



A Community Carbon Dioxide Scorecard for Leon County 2020

Fourth Edition

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Update of the Community Carbon Dioxide Scorecard 2001-2017 by Richard Hopkins

Executive Summary

This document puts in one place information about carbon dioxide (CO₂) 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.¹

In 2020, mobile sources accounted for 41.2% of the combined total of CO₂ 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 CO₂ emissions have declined, and combined stationary and mobile CO₂ 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 CO₂ production from electricity and natural gas use and residential customers for 46%. CO₂ 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 CO₂ 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 CO₂ production from stationary sources (City

¹ <https://www.tal.gov.com/sustainability/cleanenergyplan.aspx>:

of Tallahassee electric and gas plus Leon County customers of Talquin Electrical Cooperative). Although total CO₂ production from stationary sources rose steadily from 2001 to 2008, it has since fallen below 2001 levels.

The declines in per-capita Leon County CO₂ 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,² the CO₂ 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.³

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 MCF⁴ in 2000 to 21.2 in 2020. This has resulted in a decrease in average residential natural gas CO₂ 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 CO₂ 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 2021.⁵ 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

² Some of the generators are also able to burn oil.

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

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

⁵ <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 2021.⁶ 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.

⁶ *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>

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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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ 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 CO₂ emissions, we believe the focus should be on reducing net CO₂ production, ideally to zero. CO₂ emissions account for about 88% of all greenhouse gas emissions in Florida.⁷

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.⁸

⁷ The Florida Department of Environmental Protection estimated that in 2010, greenhouse gasses other than CO₂ (methane, sulfur and nitrogen oxides, and hydrofluorocarbons) accounted for the remaining 12% of CO₂-equivalents released in the state. The non-CO₂ 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.

⁸ 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-CO₂ 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:

- CO₂ produced elsewhere associated with goods and services consumed in Leon County.
- CO₂ and methane releases associated with waste management and wastewater treatment.
- Life cycle CO₂ costs of energy production, infrastructure, and distribution, or any additional industrial emissions of greenhouse gasses.

Sources of CO₂ Production in Leon County

CO₂ Produced in Leon County in Tons and Percentage by Category, 2018 and 2020				
Sources	Tons of CO₂	% of CO₂	Tons of CO₂	% of CO₂
	2018	2018	2020	2020
Commercial Electric, City of Tallahassee	721,533	21.2%	622,614	19.6%
Residential Electric, City of Tallahassee	510,456	15.0%	502,950	15.9%
Commercial Gas, City of Tallahassee	105,256	3.1%	99,007	3.1%
Residential Gas, City of Tallahassee	35,673	1.0%	34,075	1.1%
Commercial Electric, Talquin Electric Co-op	86,189	2.5%	86,735	2.7%
Residential Electric, Talquin Electric Co-op	266,827	7.9%	276,254	8.7%
Mobile Sources (cars, trucks, buses etc.)	1,431,401	42.1%	1,307,078	41.2%
Propane sold in Leon County and City of Tallahassee	15,281	0.45%	15,359	0.48%
Jet Fuel (0.42% of state total)	120,512	3.5%	128,833	4.1%
Methane from Leon County Landfill, City Gas Utility, & FSU (CO₂e)*	105,596	3.1%	98,093	3.1%
Totals	3,398,723	100%	3,170,997	100%
*ghgdata.epa.gov				

In addition to CO₂ released from stationary and mobile sources, the table also includes CO₂ released from burning propane sold in Leon County and the City of Tallahassee; CO₂ released from Leon County’s state share of jet fuel; and CO₂e 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.⁹

Using the value of 12.7 pounds of CO₂ released per gallon of propane burned, we estimate that the total propane sold in 2018 contributed 15,281 tons of CO₂ 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.

⁹ Provided by City of Tallahassee and Leon County staff.

