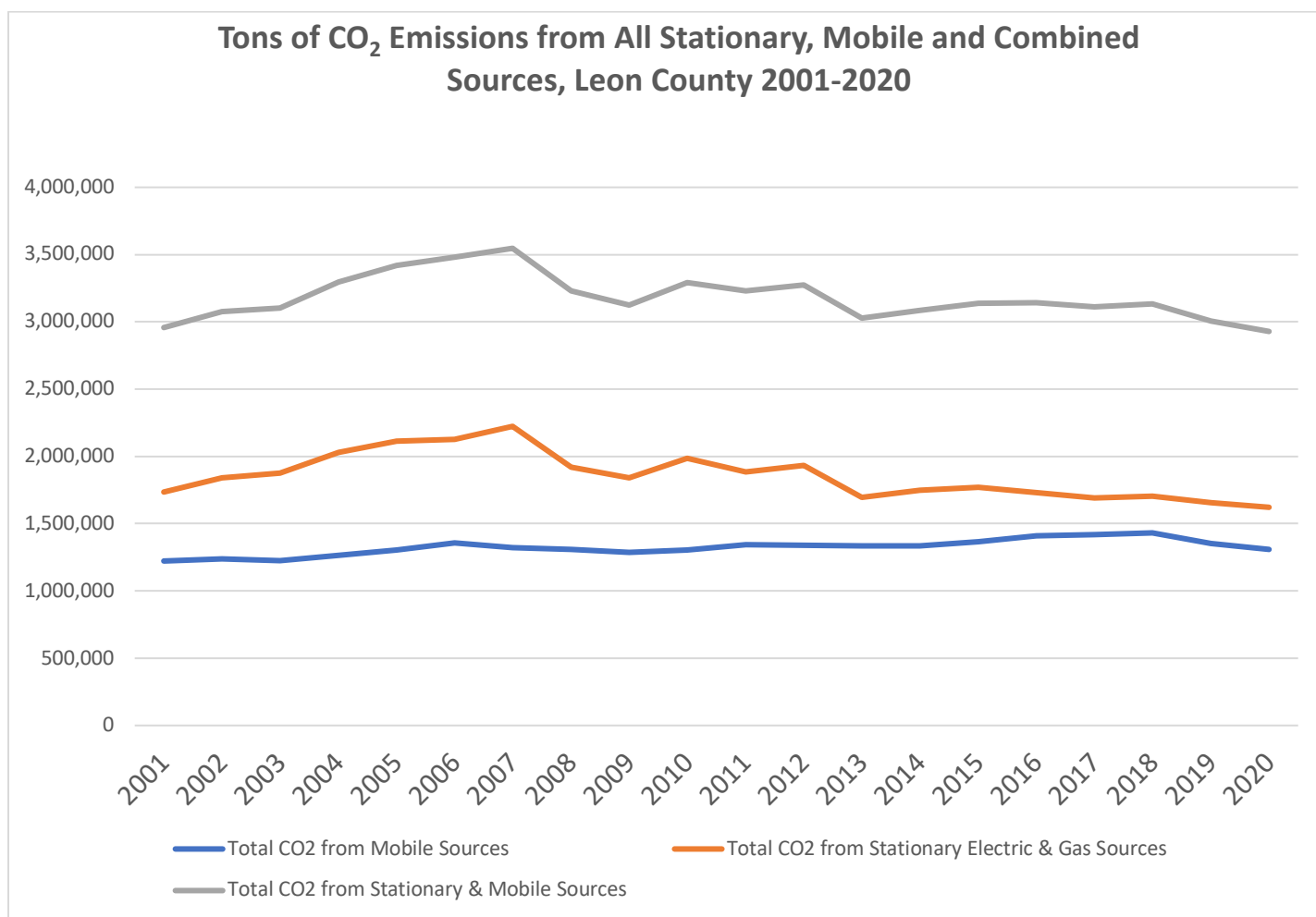
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<sup>10</sup> Information about jet fuel and liquid gas in Florida as a whole: US Energy Information Administration's State Energy Data System (SEDS) at [https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep\\_use/total/use\\_tot\\_FLcb.htm%20l&sid=FL](https://www.eia.gov/state/seds/data.php?incfile=/state/seds/sep_use/total/use_tot_FLcb.htm%20l&sid=FL)



## Total CO<sub>2</sub> Production

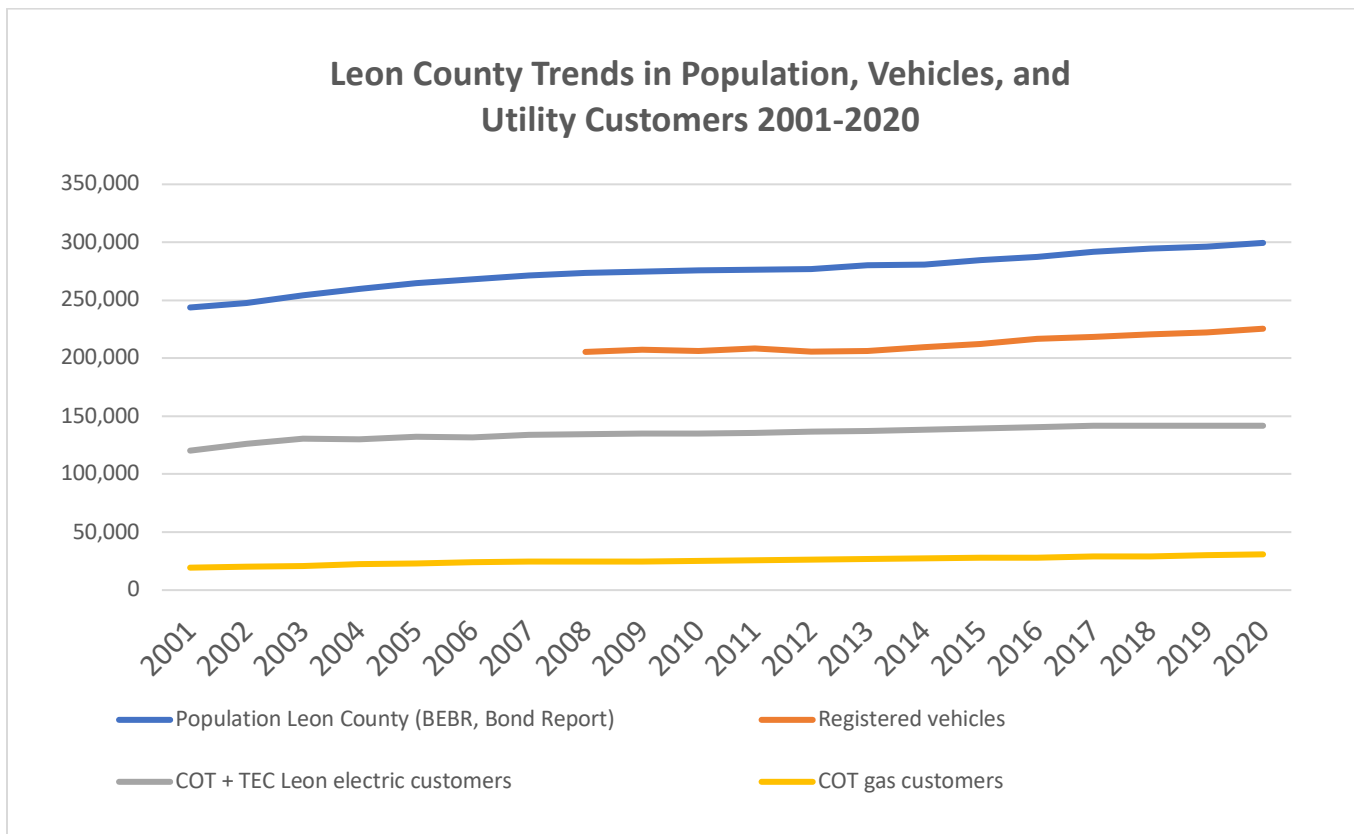




Total annual CO<sub>2</sub> emissions attributable to Leon County residents and businesses have been essentially stable since 2008 with stationary sources noticeably declining and mobile sources gradually increasing (though declining during the recent COVID years).<sup>11</sup> Stationary sources accounted for 55.4%, while mobile sources account for 44.6% of total CO<sub>2</sub> production in 2020, shifting somewhat from 58.7% stationary and 41.3% mobile in 2001, reflecting general population and vehicle use growth.

Meanwhile the population of Leon County, the number of electrical customers, the number of natural gas customers, and the number of vehicles have all been steadily increasing.

<sup>11</sup> Sum of stationary and mobile sources excludes propane, landfill, city gas, FSU, and jet fuel for which long run data is not available.



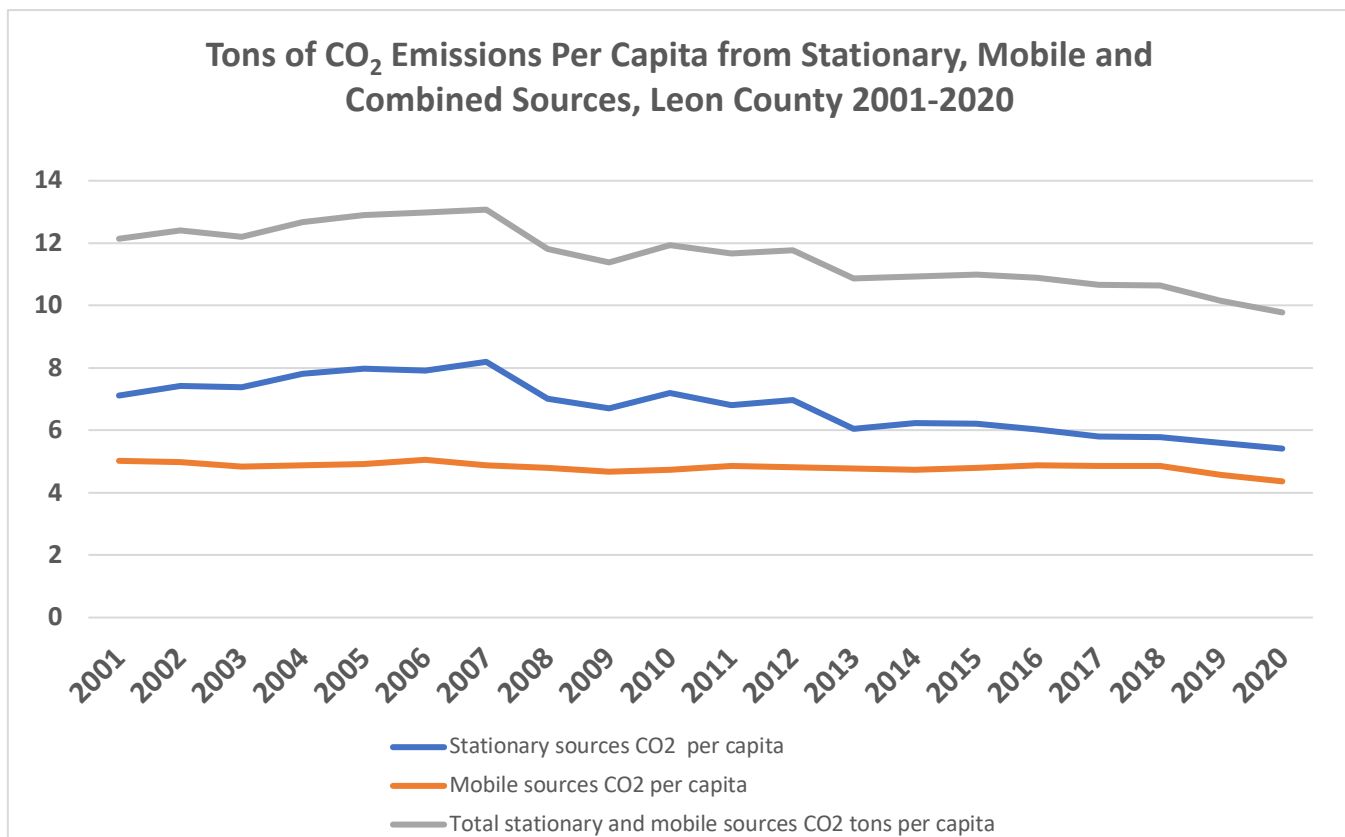
Adjusted for population growth, the per capita CO<sub>2</sub> production from stationary and mobile sources has been downward from 2001 through 2020. The cumulative decline is 19.4%, from 12.1 to 9.8 tons per capita per year.

Interestingly, over the same 20-year timeframe while the number of COT residential electric customers has grown 23.8%, the annual residential load has grown only 15.6%. This in part due to average residential customer use falling 10.8% over the same period. This is partly explained by the growing number of rooftop customer solar energy installations across the system and COT residential demand side education and management outreach initiatives as well as other factors described elsewhere in this report. Also, installation of more efficient appliances, better insulated homes, and higher energy prices are also driving average demand down. The City of Tallahassee 10 Year Site Plan supports this view.<sup>12</sup>

The long-term decline in CO<sub>2</sub> production from residential sources since 2007 is also driven by a large decrease in the COT utility’s CO<sub>2</sub> emissions due to switching from other fuels to natural gas and installation of more efficient and combined-cycle gas-burning electrical generation equipment.

<sup>12</sup> “The growth in customers and energy use has slowed in recent years due in part to the economic conditions ... as well as due to changes in the federal appliance/equipment efficiency standards ... (M)any customers have taken steps on their own to reduce their energy use and costs in response to the changing economy ... (D)emand and energy reductions achieved as a result of these voluntary customer actions ... appear to have had a considerable and lasting impact on forecasts of future demand and energy requirements. The latest projections reflect a revised outlook for DSM needs over the coming years.” Ten Year Site Plan April 2022, Page 14.