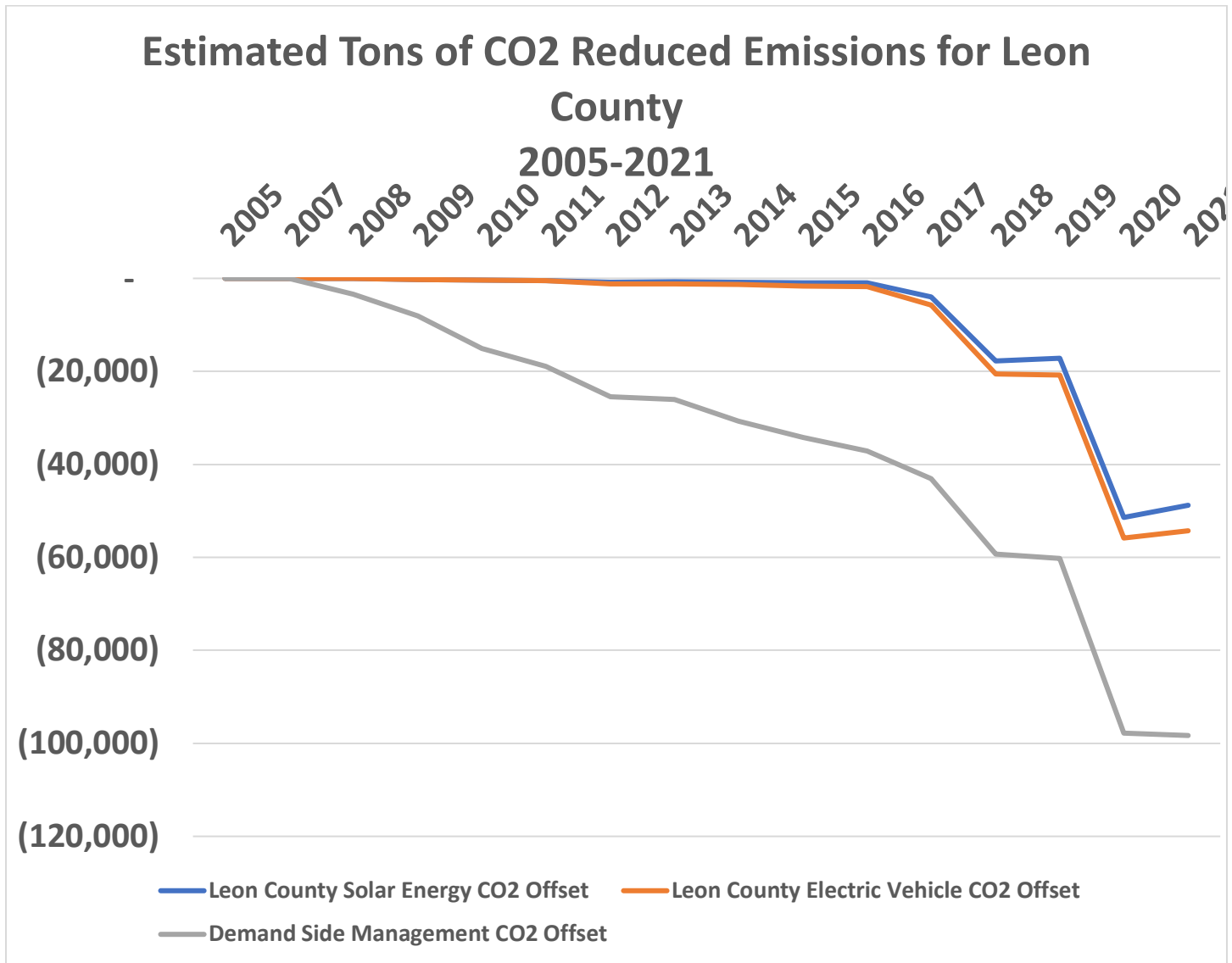
Jet fuel use accounts for 16% of fossil fuel energy used in Florida.¹⁰ Its use is concentrated in the top 10 Florida airports, which account for 95% of passengers. Tallahassee's airport accounts for just under half of a percent of Florida passengers. If Leon County's share of jet fuel use is also 0.5%, then in 2018 CO₂ from jet fuel was 120,512 tons - the equivalent of nearly 4% of Leon County CO₂ 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 CO₂ 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.

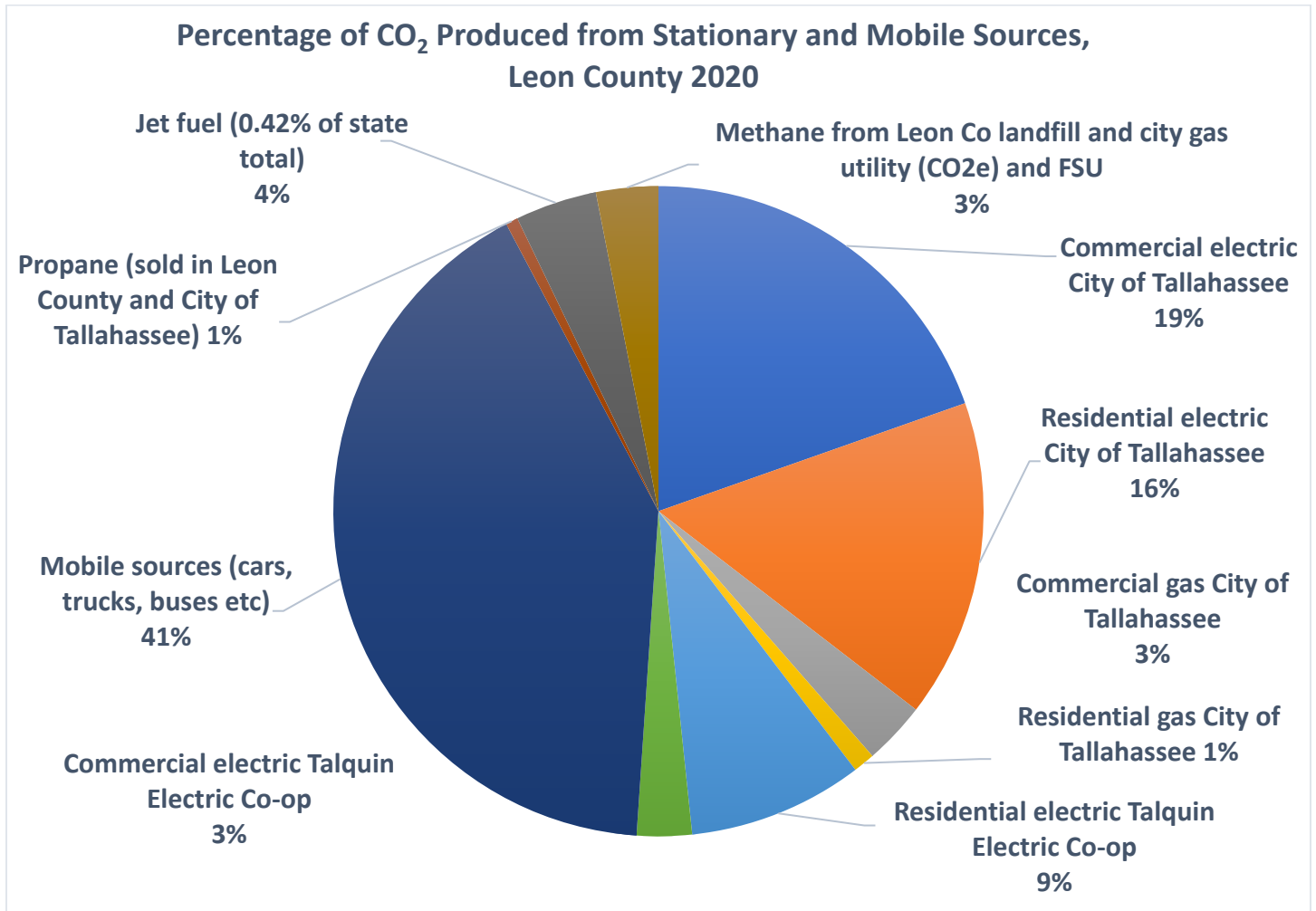
However, as the following graph provides, some of the significant downward movement in the annual estimates of CO₂ production is also attributable to forecast reductions in the tons of CO₂ emissions for Leon County resulting from specific local initiatives carried out over the past 17 years. These initiatives included purchase and operation of electric vehicles, installation of solar energy generating technologies, and implementing demand side management strategies.

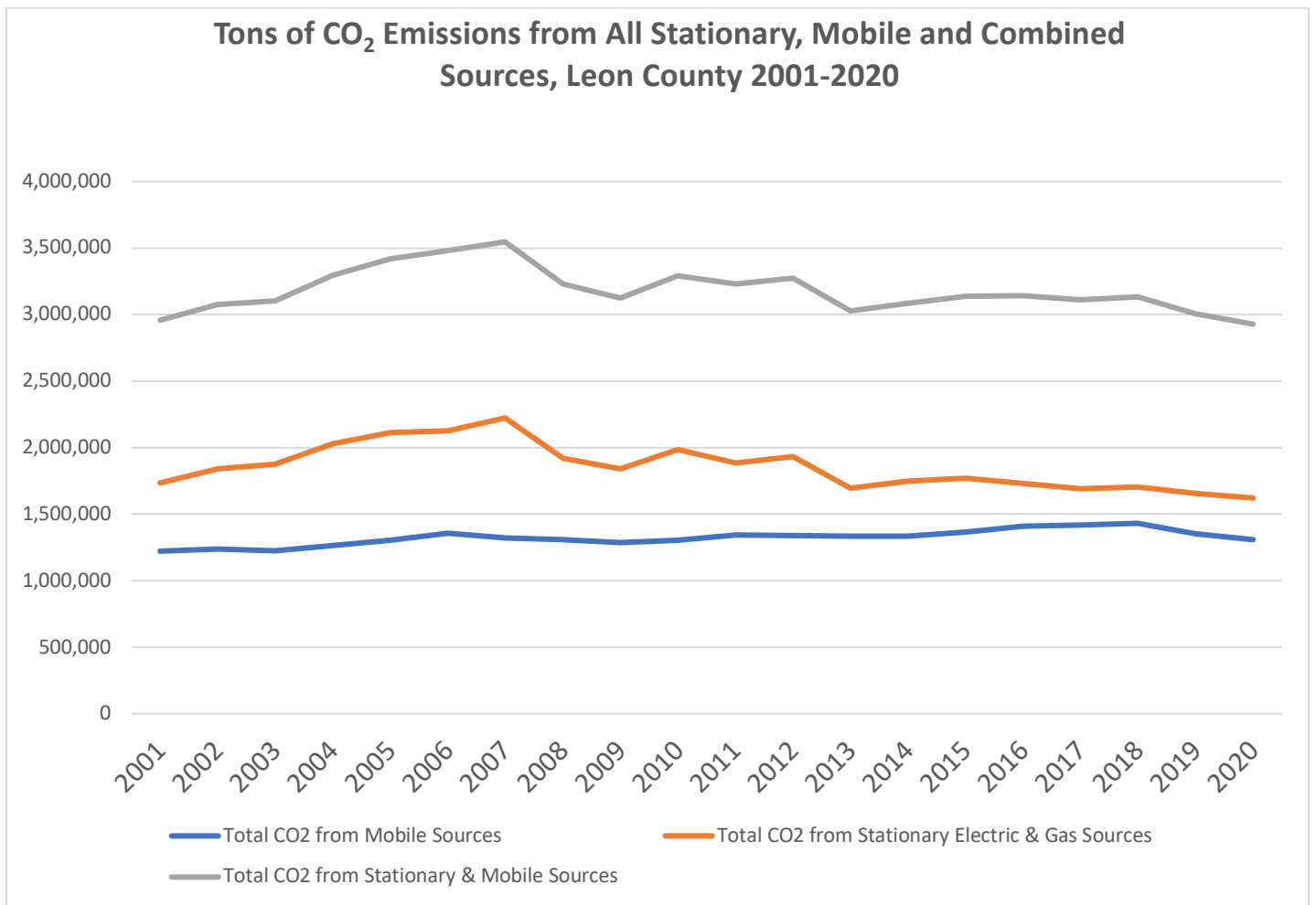
These activities were undertaken by local governments, energy providers, individuals, business, and other institutions. Taken together these actions are estimated to have reduced total annual Leon County CO₂ emissions by almost 100,000 tons or 3.1% by 2021. While this is a small percent of the total, 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.