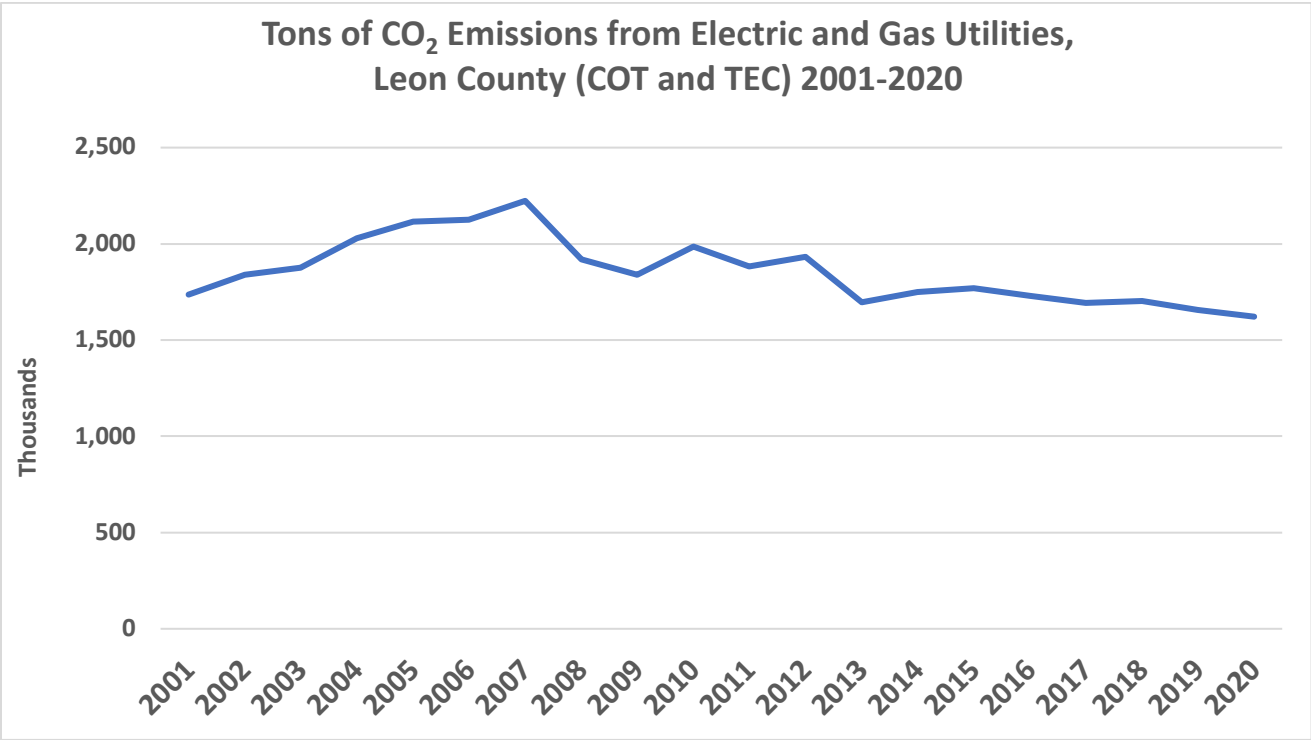
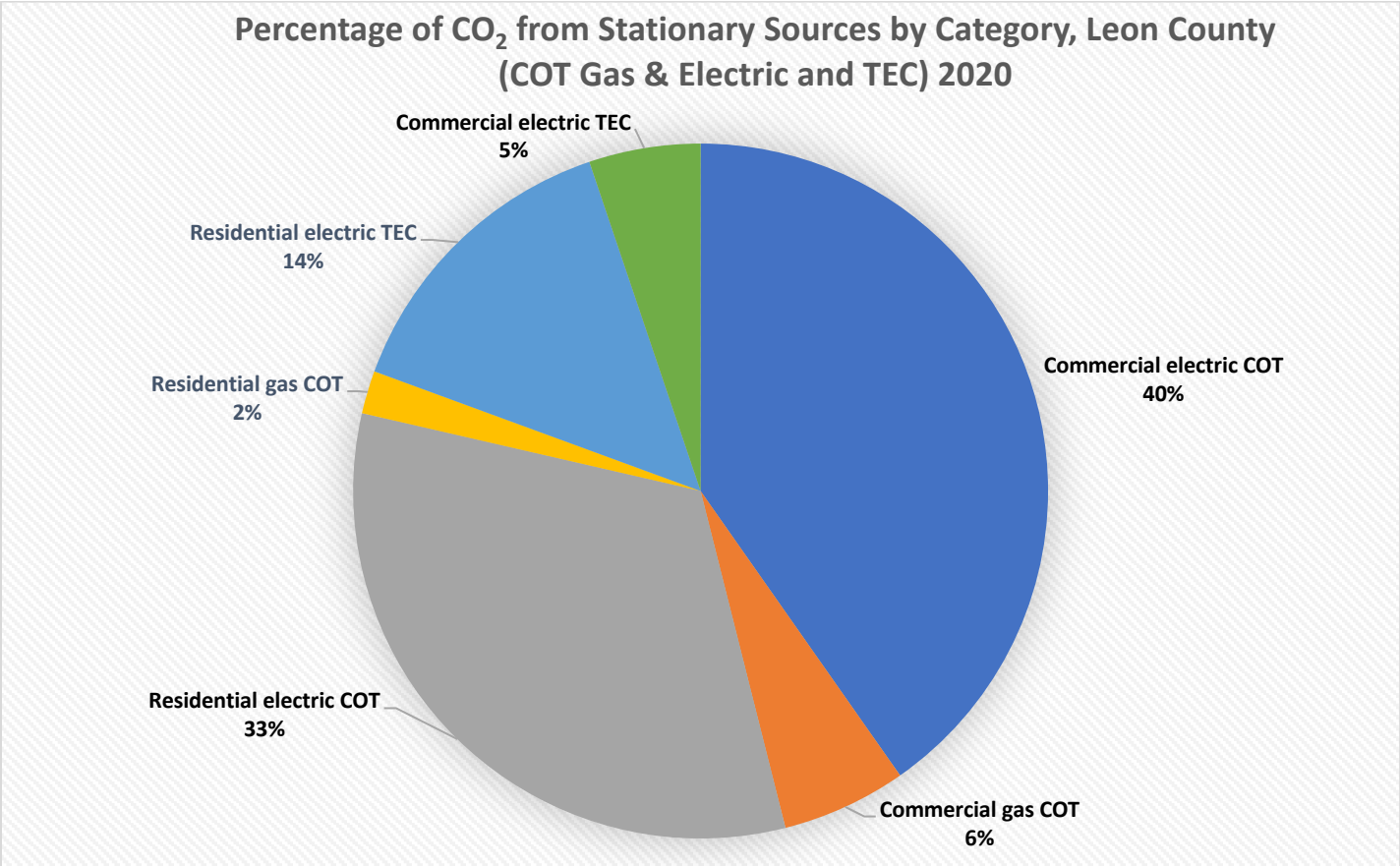


## Stationary Sources

Stationary sources are local sources of carbon dioxide production that have a fixed location including electric generation facilities, houses, office buildings, schools, stores, and factories. The emission sources for such production comes primarily from electric and natural gas use.

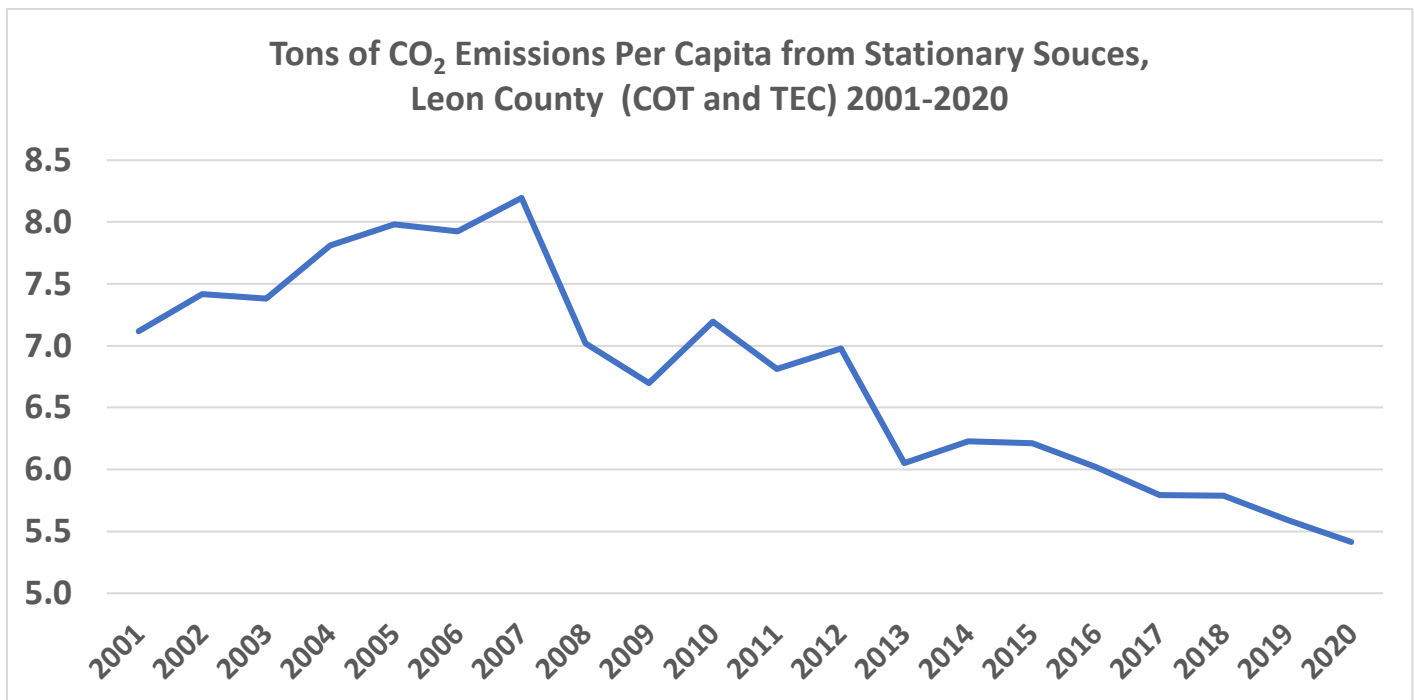
Total CO<sub>2</sub> production from stationary sources in Leon County (COT plus TEC) peaked in 2007, fell through 2013, and has been gradually declining since 2013.

For the COT utility in 2020, commercial electrical customers accounted for more CO<sub>2</sub> production than residential customers; the reverse is true for the TEC. Total commercial electric customers accounted for slightly more CO<sub>2</sub> production (51%) than residential electric customers (49%) in 2020. Electricity use accounted for much more of Leon County's stationary source CO<sub>2</sub> production (92%) than natural gas use (8%).



The decline from 2007 to 2013 mostly reflects the city’s shift from other fossil fuels to natural gas for electricity generation and installation of more efficient electric generating equipment. It also reflects stable or declining average per capita energy use by electricity customers and residential gas customers and some greater penetration of city and private customer solar installations. Since 2013 the net effect of greater use of lower emitting energy as well as more efficient production of electricity has resulted in almost flat total CO<sub>2</sub> production from stationary sources despite population growth.

On a per-capita basis, CO<sub>2</sub> production from stationary sources in 2020 was down 24% since 2001 (7.1 to 5.4 tons per capita), and 34% since 2007 (8.2 to 5.4 tons per capita). While this trend holds throughout the period, 2020 COVID impacts, and subsequent drops in demand from FSU, FAMU, State of Florida, and commercial customers, resulted in even further drops in demand. Some of these decreases may not be sustained.



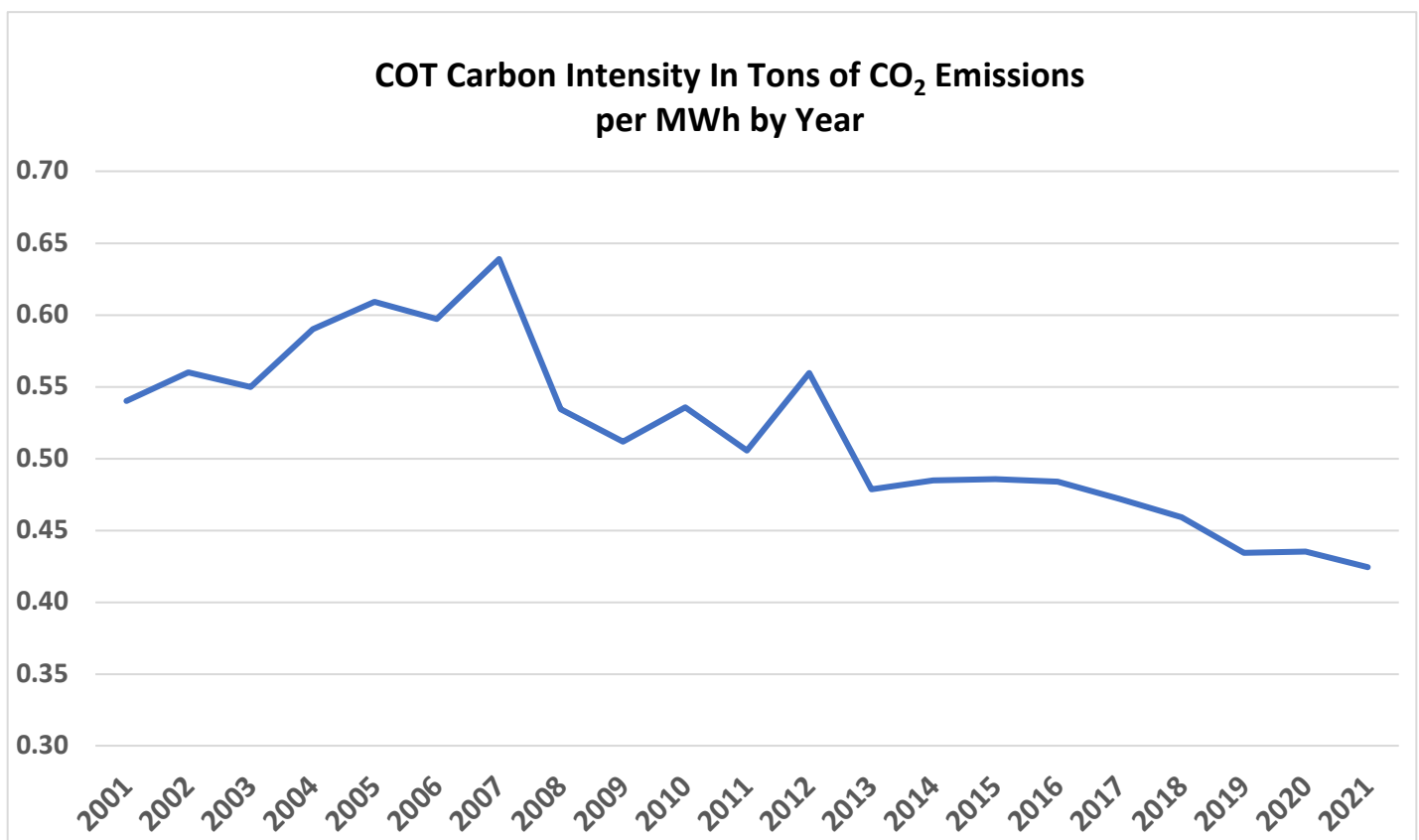
## Electrical Usage

### *Carbon Intensity*

The following chart provided by City of Tallahassee Electric Utility staff offers estimates of tons of CO<sub>2</sub> emissions per MWh by year, otherwise referred to as “carbon intensity.” The carbon intensity of electricity is the number of grams of CO<sub>2</sub> it takes to make one unit of electricity at one Megawatt per hour (MWh). Electricity that’s generated using various fossil fuels varies in carbon intensity. As mentioned earlier COT has switched to natural gas as its primary and less carbon intensive fuel beginning in 2008.

Note that from 2001 to 2007 the intensity increased but has since dropped by 33.6% - from .64 to .43. As discussed earlier this improvement reflects new higher efficiency generation equipment installed over time and lower carbon fuels. Technological improvements have led to improved efficiency of natural gas generators since the mid-1980s when combined-cycle plants began replacing older, less efficient steam turbines.<sup>13</sup> In addition, the electricity generated by the city's solar farms (discussed below) has also helped lessen the amount of total carbon fuels needed since 2018 and thereby the amount of CO<sub>2</sub> per MWh generated by the city utility.

While there have been steady declines in the COT's carbon intensity for electric generation over the past two decades, the rate of decline has been less in recent years. Also, the carbon intensity across the Tallahassee/Leon County region will hopefully continue to decline slightly as larger number of homeowners and businesses install private roof top solar systems. The county-wide CO<sub>2</sub> carbon intensity could also decline if newer, more efficient generating equipment and more solar facilities come on-line across the COT and TEC systems.