¹⁰ 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



Total CO₂ Production

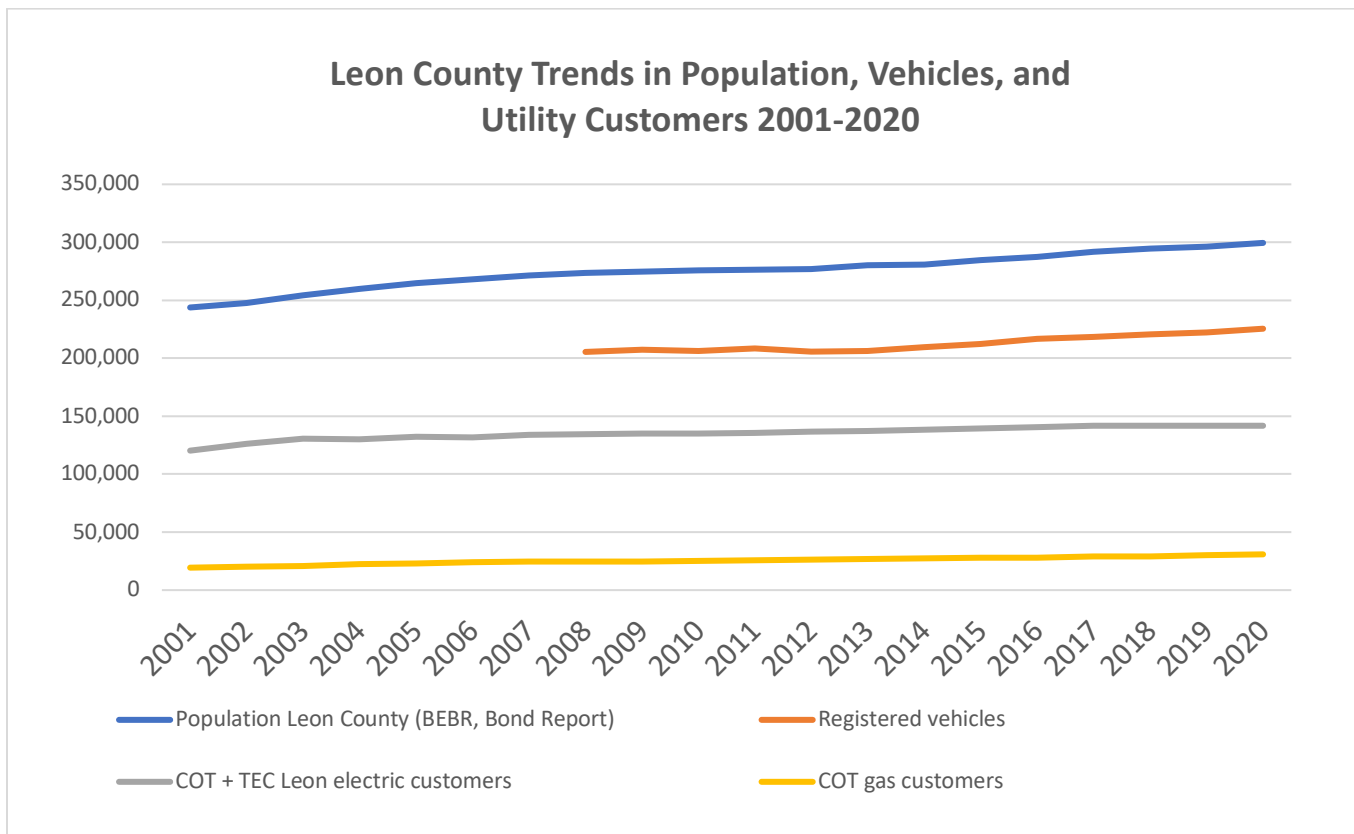




Total annual CO₂ emissions attributable to Leon County residents and businesses have been essentially stable since 2008 with stationary sources noticeably declining and mobile sources gradually increasing (though declining during the recent COVID years).¹¹ Stationary sources accounted for 55.4%, while mobile sources account for 44.6% of total CO₂ 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.

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

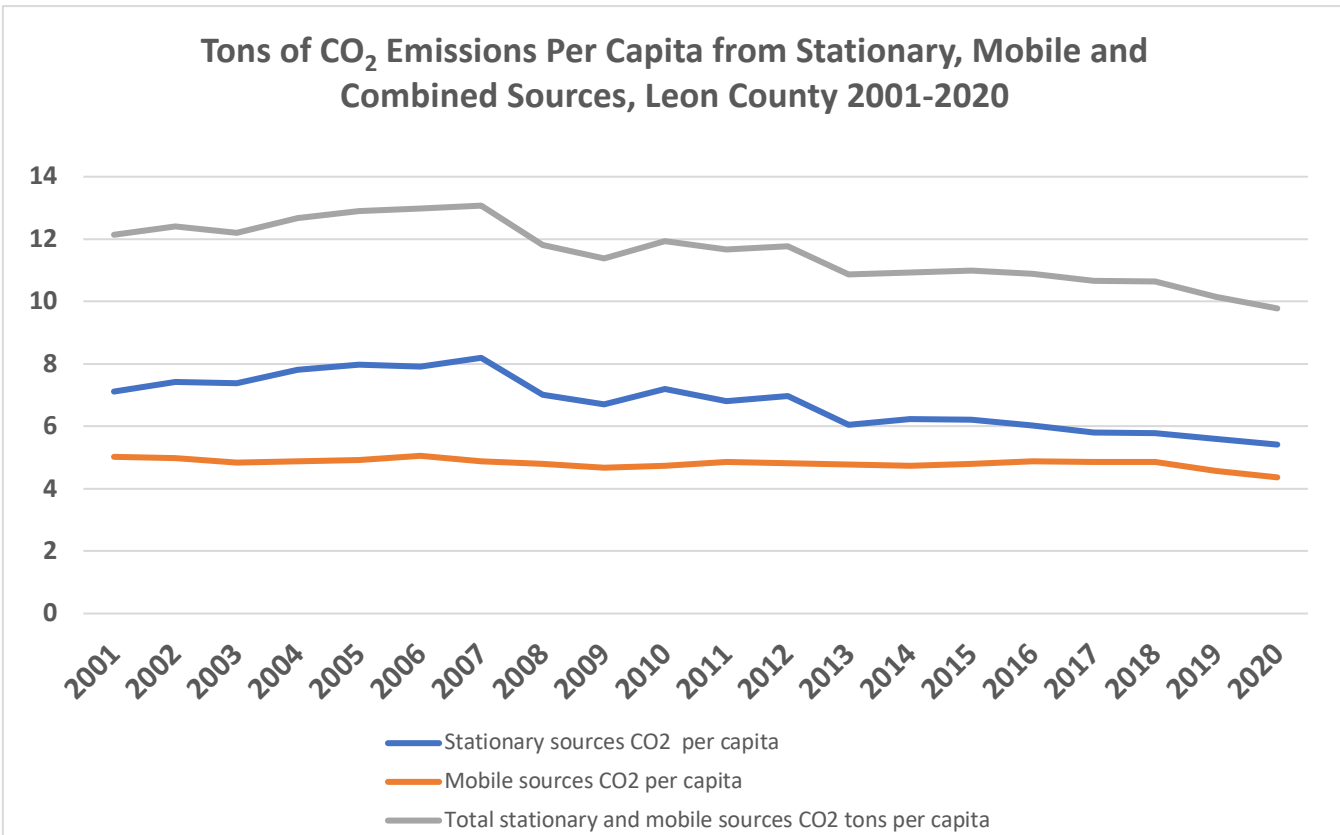


Adjusted for population growth, the per capita CO₂ production from stationary and mobile sources has been downward from 2001 through 2020. The cumulative decline is 19.4%, from 12.1 to 9.8 tons per capita per year.