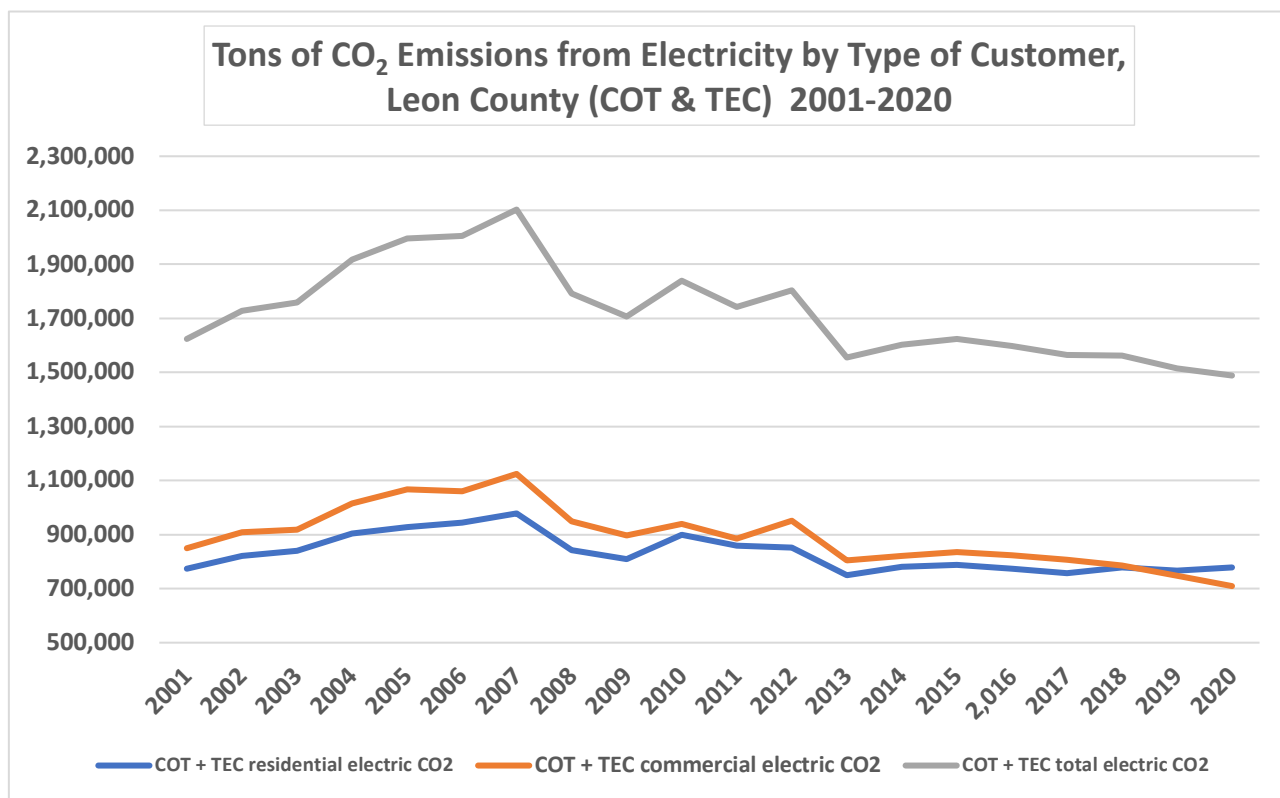


Talquin Electric Cooperative buys almost all its electricity from the Seminole Electric Co-op and just over half of Seminole's electricity comes from burning coal. The carbon intensity of TEC will also decrease as both Talquin and Seminole add utility scale solar and as more of their customers install solar photovoltaic systems.

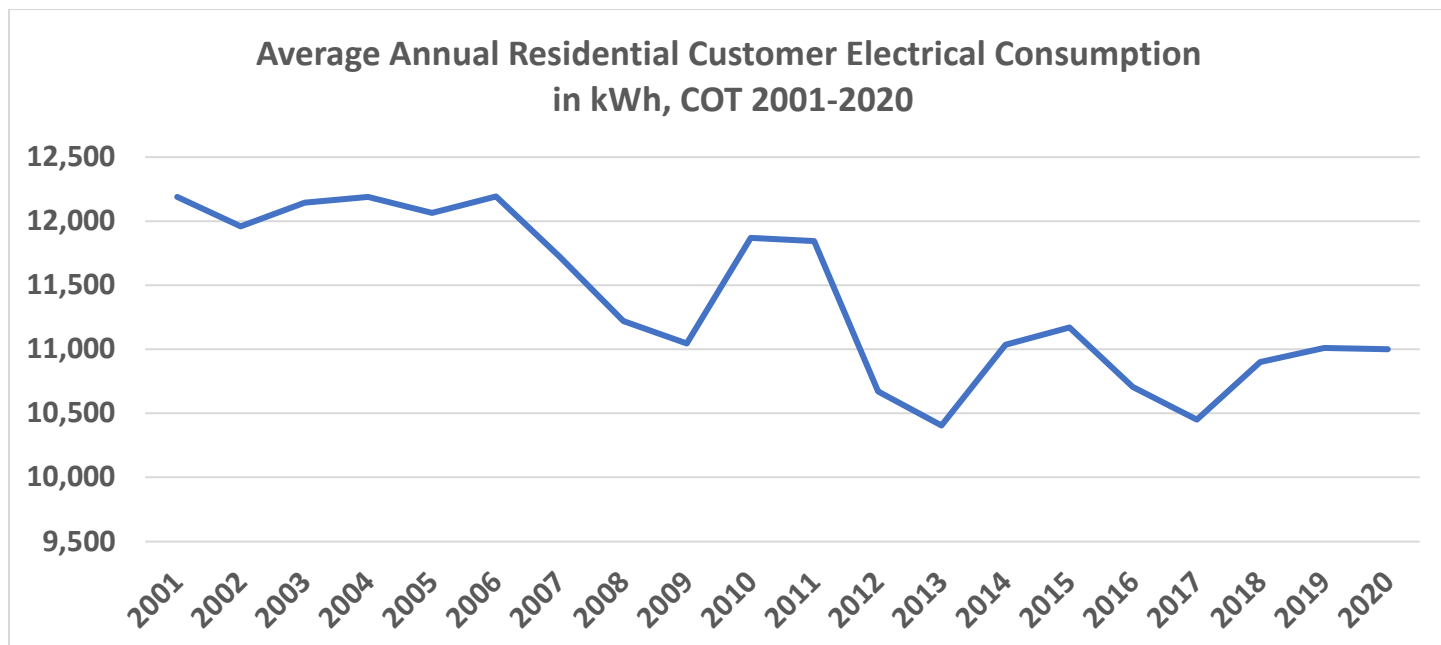
<sup>13</sup> <https://www.eia.gov/todayinenergy/detail.php?id=45496>

## CO<sub>2</sub> Production Attributable to Electrical Usage

Commercial and residential electricity customers each account for close to half of total CO<sub>2</sub> production from electricity. Commercial electrical demand and therefore CO<sub>2</sub> emissions fell below residential levels for the first time during the COVID years. Residential and commercial electric demand contributed 767,443 and 748,453 tons of CO<sub>2</sub> respectively across the county by 2020.



## ***Residential Usage***



The considerable declines in stationary per capita CO<sub>2</sub> emissions likely reflect several trends over this timeframe. Despite the continued growth in population (23% over the 2001-2020 period), as mentioned earlier COT and Leon County have experienced ongoing reduced electrical and gas energy use per customer. Also, a variety of consumer shifts to more efficient appliances like dual-cycle heat pumps have likely contributed to the decline. Other contributions include the addition of better insulated new and retrofitted older homes and buildings and decreased CO<sub>2</sub> production per MWh of electricity produced by the city utility. These result in average customer CO<sub>2</sub> drops and average per capita CO<sub>2</sub> falls as well.

## ***Commercial Usage***

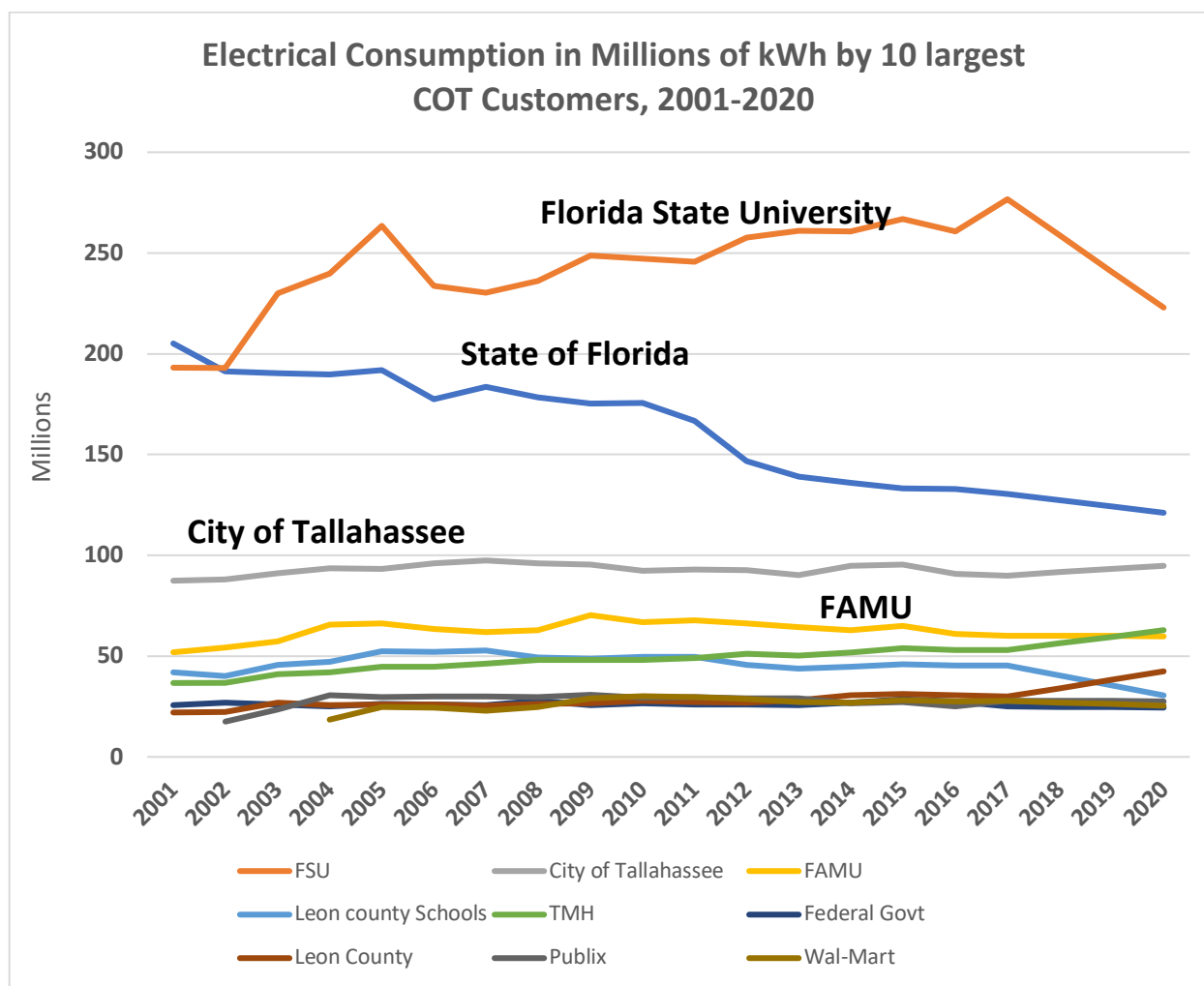
The ten biggest electric customers together used 27.2% of COT's electricity in 2020. FSU alone accounted for 8.5%, and state government for 4.6%. Consumption patterns can change rapidly over time and these 2020 values were considerably dampened by COVID confinement. The biggest 2020 declines were at educational institutions.

The consumption data does not account for changes over time in the number of square feet in each customer's establishment. FSU, FAMU, and Tallahassee Memorial Healthcare have steadily added buildings and square feet, while the number of state employees, and thus of square feet of state-owned office space in Tallahassee, has been steady or declining.

<b>Total Energy Consumption in kWh and Percentage of Total Electricity Consumption for 10 Biggest Tallahassee Electric Customers, 2020<sup>14</sup></b>				
	<b>kWh</b>	<b>kWh %</b>	<b>Revenue</b>	<b>Revenue %</b>
<b>Florida State University</b>	222,940,572	8.5%	\$ 15,466,226	6.2%
<b>State of Florida</b>	121,117,778	4.6%	\$ 9,234,184	3.7%
<b>City of Tallahassee</b>	94,949,517	3.6%	\$ 8,574,152	3.4%
<b>Tallahassee Memorial HealthCare</b>	62,888,379	2.4%	\$ 4,123,906	1.6%
<b>Florida A &amp; M</b>	59,899,762	2.3%	\$ 4,033,773	1.6%
<b>Leon County</b>	42,442,782	1.6%	\$ 4,458,755	1.8%
<b>Leon County School Board Leon County</b>	30,503,622	1.2%	\$ 2,334,600	0.9%
<b>Publix Markets</b>	27,634,499	1.1%	\$ 2,132,790	0.9%
<b>Wal-Mart</b>	25,389,794	1.0%	\$ 1,811,291	0.7%
<b>Federal Government</b>	24,449,257	0.9%	\$ 1,839,986	0.7%
<b>Totals</b>	712,215,962	27.2%	\$ 54,009,663	21.5%

If the National High Magnetic Field Laboratory (Mag Lab) at FSU were listed separately from FSU, it would be the fifth largest customer, and the rest of FSU would still be #1. Electricity consumption by the Mag Lab has been stable over the last ten years.

<sup>14</sup> City of Tallahassee Electric Utility Staff, 2022.

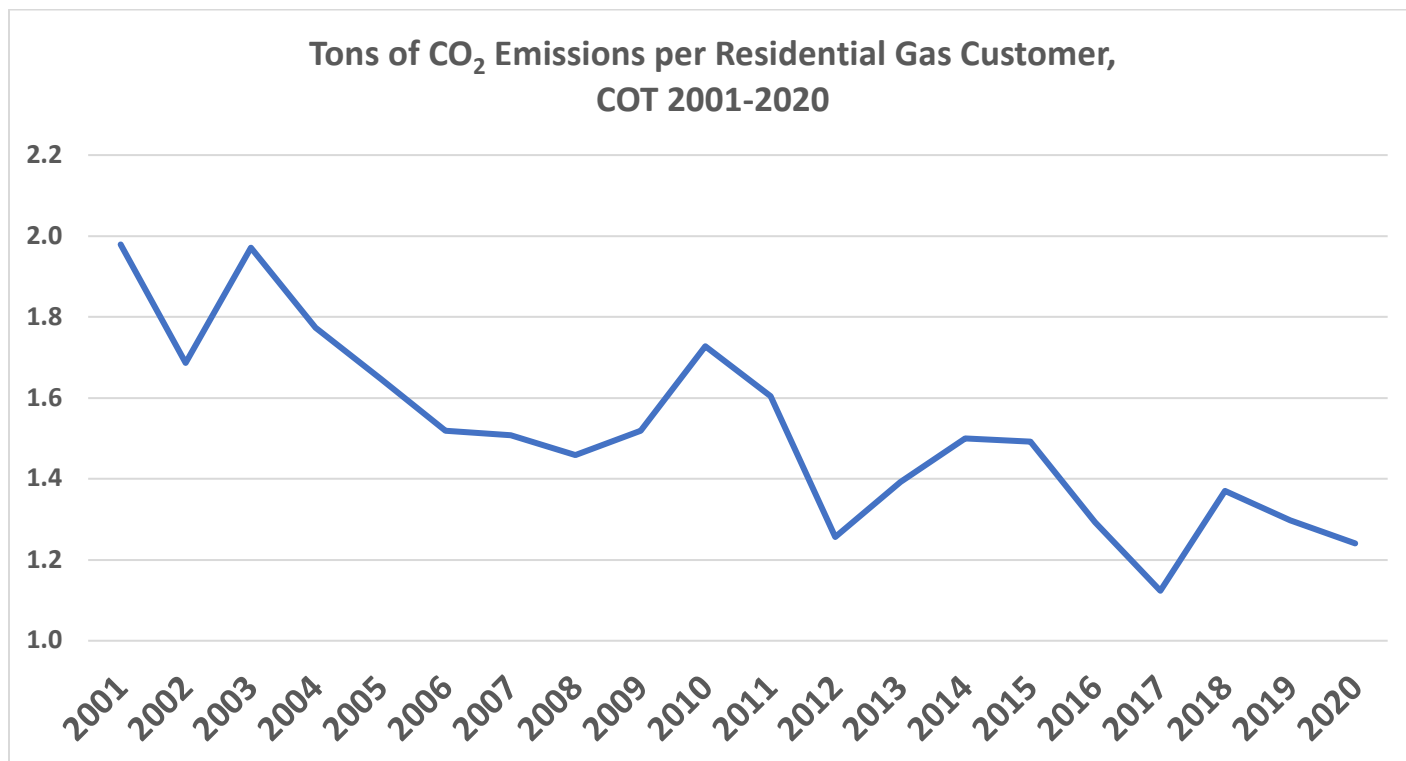
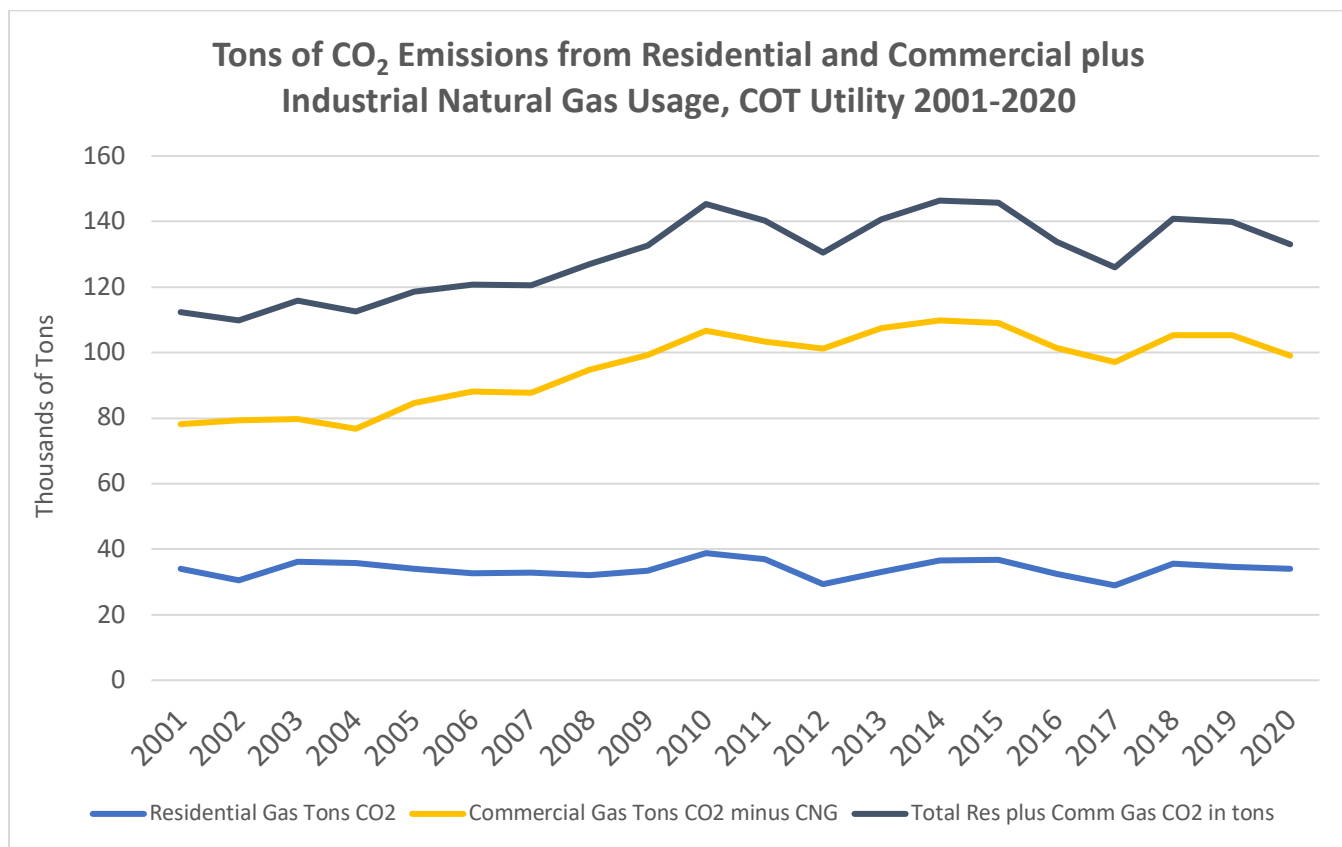


## Natural Gas Usage

The number of commercial gas customers has increased by 44% (1,464 to 2,103) over the 2001-2020 period, corresponding with a 31% increase in CO<sub>2</sub> releases attributable to natural gas use. Meanwhile, despite a 59% growth in residential gas customers (from 19,358 to 30,852) over the same period, total CO<sub>2</sub> releases attributable to residential customers have remained essentially the same in 2001 and 2020. This is because annual CO<sub>2</sub> emissions per residential gas customer declined from 2.0 to 1.2 tons, or about 40% as average residential gas consumption fell 37% from 34 to 21 Mcf over this period. Fall and winter outdoor temperatures in Tallahassee have risen (see discussion of heating/cooling days below), which has also contributed to reduced county-wide gas demand for heating homes, as well as newer homes that are served with gas being more efficiently built.

In 2001, there were 645 miles of gas distribution pipelines in Leon County. By 2020 the number of miles had expanded by 304 miles (or 16 miles per year) for a total of 949 miles.





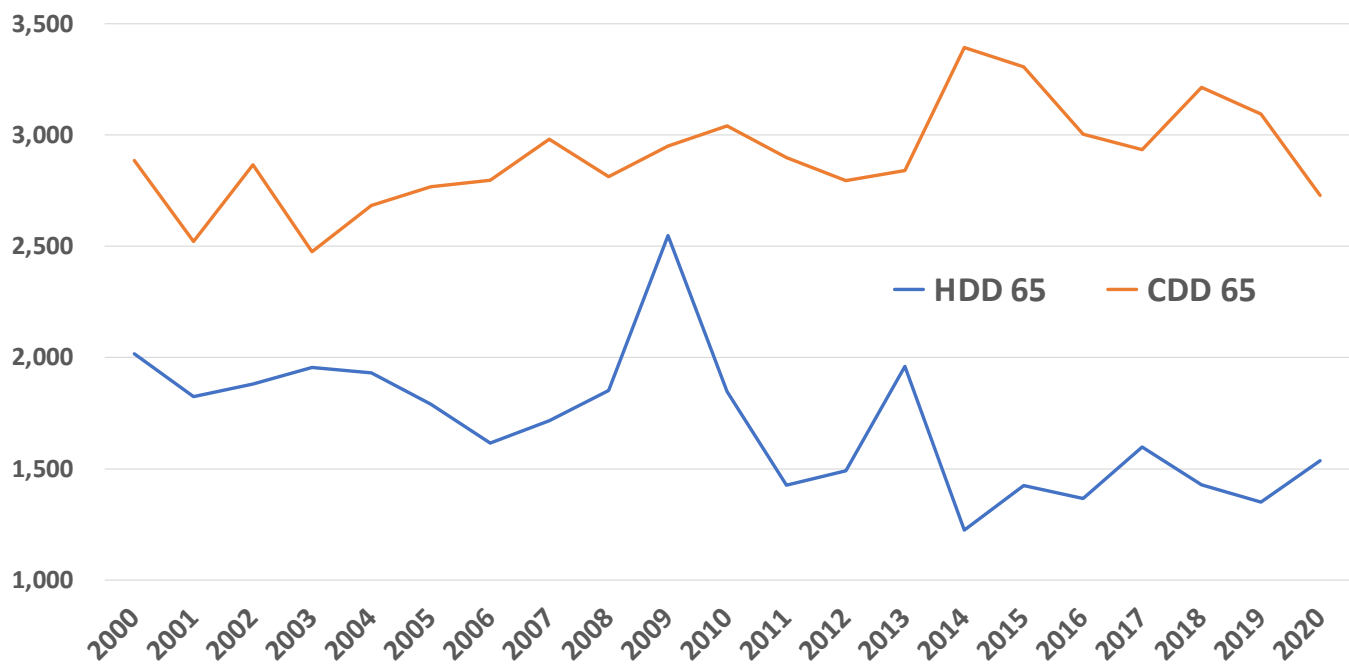
### ***Tallahassee Heating and Cooling Degree Days (HDD/CDD)<sup>15</sup>***

From 2000 to 2020, the Tallahassee-Leon County area experienced a gradual *increase* in the number of cooling degree days (in orange) and a larger *decrease* in the number of heating degree days (in blue).

Here we tabulate the annual total of heating degree-days, (HDD) and cooling degree-days (CDD). Degree days are measures of how cold or warm a location is. A *degree day* compares the mean (the average of the daily high and low) outdoor temperatures recorded for a location to a standard temperature, usually 65° Fahrenheit (F) in the United States. The more extreme the outside temperature, the higher the number of degree days.

For example, a day with a mean temperature of 40°F has 25 HDD. Two such cold days in a row have a total of 50 HDD for the two-day period. This provides an objective indication of how much a region is increasing or decreasing in outdoor ambient temperature and what the need to heat or air-condition indoor spaces will be and thus the required energy use for those purposes.

**Sum of Tallahassee Heating Degree Days (HDD) and Cooling Degree Days (CDD) 2000-2020**



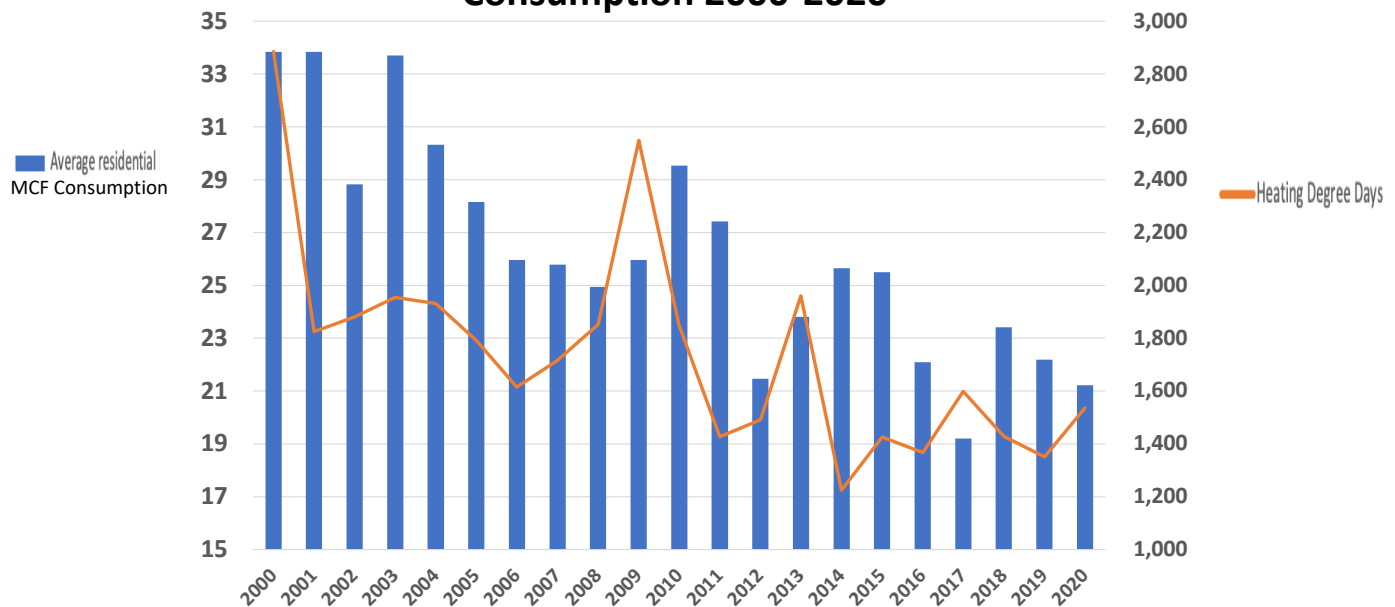
The annual number of heating degree days (requiring energy for heating interior spaces) in Tallahassee has fallen by 24% - from 2,017 in 2000 to 1,536 HDD by 2020. This trend suggests that on average 24% less electricity, natural gas and other fuels are required for year-round heating needs. Indeed, the previous

<sup>15</sup> Source: Bizee Degree Days website <http://www.degreedays.net> operated by Weather Underground using US National Weather Service data.

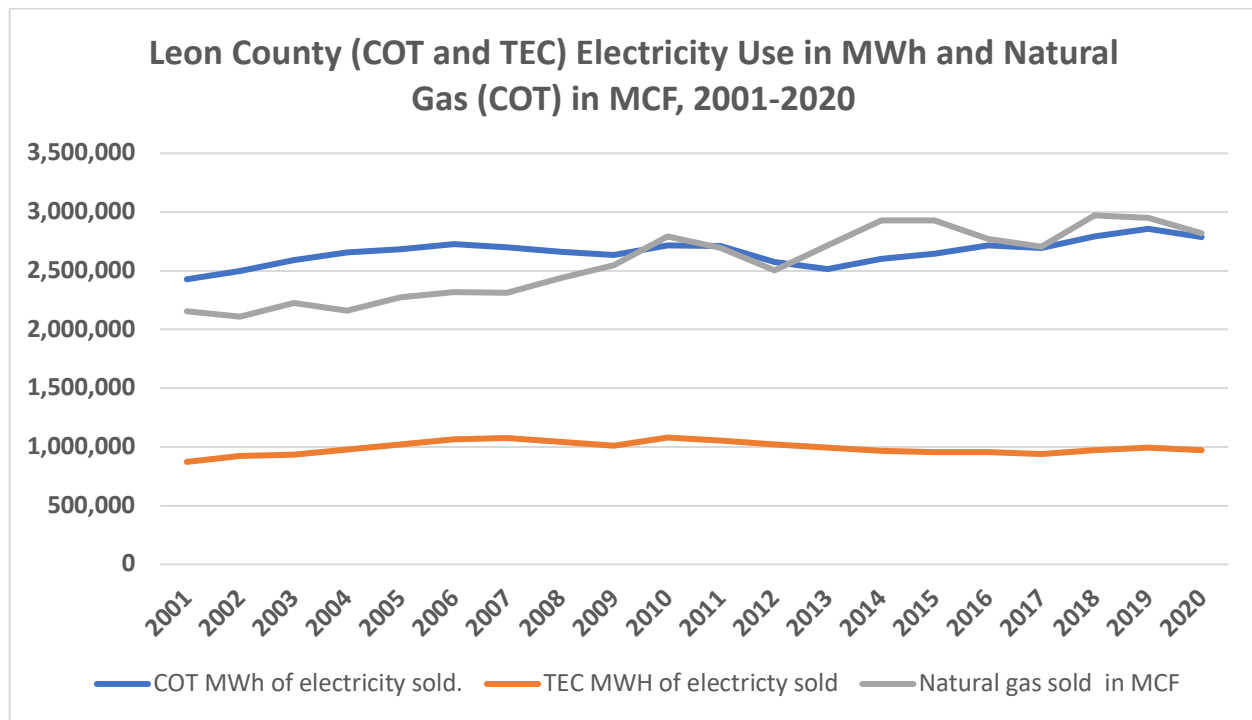
discussion and accompanying chart showed average residential natural gas consumption use falling significantly as heating degree-days fell over the last two decades.

Conversely, the average number of cooling degree days (requiring energy for cooling interior spaces) in Tallahassee has generally risen. During the decade 2001-2010 the annual average was 2,787 CDD. Every year thereafter (except 2020) exceeded that average, with the 2011-2020 decade averaging 3,021 CDD. This represents an 8.3% increase between these two decades. Yes, the warm/hot months are getting warmer as are the cooler months.

### Tallahassee/Leon County Heating Degree Days (HDD) and Average Residential Customer Natural Gas MCF Consumption 2000-2020



COT and TEC service areas have experienced slow but consistent population and natural gas residential customer growth but relatively flat total electrical energy production since 2006. While the total number of COT natural gas residential customers grew by 60% from 19,358 in 2001 to 30,852 in 2020, total natural gas consumption and therefore CO<sub>2</sub> emissions have increased only 31% - from 2,155,948 MCF in 2001 to 2,820,844 MCF by 2020. As mentioned earlier, average residential customer use also dropped of 58%, again likely reflecting the significantly reduced need to heat interior spaces over the cool season of the year as well as more efficient home heating equipment, insulations, and other efficiencies.



CO<sub>2</sub> production from natural gas is simply proportional to the amount used (in MCF), while CO<sub>2</sub> production from electricity is the product of amount used (seen here in MWh) and carbon intensity (tons of CO<sub>2</sub> released per MWh distributed).

## Solar Energy

### *Solar Energy Capacity<sup>16</sup>*

Leon County customer installed on-site and rooftop photovoltaic generating capacity rose steadily from 2007 to 2017 and dramatically thereafter thru 2021. The number of annual Leon County solar energy customer installations increased from 120 in 2011 to 706 in 2021, or by 588%. Meanwhile total customer-installed generating capacity jumped almost 1000% over that period - from 759 to 7,533 kWac.<sup>17</sup> In fact, customer capacity more than doubled over the 2019-2021 period alone.