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.¹²

The long-term decline in CO₂ production from residential sources since 2007 is also driven by a large decrease in the COT utility’s CO₂ emissions due to switching from other fuels to natural gas and installation of more efficient and combined-cycle gas-burning electrical generation equipment.

¹² “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.

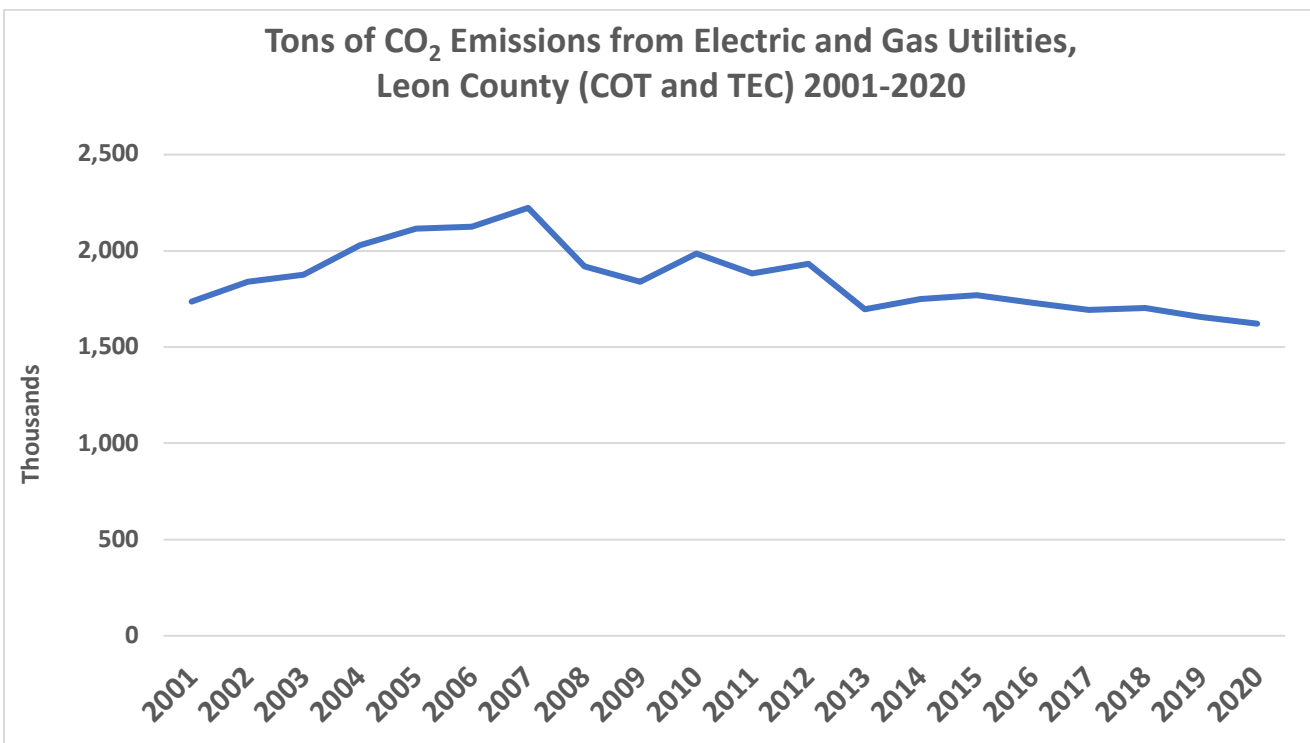
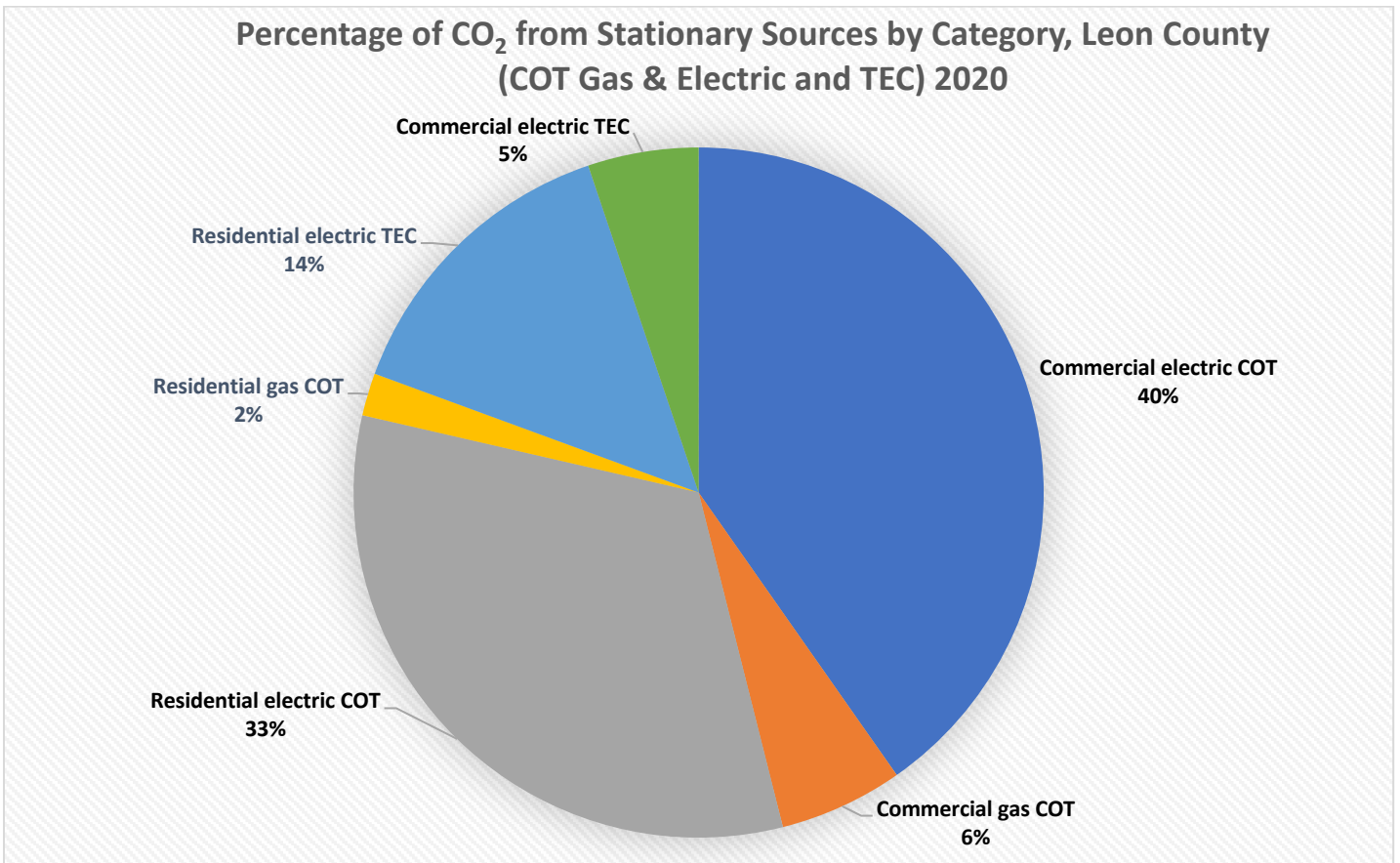