<sup>16</sup> Note that solar energy “capacity” is the maximum amount of energy an installed system is built to produce and should not be confused with the amount of energy the system actually produces over a certain time period.

<sup>17</sup> Unlike utility generated electricity which flows as an alternating current (AC), electricity generated from solar panels flows as direct current (DC) and is then converted to AC for household use or for traveling via the grid. AC is safe and efficient over long distances and therefore is used across the world for powering our most common appliances (lights, tools, motors, generators and so forth) in homes and buildings. DC cannot travel very far before it begins to lose energy but is produced by solar panels and used in energy storage, cell phones and other appliance batteries and numerous other applications.

At the end of 2017, the City of Tallahassee and Origis Energy completed Solar Farm #1 at the Tallahassee Airport, with an installed capacity of 20,000 kWac supplying about 1.3% of COT utility's electrical energy production (in kilowatt-hours). In 2020 the utility significantly increased its solar energy generation with the completion of Solar Farm #2 that has a 42,000 kWac capacity, for a combined total of 62,00 kWac. In combination these arrays supply approximately 4% of the City of Tallahassee's annual energy needs.

The COT has no immediate plans for expanding current solar farm capacity due to the need to resolve regulatory constraints resulting from increased solar energy generation. Meanwhile, the Tally 100 Coalition (citizens energy advisory group) is trying to get the city to adopt clean energy initiatives within 5 to 10 years as part of the community planning process. These goals are likely to be ambitious given a 17- to 30-year time horizon for approaching or reaching 100% net renewable energy community-wide.<sup>18</sup>

These managed solar farms alone have more than seven times the capacity of all 706 customer installed solar units in Leon County as of 2021. Continued sizeable private and public investments of this scale and larger are essential to achieve significant CO<sub>2</sub> reductions here and across the nation and world.

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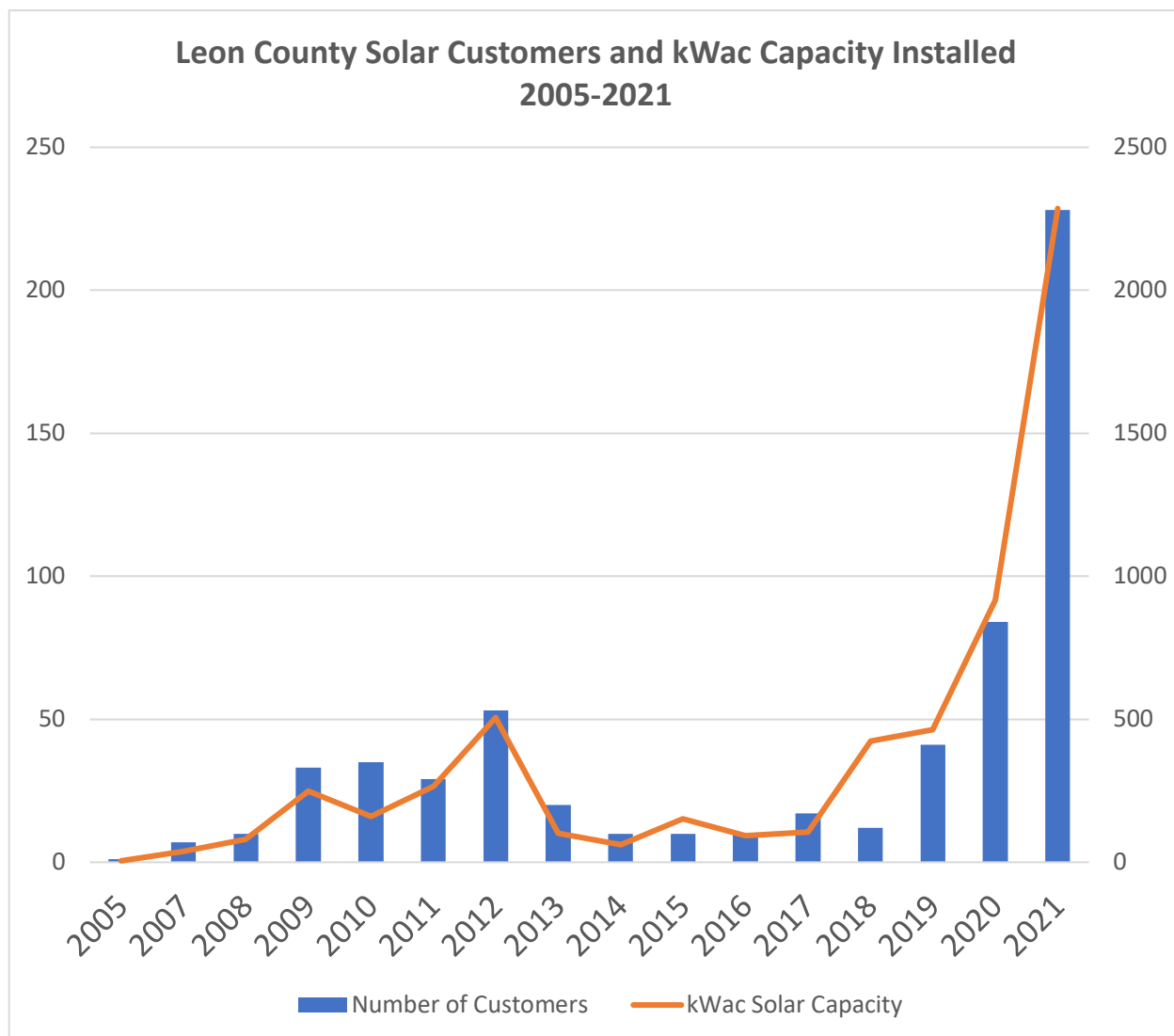
Source: Communications with Steve Urse, April 2022.

<b>Installed Solar Generation Capacity, Leon County (COT+TEC) 2005 to 2021</b>												
Year	COT Customer Installs	COT Cust. Installs Cum.	COT Cust. Annual kWac Installs	COT Cust. kWac Cum.	TEC Cust. Installs	TEC Installs Cum.	TEC Cust. Annual kWac	TEC Cust. kWac Cum.	Leon County Cust. installed Cum.	Leon County Cust. kWac Cum.	COT Solar Farm kWac	Leon County Cust. + COT Solar kWac Cum.
2005	1	1	4	4	0	0	-	-	1	4	-	4
2007	7	8	33	38	0	0	-	-	8	37	-	37
2008	10	20	69	109	0	0	-	-	20	106	-	106
2009	33	53	211	324	6	6	27	27	59	344	-	344
2010	35	88	136	463	6	12	29	56	100	509	-	509
2011	29	117	225	694	3	15	25	81	132	759	-	759
2012	53	170	430	1,134	6	21	29	110	191	1,218	-	1,218
2013	20	190	86	1,222	3	24	15	125	214	1,319	-	1,319
2014	10	200	53	1,276	5	29	103	228	229	1,475	-	1,475
2015	10	210	129	1,408	9	38	57	285	248	1,661	-	1,661
2016	10	220	79	1,489	5	43	22	307	263	1,762	-	1,762
2017	17	237	90	1,581	11	54	72	379	291	1,924		1,924
2018	12	249	360	1,949	10	64	90	469	313	2,374	20,000	22,374
2019	41	290	394	2,352	21	85	384	853	375	3,152	-	23,152
2020	84	374	779	3,150	58	143	593	1,446	517	4,525	42,000	66,525
2021	228	602	1,943	5,137	104	247	1,065	2,511	706	7,533	-	69,533

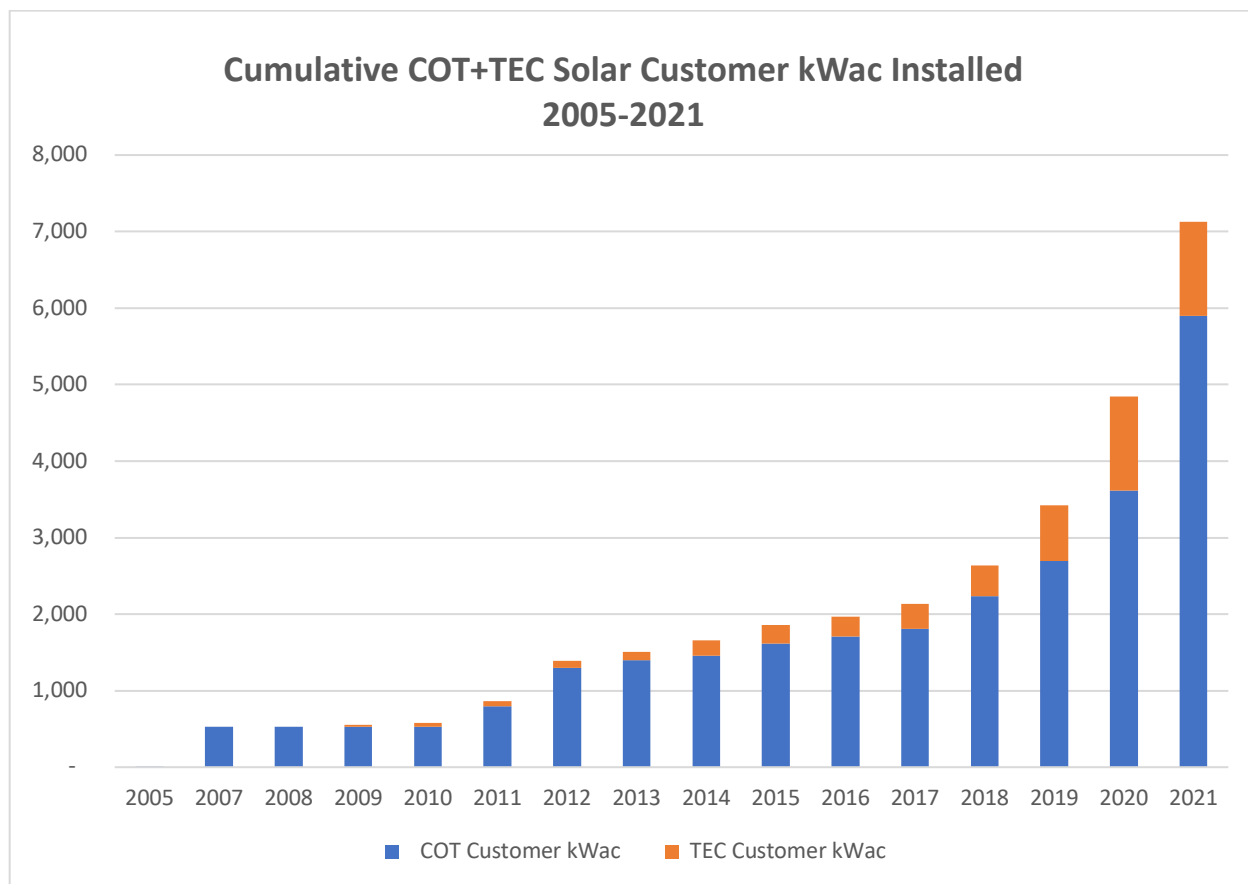
In 2017 Leon County Talquin customers had approximately 379 kWac of PV capacity in place which expanded almost 700% to 2,511 kWac by the end of 2021.<sup>19</sup> Current solar applications are increasing at a rate of approximately 10% per month. TEC is in the process of constructing a utility-owned solar generating farm

<sup>19</sup> The DC/AC ratio or inverter load ratio is calculated by dividing the array capacity (kW DC) over the inverter capacity (kW AC). For example, a 150-kW solar array with a 125-kW inverter will have a DC/AC ratio of 1.2. On the other hand, a 150-kW array with a 100-kW inverter has a ratio of 1.5, Jun 14, 2018: *What is the Optimal DC/AC Inverter Ratio for Commercial*, <https://www.linkedin.com/pulse/what-optimal-dcac-in/>; Private communications with Bob Seaton, COT, advised that the industry preferred standard in Florida is to multiply DC capacity by .85 to yield AC capacity, August 2022.

located in counties nearby but not in Leon County. TEC has committed to a Leon County connected system in the future once current projects are complete.<sup>20</sup>

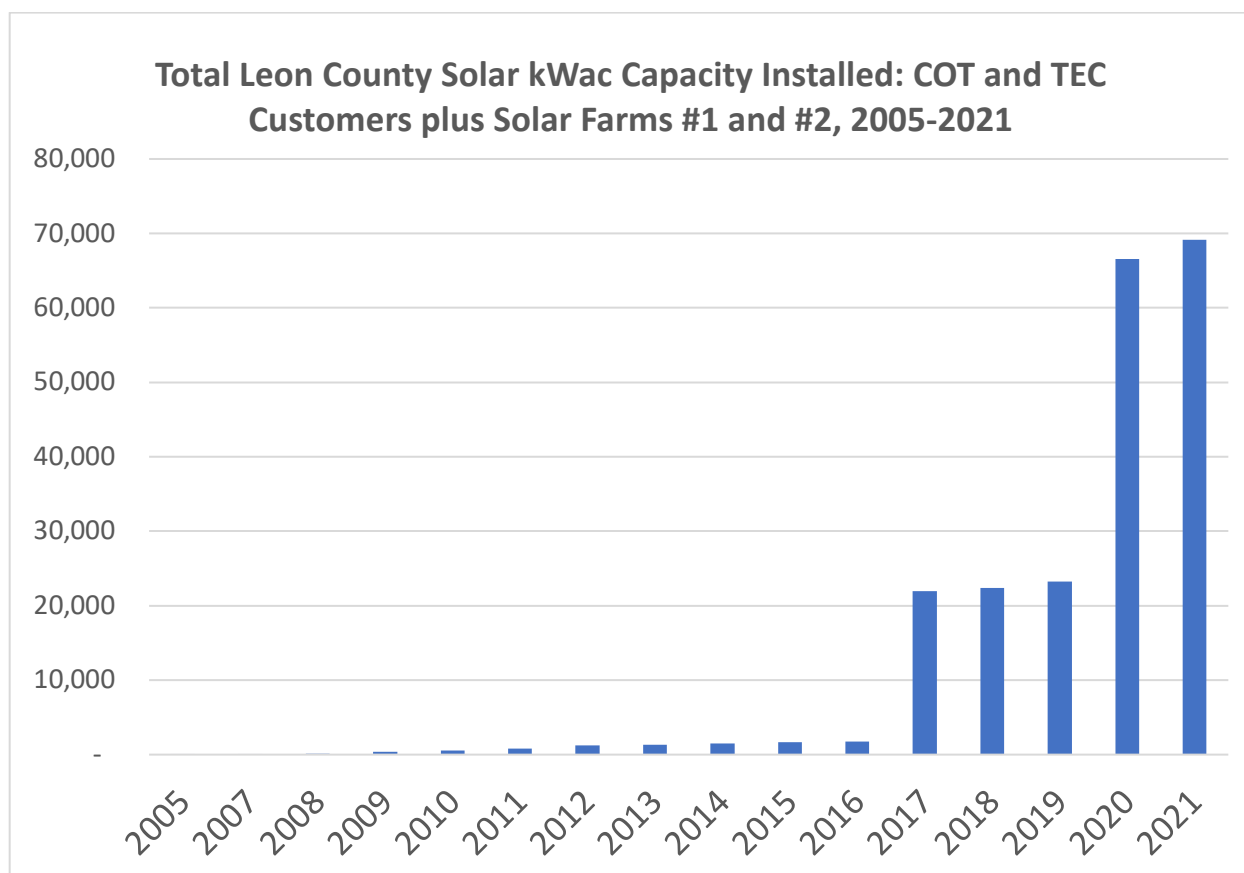


<sup>20</sup> Private communications with Dan Ard, Talquin Electric, May 18, 2022.



In summary, across Leon County customer installed solar energy installations have grown from 1,924 to 7,533 kWac over the 2017 to 2021 period - a jump of almost 400% - while COT solar energy generation capacity expanded from 20,000 to 62,000 kWac over the same period.





## CO<sub>2</sub> Offset

While the immediate and very good reason for installing solar might be to reduce your energy costs, the ultimate purpose of this technology is to replace fossil fuel energy generation in order to reduce CO<sub>2</sub> emissions. What follows is an effort to quantify the impact of our local efforts toward achieving that goal by means of both private rooftop and utility solar farms. To do so the following assumptions and calculations are made.