Stationary Sources

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.

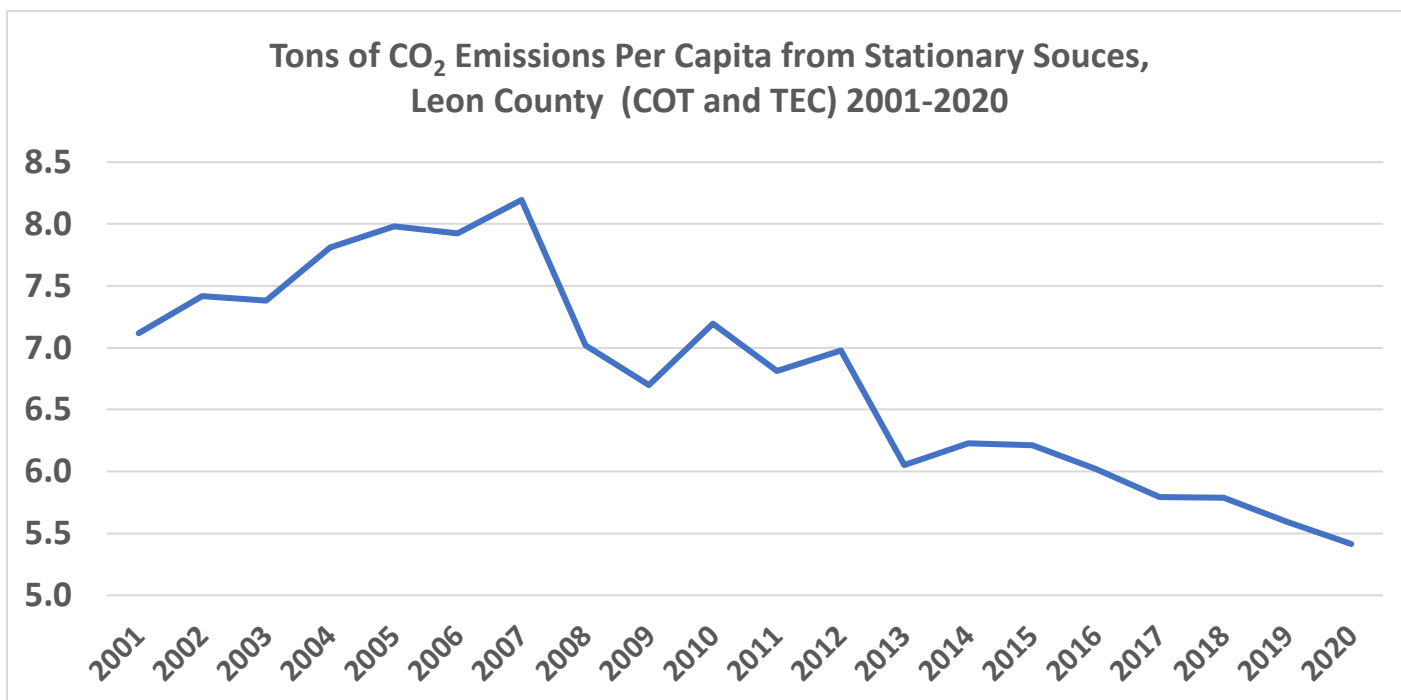
Total CO₂ production from stationary sources in Leon County (COT plus TEC) peaked in 2007, fell through 2013, and has been gradually declining since 2013.

For the COT utility in 2020, commercial electrical customers accounted for more CO₂ production than residential customers; the reverse is true for the TEC. Total commercial electric customers accounted for slightly more CO₂ production (51%) than residential electric customers (49%) in 2020. Electricity use accounted for much more of Leon County’s stationary source CO₂ 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 CO₂ production from stationary sources despite population growth.