If the COT's combined Solar Farm MWh production for 2020 (112,840,000 kWh) and 2021 (109,219,000 kWh) are summed, they produced on average 1,791 kWh per kWac per year.<sup>21</sup> This value is used to estimate the systems' production for 2018 (Solar Farm #1 only) and 2019 (Solar Farms #1 and 2 combined). For a private solar system, one source estimates typical production for a standard 10,000 kWac system to be between 10,585 and 16,790 kWh per year or between 1,058 and 1,679 kWh per installed kWac.<sup>22</sup> Another source suggests 10,716 kWh or 1,072 kWh per installed kWac.<sup>23</sup>

The author's personal six years of rooftop solar production (installed close to central Tallahassee) is within the range of these two published estimates described above and provides a more realistic and consistent estimate for local use in this study. Therefore, this six-year average local production of 1,160 kWh per kWac is used in the

<sup>21</sup> Private communications COT, Bob Seaton, August, 2022

<sup>22</sup> <https://www.renewablewise.com/how-much-does-a-10kw-solar-system-produce/>

<sup>23</sup> <https://www.ecowatch.com/solar/10kw-solar-systems>

following table to estimate annual kWh production for all other Leon County customer installed kWac capacity.<sup>24</sup> Meanwhile COT published Solar Farm #1 and #2 kWh annual production will be used for those facilities.

Based on the above, the following table provides the estimated total production of the combined private and public 69,533 kWac solar generation capacity installed across Leon County (private customers and COT Solar Farms 1 and 2). This combined total is calculated to have generated 115,047 MWh of electricity in 2021 alone. By multiplying this number with the COT carbon intensity factor (.435) we estimate that the annual Leon County customer and COT installed solar electric generation reduced CO<sub>2</sub> emissions by 48,818 tons in 2021.<sup>25</sup> This constitutes 3.01% of all Leon County stationary sources emissions for that year.

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<sup>24</sup> Lynch 7-year annual kWh/kWac: 4,844 /4.174 kWac = 1,162 kWh per kWac.

<sup>25</sup> CO<sub>2</sub> emissions = (Leon County customer total solar MWh + COT solar Farms #1 and #2 MWh) x (COT previous year carbon intensity factor).

Year	Leon County Customer kWac Installed	COT Solar Farm kWac Installed	Leon County Total COT + Customer kWac Installed	Leon County Customer + COT Solar Farm kWh	Sum of Leon County Solar MWh Produced by Year End	Leon County & COT Solar CO2 Emission Offsets in Tons	Total Leon County Stationary Electric + Gas CO2 Emissions in Tons	Solar CO2 Offsets as a Percent of Leon Total Stationary CO2 Emissions
2005	4		4	4,931	5	3	2,114,347	0.00%
2007	37		37	43,393	43	28	2,125,687	0.00%
2008	106		106	123,275	123	66	2,223,312	0.00%
2009	344		344	399,180	399	204	1,919,470	0.01%
2010	509		509	590,620	591	316	1,839,573	0.02%
2011	759		759	880,970	881	445	1,984,511	0.02%
2012	1,218		1,218	1,413,636	1,414	791	1,883,544	0.04%
2013	1,319		1,319	1,530,646	1,531	732	1,933,776	0.04%
2014	1,475		1,475	1,711,295	1,711	830	1,695,120	0.05%
2015	1,661		1,661	1,927,332	1,927	936	1,749,463	0.05%
2016	1,762		1,762	2,044,574	2,045	989	1,769,383	0.06%
2017	1,924		21,924	8,501,902	8,502	4,011	1,730,827	0.23%
2018	2,374	20,000	22,374	38,570,202	38,570	17,708	1,691,726	1.05%
2019	3,152		23,152	39,473,333	39,473	17,148	1,703,564	1.01%
2020	4,525	42,000	66,525	118,090,993	118,091	51,409	1,655,850	3.10%
2021	5,022		69,533	115,046,887	115,047	48,818	1,621,634	3.01%

## Demand Side Management

Demand Side Management (DSM) is a strategy used by electricity utilities to control demand by encouraging consumers to modify their level and pattern of electricity usage. DSM activities include installing more energy efficient residential and commercial heating, ventilation, and air conditioning systems (HVAC); water heaters; pool pumps; higher levels of energy saving insulation; and so forth. Other DSM activities include potential change in consumer behavior thru energy audits as well as some limited grants.

COT staff have identified both the number of DSM activities completed over the 2015-2021 period as well as estimated electrical energy savings generated by these programs.<sup>26</sup>

The chart below shows the number of DMS activities completed over the 2015-2021 period.

<sup>26</sup> Michael Ohlsen, City of Tallahassee Electric & Gas Utility, May 2022.

<b>City of Tallahassee Electricity Demand Side Management Activities</b>							
<b>Year</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
<b>Number of Residential Energy Audits</b>	6,699	6,011	4,335	4,758	4,277	3,078	3,574
<b>Energy Star Appliance Rebates -- Total</b>	3,667	2,809	3,571	3,771	3,853	3,126	3,269
<b>Homes served by Neighborhood Reach</b>	1,232	1,132	989	189	101	0	0
<b>Gas Appliance Conversion Rebates --Total</b>	1,010	1,022	1,807	1,841	2,199	2,013	1,788
<b>High Efficiency HVAC Rebates</b>	840	787	738	798	673	637	733
<b>Water Heater Rebates (natural gas)</b>	702	692	671	520	915	763	776
<b>Ceiling Insulation Grants</b>	776	638	501	412	327	269	308
<b>Energy Efficiency Loans</b>	447	479	421	525	438	371	363
<b>Commercial Energy Audits</b>	215	161	120	202	120	73	91
<b>Energy Star New Home Rebates</b>	75	110	153	129	187	192	191
<b>Variable Speed Pool Pump Rebates</b>	52	52	60	41	66	77	68
<b>Participants in Nights &amp; Weekends</b>	1,933	2,095	?	?	?	?	?

The next chart shows estimated incremental energy savings (reductions in MWh consumed) for all DSM efforts on a calendar year basis. This includes participation in rebates, grants, loans, and energy audits. This program has likely had a cumulative effect (from 14 years of activities) of possible ongoing annual savings of 103,759 MWh of electricity use into the future.

<b>City of</b>	<b>Incremental</b>	<b>Possible Ongoing</b>
<b>Tallahassee</b>	<b>Energy Savings</b>	<b>Annual Cumulative</b>
<b>Program Year</b>	<b>Annual (MWh)</b>	<b>Savings (MWh)</b>
<b>2008</b>	<b>6,193</b>	<b>6,193</b>
<b>2009</b>	<b>9,228</b>	<b>15,421</b>
<b>2010</b>	<b>12,110</b>	<b>27,531</b>
<b>2011</b>	<b>8,798</b>	<b>36,329</b>
<b>2012</b>	<b>7,190</b>	<b>43,519</b>
<b>2013</b>	<b>8,527</b>	<b>52,046</b>
<b>2014</b>	<b>8,559</b>	<b>60,605</b>
<b>2015</b>	<b>6,454</b>	<b>67,059</b>
<b>2016</b>	<b>6,029</b>	<b>73,088</b>
<b>2017</b>	<b>5,969</b>	<b>79,057</b>
<b>2018</b>	<b>5,486</b>	<b>84,543</b>
<b>2019</b>	<b>6,274</b>	<b>90,817</b>
<b>2020</b>	<b>5,575</b>	<b>96,392</b>
<b>2021</b>	<b>7,367</b>	<b>103,759</b>

These are acknowledged to be optimistic estimates and certainly overstate the persistence of energy saving measures as some appliance upgrades may have a useful life of only 10 years. The totals also include a small benefit associated with participation in a Home Energy Audit, which may not persist beyond the first year or may change as occupancy changes.<sup>27</sup> TEC also has an active energy audit program but data from this program is currently not available.

<sup>27</sup> Michael Ohlsen, City of Tallahassee Electric & Gas Utility, June 2022

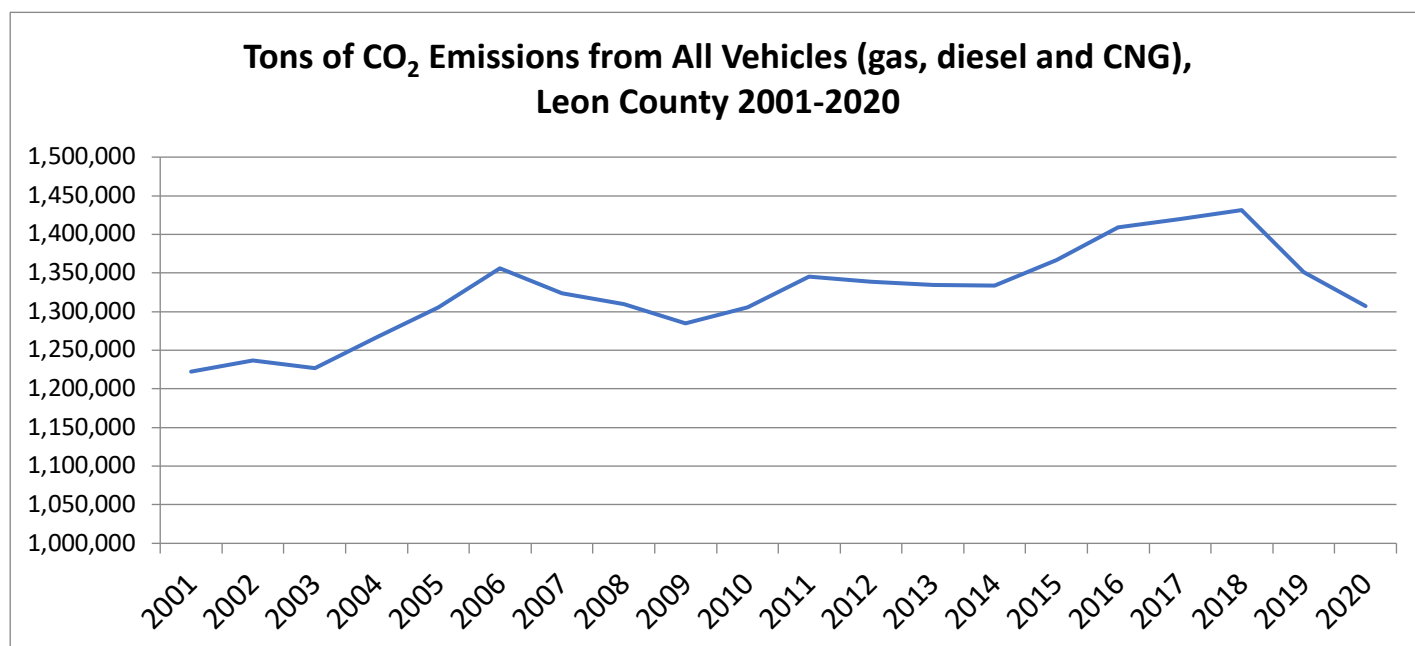
Despite these qualifications the following table estimates the potential reductions in CO<sub>2</sub> emissions if all these forecasted MWh savings have been realized. The potential ongoing annual reductions are forecast to reduce Leon County emissions by 44,028 tons of CO<sub>2</sub> in 2021 alone.

<b>Year</b>	<b>Estimated Ongoing Annual Cumulative Savings (MWh)</b>	<b>COT Carbon Intensity Factor</b>	<b>DSM Tons of CO<sub>2</sub> Offset</b>	<b>Total Leon County Stationary &amp; Mobile Tons of CO<sub>2</sub></b>	<b>Percent of Leon County Stationary &amp; Mobile CO<sub>2</sub></b>
2008	6,193	0.534	3,308	3,546,771	0.09%
2009	15,421	0.512	7,895	3,228,912	0.24%
2010	27,531	0.536	14,748	3,124,321	0.47%
2011	36,329	0.505	18,363	3,290,123	0.56%
2012	43,519	0.559	24,342	3,228,806	0.75%
2013	52,046	0.478	24,900	3,272,705	0.76%
2014	60,605	0.485	29,388	3,029,529	0.97%
2015	67,059	0.486	32,575	3,083,374	1.06%
2016	73,088	0.484	35,360	3,136,075	1.13%
2017	79,057	0.472	37,300	3,140,154	1.19%
2018	84,543	0.459	38,814	3,111,507	1.25%
2019	90,817	0.434	39,452	3,134,964	1.26%
2020	96,392	0.435	41,963	3,007,091	1.40%
2021	103,759	0.424	44,028	2,928,711	1.50%

## Mobile Sources

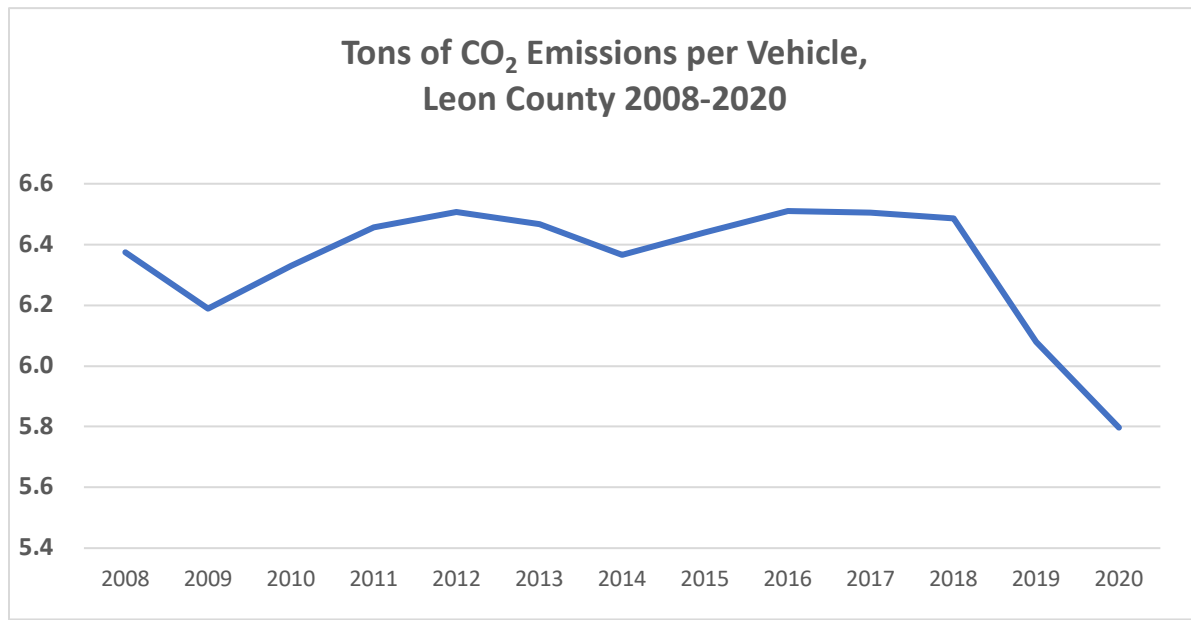
### CO<sub>2</sub> Production Attributable to Leon County Motor Vehicles

Leon county has experienced a slow but steady increase in registered motor vehicles over the past 12 years, growing from 205,445 in 2008 to 225,477 in 2020.<sup>28</sup> This 10% increase corresponds to a gradual population increase. Accompanying that was a commensurate 7% growth in mobile CO<sub>2</sub> emissions thru 2018. The period 2019-2020 had unusually low emissions from mobile sources years because of COVID travel reductions.

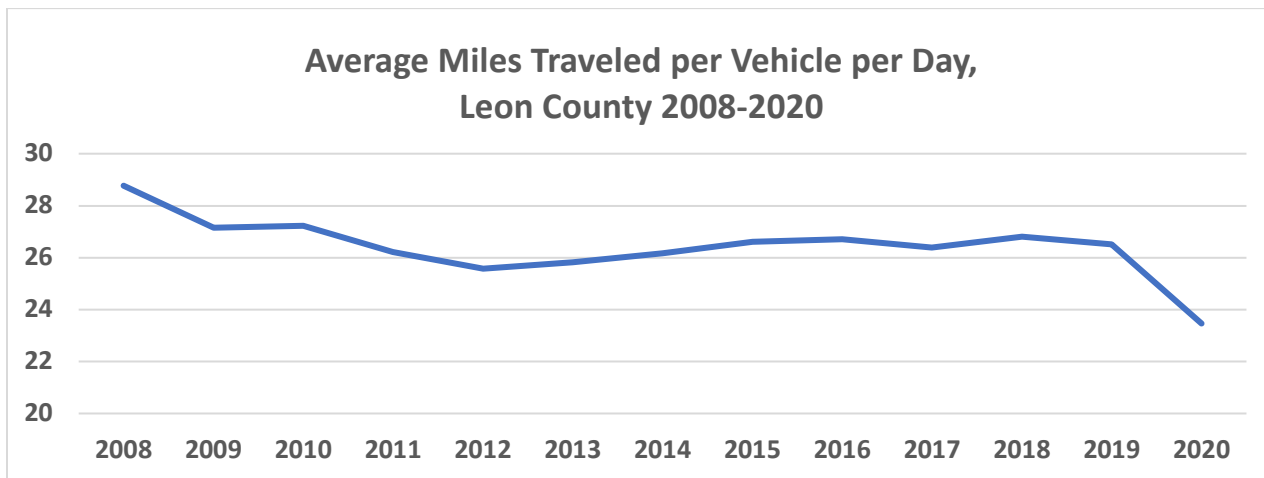


Tons of CO<sub>2</sub> emissions per vehicle across Leon County dropped by .58 tons or 9% over the 2008-2020 period. This is likely attributable to introduction of new more fossil fuel efficient and plug-in hybrid and electric vehicles. Average vehicle daily trip miles also fell over the 2008-2020 timeframe as well.

<sup>28</sup> Motor vehicles registered: Florida Highway Safety & Motor Vehicles, <https://www.flhsmv.gov/resources/driver-and-vehicle-reports/>.



The average daily vehicle travel length fell from 29 miles a day in 2008 to a fairly stable 26 miles over the 2011-2019 period and to 23.5 miles in 2020. Nationally and locally individuals have tended to travel fewer miles in recent years and fewer still given COVID travel reductions in 2020.<sup>29</sup> Hence the relative drop in CO<sub>2</sub> emissions per vehicle year fell as well.

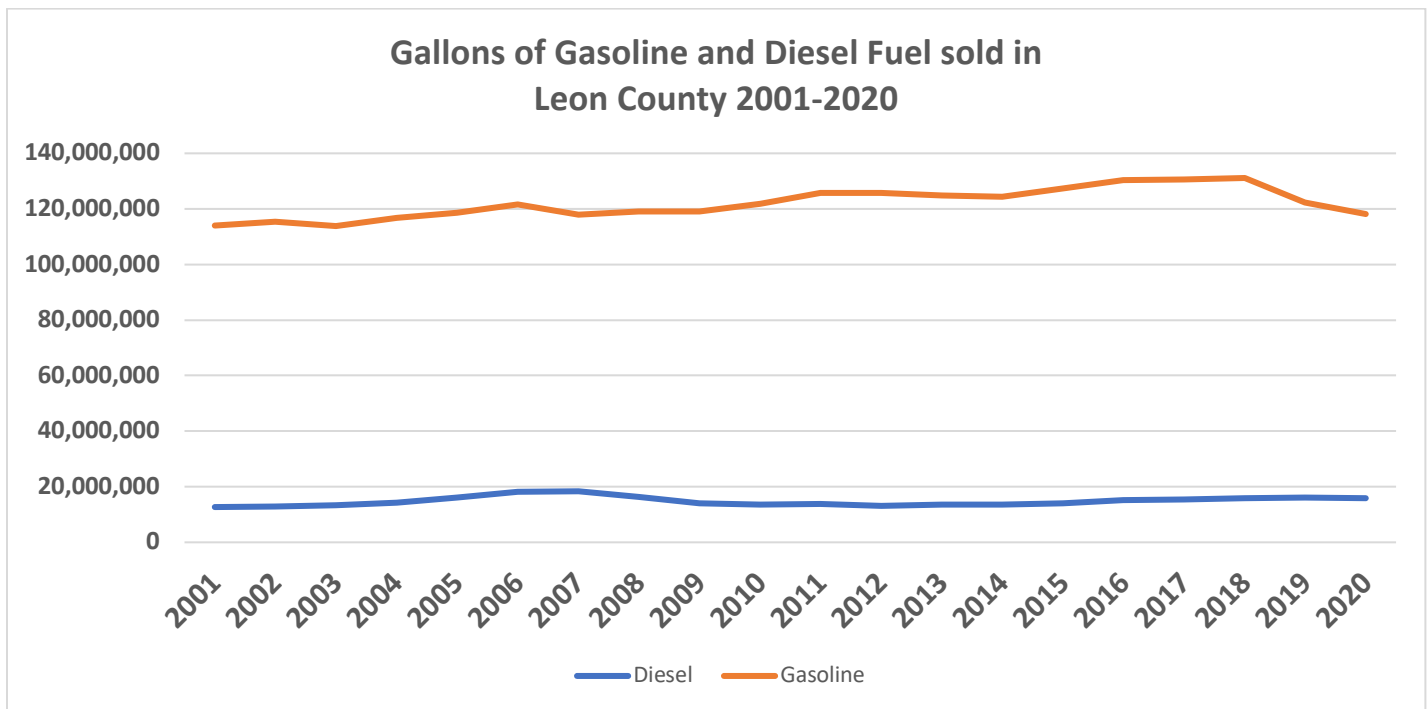


Sales of gasoline in Leon County have been slowly increasing over 2001-2018 but fell in 2019 and again dramatically in 2020 due to COVID confinement resulting in less travel. Meanwhile diesel sales have been flat throughout the period. Diesel is used mostly for large transport and smaller domestic vehicles (trucks and busses) which were still in high demand throughout the period.<sup>30</sup>

<sup>29</sup> Florida Department of Transportation. Go to [https://ftp.fdot.gov/public/folder/RedkVJJQbE\\_ZL0\\_9HyAF-A/Public\\_Roads](https://ftp.fdot.gov/public/folder/RedkVJJQbE_ZL0_9HyAF-A/Public_Roads)

<sup>30</sup> Total gallons of gasoline and diesel fuel sold in Leon County each year: Florida Department of Revenue. Search for certgallonsNN.xls, where NN is the last two digits of the year of interest.





### ***Electric Vehicle Sales<sup>31</sup>***

Florida annual sales of all electric and plug-in hybrid electric vehicles has grown by almost 600% over the past 5 years: from 6,111 in 2016 to 42,754 in 2021. As of June 2022, Florida had the second most light-duty electric vehicles registered in the U.S. (95,640) behind California (563,070).<sup>32</sup> While current penetration levels are still low, sales are continuing to accelerate each year as consumers and manufactures warm to the new technology.<sup>33</sup> Auto analysts and economists acknowledge that key factors such as new policies, expanded options in EV models and pricing, as well as changes in consumer confidence and behavior, should drive more rapid growth.

The Florida Department of Motor Vehicles indicates that EV penetration in Leon County is approximately 0.5%, just slightly lower than the trajectory of Florida overall (approximately 0.7%). According to vehicle registration data, Leon County had 893 privately owned EVs on the road in July 2021. In July 2020, Florida had an EV adoption rate of 0.41%.<sup>34</sup> Between July 2020 and July 2021, EV sales jumped 53% and accounted for nearly 3% of all cars sold in Florida, with a similar increase in the number of charging stations for that year. FDOT anticipates that 20%-35% of all light-duty vehicles in the state will be electric by 2040.<sup>35</sup>

<sup>31</sup> Much of this section is extracted and reproduced directly from *Electric Vehicle Readiness*, report prepared for meeting of the Tallahassee City Commission, July 13, 2022; <http://go.boarddocs.com/fla/talgov/Board.nsf/goto?open&id=CG3SGY72B043>.

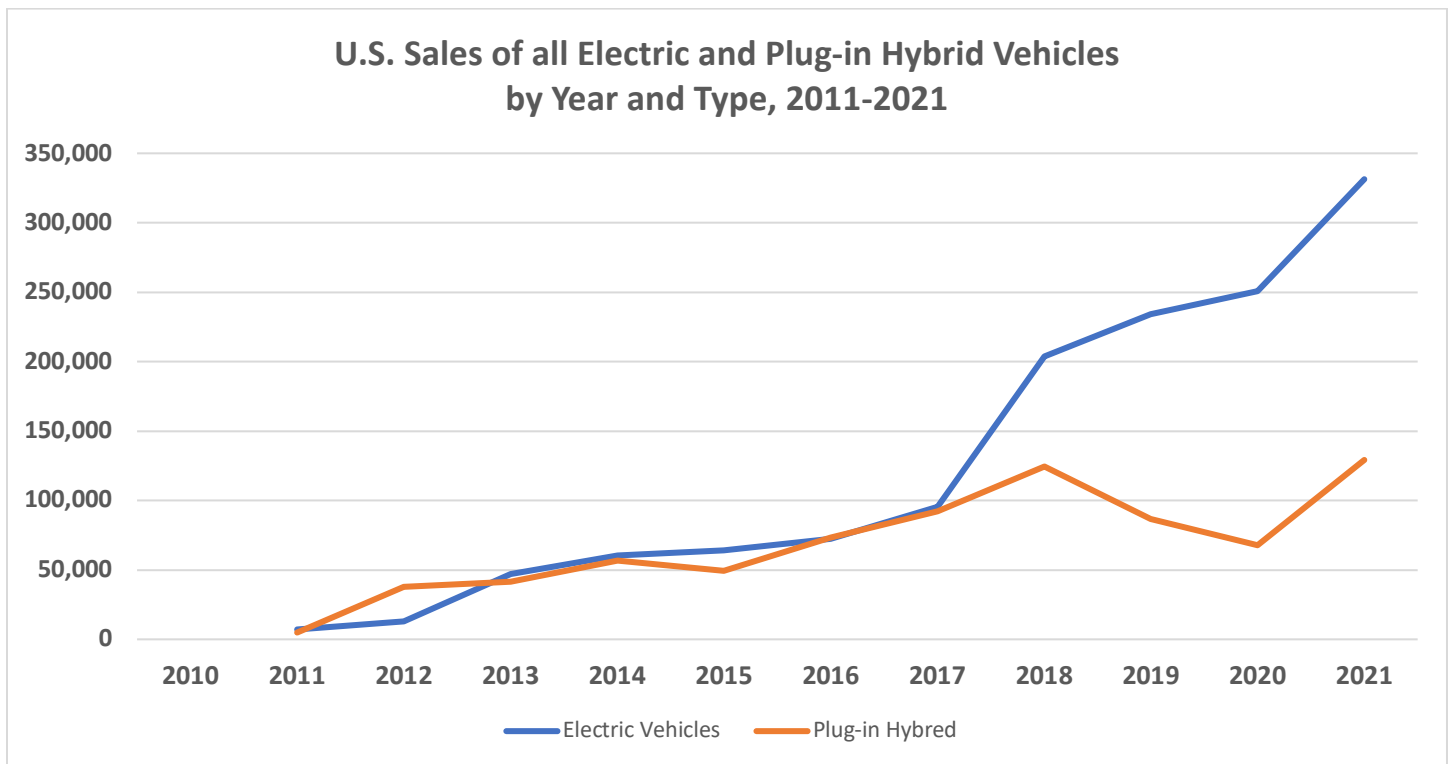
<sup>32</sup> Numbers of electric and plug-in-hybrid vehicles sold in Florida: Auto Alliance website at <https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard> and <https://cleanenergy.org/blog/floridas-electric-vehicle-market-is-ready-for-lift-off/>; <https://www.gov.ca.gov/2022/02/25/california-leads-the-nations-zev-market-surpassing-1-million-electric>.

<sup>33</sup> <https://wusfnews.wusf.usf.edu/environment/2022-02-13/florida-no-2-in-nation-for-electric-cars-about-to-get-a-boost-to-its-charger-network>.

<sup>34</sup> Florida Department of Transportation Infrastructure Master Plan, public webinar, April 2021

<sup>35</sup> Florida Department of Transportation EV Infrastructure Plan, July 2021.

While this small number of vehicles has not yet made a significant impact in the reduction of CO<sub>2</sub> emissions here (see estimates below) or across the country and world, prospects appear hopeful for larger more measurable reductions in the future.



Based on current projections, industry estimates suggest that EV sales in the U.S. could increase to 4.7 million units by 2030, making up approximately 29.5% of all new car sales.<sup>36</sup>

By the end of 2022, 15% of the city’s light-duty fleet will be electric or hybrid. The city currently operates 50 light-duty 100% electric EVs and 54 hybrid EVs. In total, the city has replaced 130 gasoline vehicles and has nine electric and 33 hybrid police vehicles in service. The city is also in the process of procuring 25 additional hybrid police SUVs, 14 F-150 Lightnings, and five Chevy Bolts this year to use across various departmental operations.<sup>37</sup>

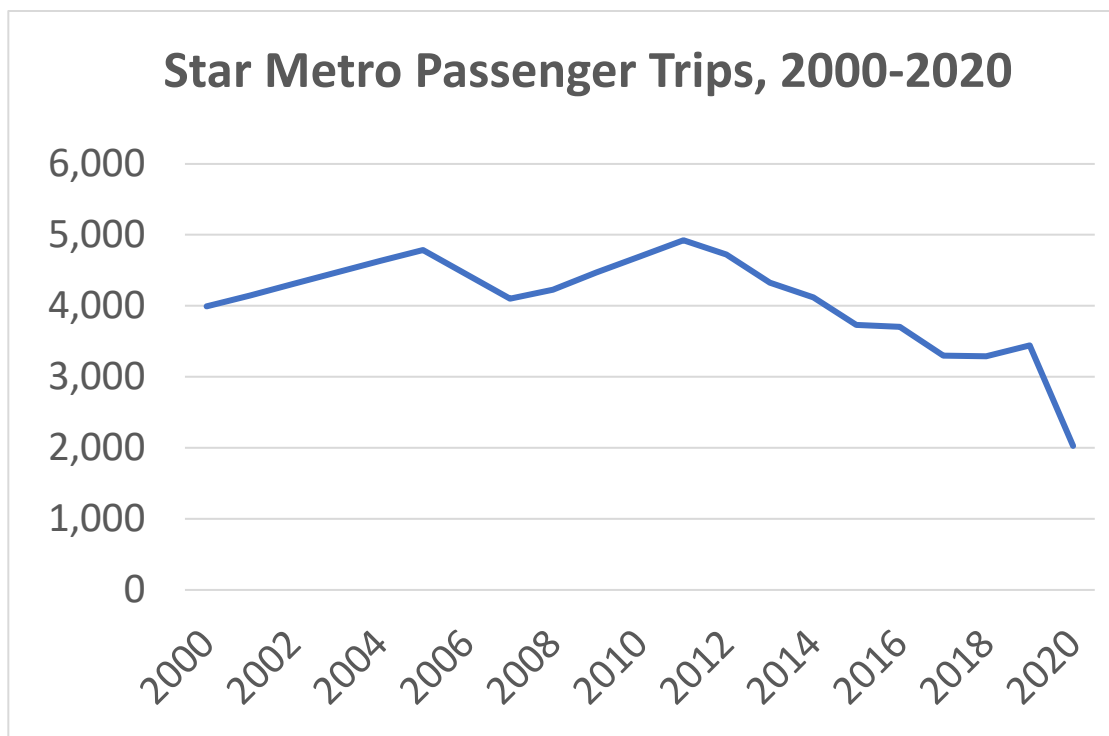
### ***Bus Travel***

StarMetro annual passenger trips peaked in 2011 at almost 5 million but fell by 33% thru 2017 to only 3.3 million. COVID related restrictions limiting population movements across the U.S took its toll in Tallahassee

<sup>36</sup> Ibid, City Report to Commission dated 7/13/22, reference AutoPacific, 2022; EV Adoption, 2202

<sup>37</sup> Ibid.

with a single year 42% drop in ridership in 2020 falling to only 2 million that year.<sup>38</sup> Many other transit systems in Florida and across the nation have experienced similar declines over the same period.