On a per-capita basis, CO₂ 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.



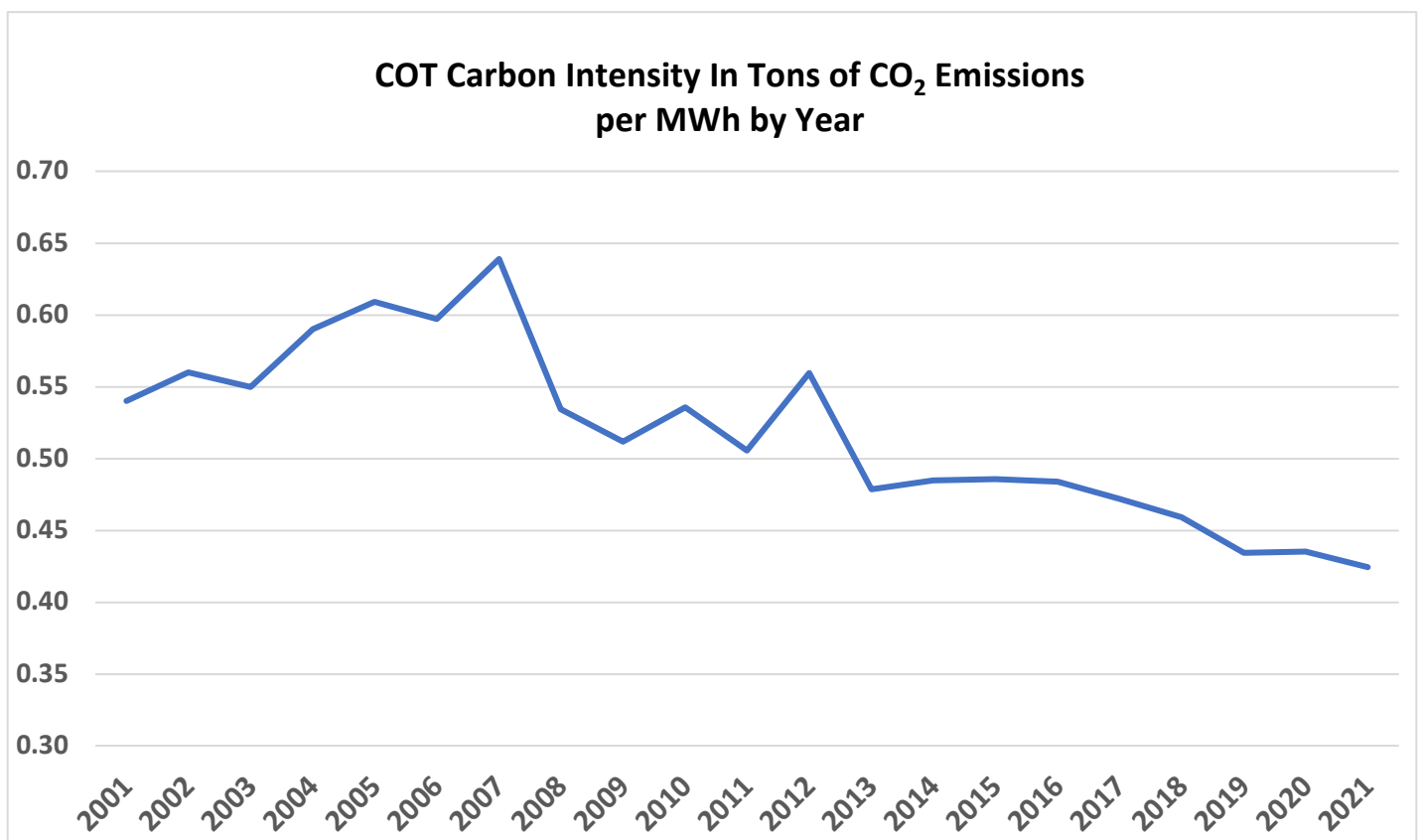
Electrical Usage

Carbon Intensity

The following chart provided by City of Tallahassee Electric Utility staff offers estimates of tons of CO₂ emissions per MWh by year, otherwise referred to as “carbon intensity.” The carbon intensity of electricity is the number of grams of CO₂ 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.¹³ 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 CO₂ 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 CO₂ carbon intensity could also decline if newer, more efficient generating equipment and more solar facilities come on-line across the COT and TEC systems.