Currently, 30% of the StarMetro fleet is electric. StarMetro’s 19 all-electric buses continue to service Florida State University campus, making it the first university in the United States Southeast region to use all-electric buses. Buses are charged using six depot chargers at StarMetro’s administrative offices along with two electric overhead fast-charging stations on campus and one at CK Steele Plaza. StarMetro also plans to place one 75-125 kW depot charger inside the StarMetro garage facility. Additionally, in April 2022, the city completed an infrastructure study to move StarMetro toward a 100% electric fleet.

<sup>38</sup> Annual numbers of passengers, vehicle miles, and passenger miles for Star Metro (and Taltran) for 2001-2020: Florida Department of Transportation’s Florida Transit Information System (FTIS); for fixed-route directly operated totals see website at <https://ftis.org/>.

<b>Estimated Leon County Electric Vehicle Adoption and CO2 Reduction, 2011-2021</b>									
<b>Year</b>	<b>Florida Estimated # of Electric Vehicles</b>	<b>COT # of Electric Buses</b>	<b>COT # of Electric Light Duty Vehicles</b>	<b>Leon County # of Electric Vehicles</b>	<b>Light Duty Vehicles Reduced Emissions Tons/Year</b>	<b>COT Electric Bus Reduced Emissions Tons/Year</b>	<b>Bus &amp; Light Duty Vehicles Reduced Emissions Tons/Year</b>	<b>Leon County Total Mobile &amp; Diesel CO2 Emissions</b>	<b>Percent of Leon County Total CO2 Emissions</b>
<b>2011</b>	500			10	67		67	1,345,262	0.01%
<b>2012</b>	2,500			52	340		340	1,338,929	0.03%
<b>2013</b>	3,377			71	456		456	1,334,409	0.03%
<b>2014</b>	3,766			79	501		501	1,333,912	0.04%
<b>2015</b>	4,939			103	664		664	1,366,693	0.05%
<b>2016</b>	6,111			128	831		831	1,409,326	0.06%
<b>2017</b>	12,222	5	13	268	1,742	546	2,288	1,419,781	0.16%
<b>2018</b>	19,551	10	25	433	2,811	1,093	3,903	1,431,401	0.27%
<b>2019</b>	26,879	14	38	599	3,641	1,639	5,280	1,351,241	0.39%
<b>2020</b>	34,208	19	50	764	4,432	2,185	6,617	1,307,078	0.51%
<b>2021</b>	42,754	19	50	943	5,467	2,185	7,652	1,307,078	0.59%

The preceding table<sup>39</sup> reflects the potential reduction in CO<sub>2</sub> emissions in tons per year given the purchase and replacement<sup>40</sup> of gasoline powered light duty vehicles (cars and trucks) by private citizens, government, businesses, and other institutions as well as the replacement of diesel-powered busses with electric buses by the City of Tallahassee and StarMetro.

Each of the 993 light duty electric vehicles operating across Leon County annually removes 5.8 tons of CO<sub>2</sub> from Leon County's atmosphere. Each of COT StarMetro's 19 operating electric busses annually removes 115 tons (or 230,000 pounds) of county CO<sub>2</sub> emissions.<sup>41</sup>

<sup>39</sup> Because accurate 2021 fuel sales and mileage are not yet available, an annual 2019 to 2020 Leon County registered vehicle growth of 1.44% was assumed for calculating these 2021 estimates.

<sup>40</sup> While reasonably accurate annual estimates are available for Florida for the past decade, they are not available for Leon County. Therefore, Leon County rates of adoption are assumed to be identical to Florida.

<sup>41</sup> Union of Concerned Scientists, "Study Finds Electric Buses are Cleaner in All Parts of Country," <https://www.ucsusa.org/about/news/study-finds-electric-buses-are-cleaner-all-parts-country>; <https://blog.ucsusa.org/jimmy-odea/electric-vs-diesel-vs-natural-gas-which-bus-is-best-for-the-climate/>.

Our mobile sources of emissions are on the rise, but these few electric vehicles are estimated to have reduced total Leon mobile source CO<sub>2</sub> emissions by 7,652 tons in 2021 or about .59% for that year. While only a small fraction, they still constitute a meaningful beginning and growing contribution.

## ***Carpooling***

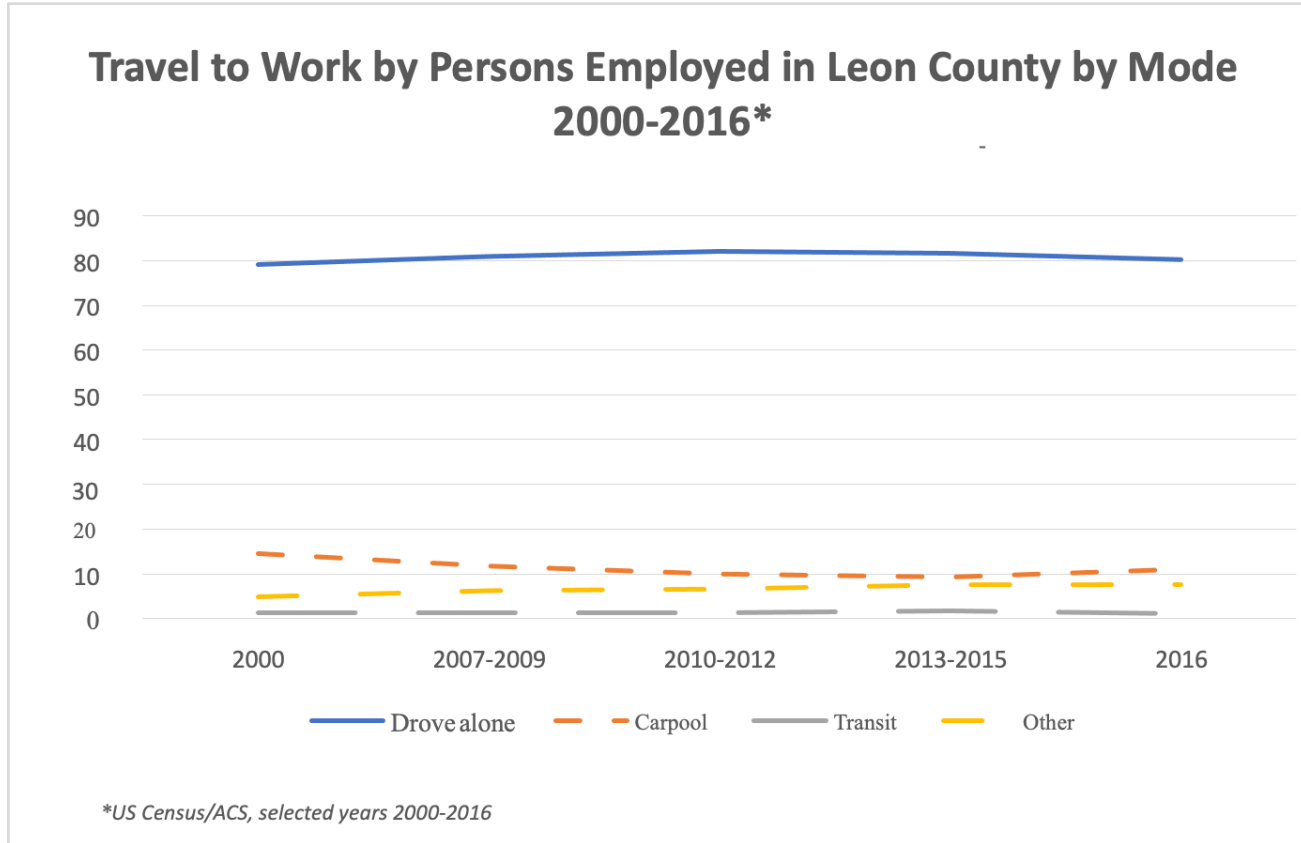
As reported in the 2018 version of this report most Leon County ( $\geq 80\%$ ) work commuters travel to work alone in their cars, and this is stable over the period. Those who carpool decreased between 2000 and 2016. This trend toward the automobile and away from public transit shifted even further thru the five-year period concluding in 2020. As reported above public transit fell dramatically over the same period.

The Table below summarizes the Bureau of the Census five-year survey results for Leon County work commuters.<sup>42</sup>

<b>Means of Transportation to Work</b>	
<b>Leon County, 5-year Period 2020</b>	<b>16 Years &amp; Over</b>
<b>Car, truck, or van:</b>	<b>87.3%</b>
<b>Drove alone</b>	<b>78.8%</b>
<b>Carpooled:</b>	<b>8.8%</b>
<b>In 2-person carpool</b>	<b>6.8%</b>
<b>In 3-person carpool</b>	<b>1.2%</b>
<b>In 4-person carpool</b>	<b>0.3%</b>
<b>In 5- or 6-person carpool</b>	<b>0.1%</b>
<b>In 7-or-more-person carpool</b>	<b>0.1%</b>
<b>Public transportation (excluding taxicab)</b>	<b>1.7%</b>
<b>Bus</b>	<b>1.7%</b>
<b>Subway or elevated rail</b>	<b>0.0%</b>
<b>Long-distance train or commuter rail</b>	<b>0.0%</b>
<b>Light rail, streetcar or trolley</b>	<b>0.0%</b>
<b>Ferryboat</b>	<b>0.0%</b>
<b>Taxicab</b>	<b>0.1%</b>
<b>Motorcycle</b>	<b>0.3%</b>
<b>Bicycle</b>	<b>0.6%</b>
<b>Walked</b>	<b>2.2%</b>
<b>Other means</b>	<b>0.8%</b>
<b>Worked from home</b>	<b>7.0%</b>

<sup>42</sup> Table B08301 from the *Census Reporter* based on data from the American Community Survey operated by US Census: [https://censusreporter.org/data/table/?table=B08301&geo\\_ids=05000US12073&primary\\_geo\\_id=05000US12073](https://censusreporter.org/data/table/?table=B08301&geo_ids=05000US12073&primary_geo_id=05000US12073).

It indicates that 87.3% drove and that 78.8% drove alone, 1.7% commuted by public transit/bus, 2.2% walked, and .6% commuted by bicycle; interestingly 7% worked from home. That group may have dramatically increased over and after the COVID pandemic period, but these results will only be available from future surveys, and we can only speculate now.



### ***Bicycle Infrastructure<sup>43</sup>***

Tallahassee is investing in protected and buffered bike lanes and marked bike boulevards to deepen existing networks of conventional bike lanes, streets with lane markings, and trails. Better bicycle infrastructure is expected to lead to more cycling.

In late 2017 a bike share program was introduced in Tallahassee. Conventional bike lanes rose only slightly in 2018 to just over 137 miles while off-street paved trails or paths in the city rose to 35.7 miles. Meanwhile off-street natural surface trails or paths up to 5 miles outside city held constant at 32 miles.

Walking or bicycling to work increased from 2.0% in 2000 to 2.7% in 2013-15 and to 2.8% in 2016-2020.

<sup>43</sup> Source: Tabular data provided by Tallahassee-Leon County Growth Management staff.

<b>Tallahassee/Leon County Bicycle Infrastructure in Miles, 2015-18</b>				
	<b>End of 2015</b>	<b>End of 2016</b>	<b>End of 2017</b>	<b>End of 2018</b>
<b>Protected Bike Lanes</b>	<b>0</b>	<b>1.3</b>	<b>1.3</b>	<b>1.3</b>
<b>Buffered Bike Lanes</b>	<b>0</b>	<b>4.8</b>	<b>6.3</b>	<b>6.3</b>
<b>Conventional Bike Lanes</b>	<b>136</b>	<b>136</b>	<b>136.9</b>	<b>137.32</b>
<b>Marked Bike Boulevards</b>	<b>0</b>	<b>1.2</b>	<b>1.2</b>	<b>1.2</b>
<b>Off-Street Paved Trails or Paths (in City)</b>	<b>28</b>	<b>28</b>	<b>38.85</b>	<b>35.7</b>
<b>Off-Street Natural Surface Trails or Paths (in City)</b>	<b>85</b>	<b>85</b>	<b>0</b>	<b>0</b>
<b>Shared Lane Markings</b>	<b>23</b>	<b>24</b>	<b>0</b>	<b>0</b>
<b>Off-Street Paved Trails or Paths up to 5 miles (outside city)</b>	<b>14.7</b>	<b>14.7</b>	<b>0</b>	<b>0</b>
<b>Off-Street Natural Surface Trails or Paths up to 5 miles (outside city)</b>	<b>32</b>	<b>32</b>	<b>32</b>	<b>32</b>
<b>Shared Lanes (not above)</b>	<b>24.1</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Public Bike Parking Spaces</b>	<b>1000</b>	<b>1010</b>	<b>1020</b>	<b>1040</b>
<b>Grade Separated Crossings</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>

Another trend to watch is the sale of electric bikes or e-bikes that may begin to change both American and Tallahassee recreational and commuting demand over the near future. That in turn might increase demand for more and higher quality bicycling infrastructure across Tallahassee and Leon County. According to recent reports the U.S. electric bike market continues to boom. The U.S. imported nearly 790,000 electric two-wheelers in 2021 according to LEVA's estimate, up by 70% from the 463,000 imported in 2020. While lagging behind 2021 European or Asian sales of 1 million and 35 million respectively, this substantial US increase exceeded American purchases of 652,000 electric cars in 2021, including plug-in hybrids.<sup>44</sup>

## Data Sources, Assumptions & Conversion Factors

Commercial CO<sub>2</sub> production: Estimates include some releases attributable to manufacturing activities in Leon County where the manufactured products leave the county. Leon County imports far more in the way of manufactured goods and food than it exports. The net CO<sub>2</sub> cost of these imported goods is not accounted for.

Converting MWh of electricity supplied to Leon County customers by Talquin Electric Cooperative: National averages for CO<sub>2</sub> production generated from coal, natural gas, and renewables were applied to the proportion of

<sup>44</sup> Sources: Bloomberg, NEF, Light Electric Vehicle Association, January 28, 2022, <https://www.bloomberg.com/news/articles/2022-01-21/u-s-e-bike-sales-outpaced-electric-cars-in-2021>  
Bloomberg

those energy sources used by TEC and applied to the estimated amount of TEC electrical power used in Leon County. We use proportions from 2015 and assume they have not changed since 2001.

*Amount of natural gas sold to Leon County customers:* City staff indicate that 11% of the City of Tallahassee's natural gas is sold to customers outside the county. We have applied a percentage of 89% to both commercial and residential gas sales to estimate gas sold to Leon County customers.

*Talquin Electric Cooperatives Leon County CO<sub>2</sub> emissions:* TEC has approximately 1,500 commercial meters in Leon County and approximately 2200 commercial meters outside it; thus 40.5% of commercial meters are in Leon and we assume that 40.5% of the power used and CO<sub>2</sub> generated for commercial customers are in Leon County. TEC has approximately 24,700 residential meters in Leon County (50.2%) and approximately 24,500 residential meters outside of Leon County. We therefore assume that 50% of TEC's residential electrical consumption and CO<sub>2</sub> production is for Leon County customers.

*Motor vehicles domiciled:* We assume that the number of vehicles registered in Leon County is the same fraction of vehicles domiciled in Leon County over time (2008 to 2020) such that changes in usage of motor fuel can be correlated to changes in number of vehicles registered.

*Motor fuel used:* We assume that motor fuel sold in Leon County is a good approximation of motor fuel used, and that this approximation is stable over the 2008-2020 period.

*Information about MWh of electricity sold and CcF (a CcF is a hundred cubic feet) of natural gas sold by the City of Tallahassee utility, by year, by type of customer:* *Annual Report to Bondholders 2020*. These are available at <http://www.talgov.com/transparency/arbh.aspx>. These reports are also the source for the number of commercial and residential customers.

*Installed photoelectric capacity by year in Tallahassee:* City of Tallahassee utility staff reports and Ten-Year Site Plan documents. Similar documents from other years can be obtained by substituting the correct year in the URL. Recent data for the Leon County portion of Talquin Electric Coop's service area were obtained from planning staff at TEC. City of Tallahassee Utility Renewal Energy provided updated estimates thru 2021.





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