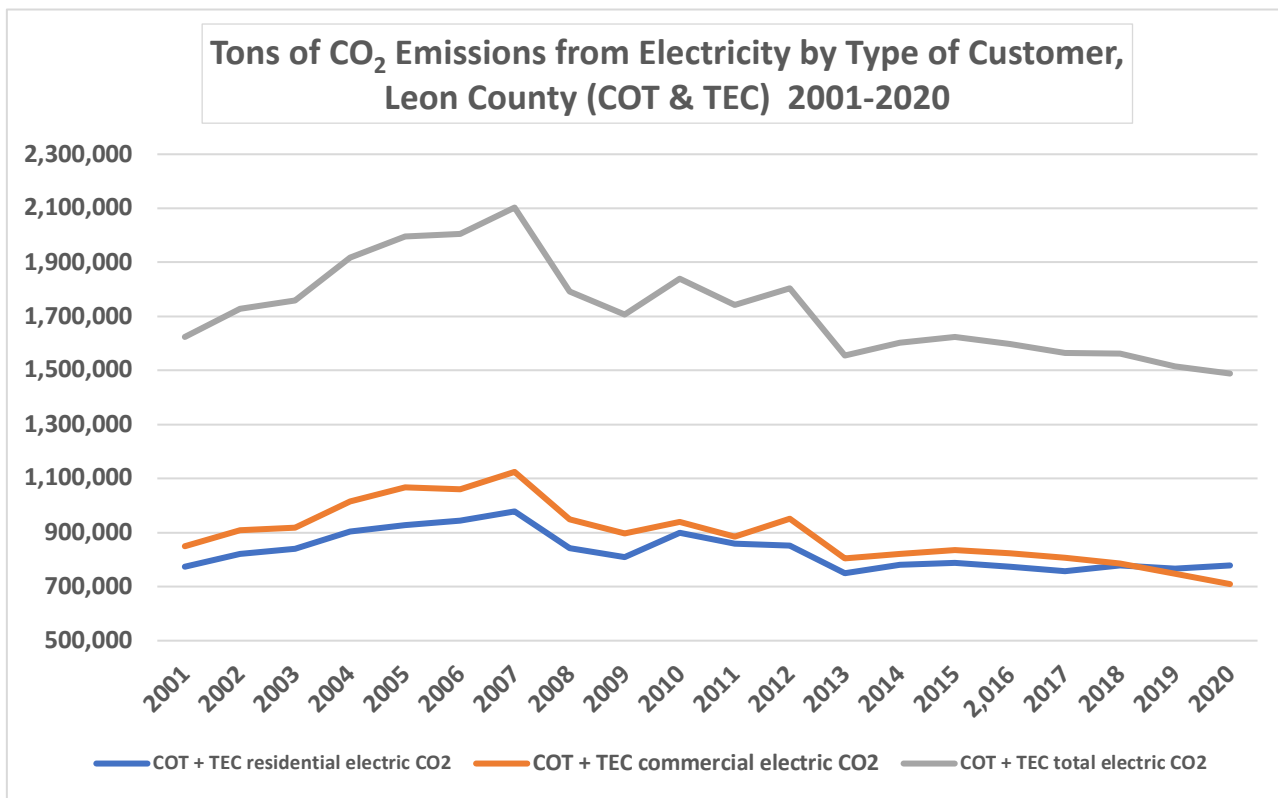


Talquin Electric Cooperative buys almost all its electricity from the Seminole Electric Co-op and just over half of Seminole’s electricity comes from burning coal. The carbon intensity of TEC will also decrease as both Talquin and Seminole add utility scale solar and as more of their customers install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

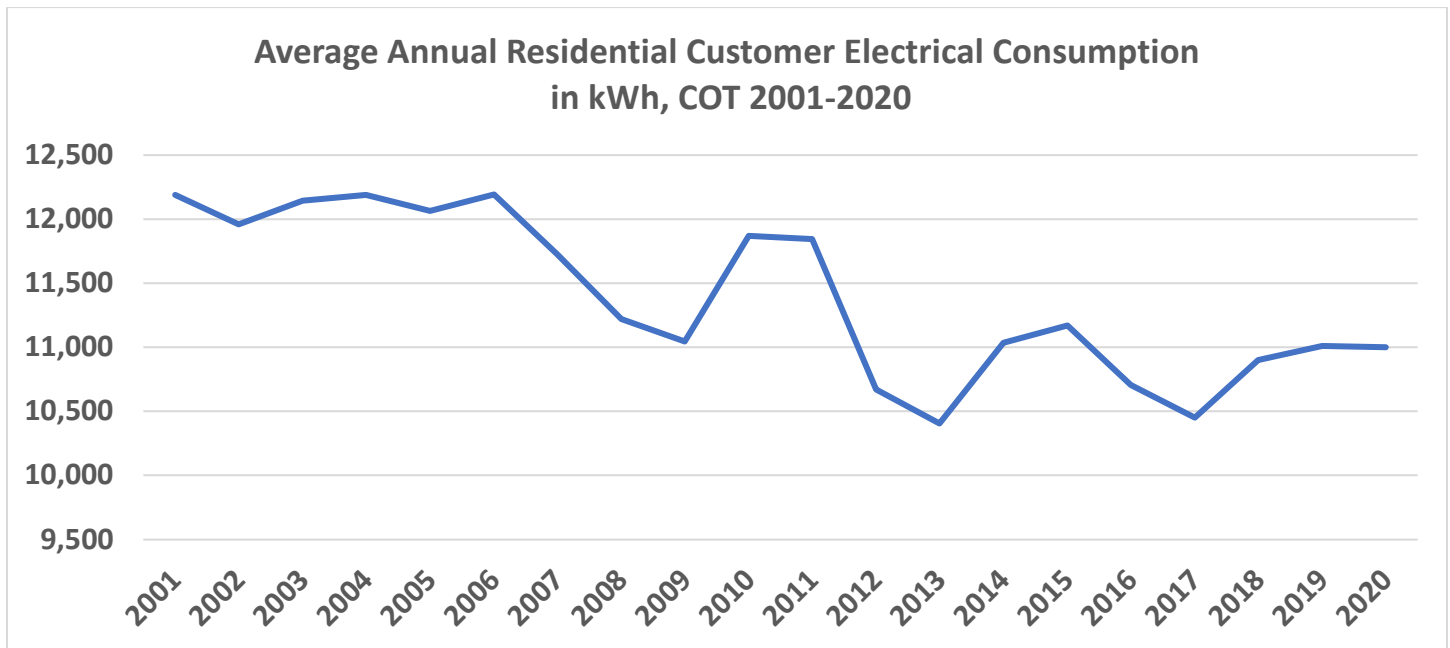
¹³ <https://www.eia.gov/todayinenergy/detail.php?id=45496>

CO₂ Production Attributable to Electrical Usage

Commercial and residential electricity customers each account for close to half of total CO₂ production from electricity. Commercial electrical demand and therefore CO₂ 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 CO₂ respectively across the county by 2020.



Residential Usage



The considerable declines in stationary per capita CO₂ 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 CO₂ production per MWh of electricity produced by the city utility. These result in average customer CO₂ drops and average per capita CO₂ falls as well.

Commercial Usage

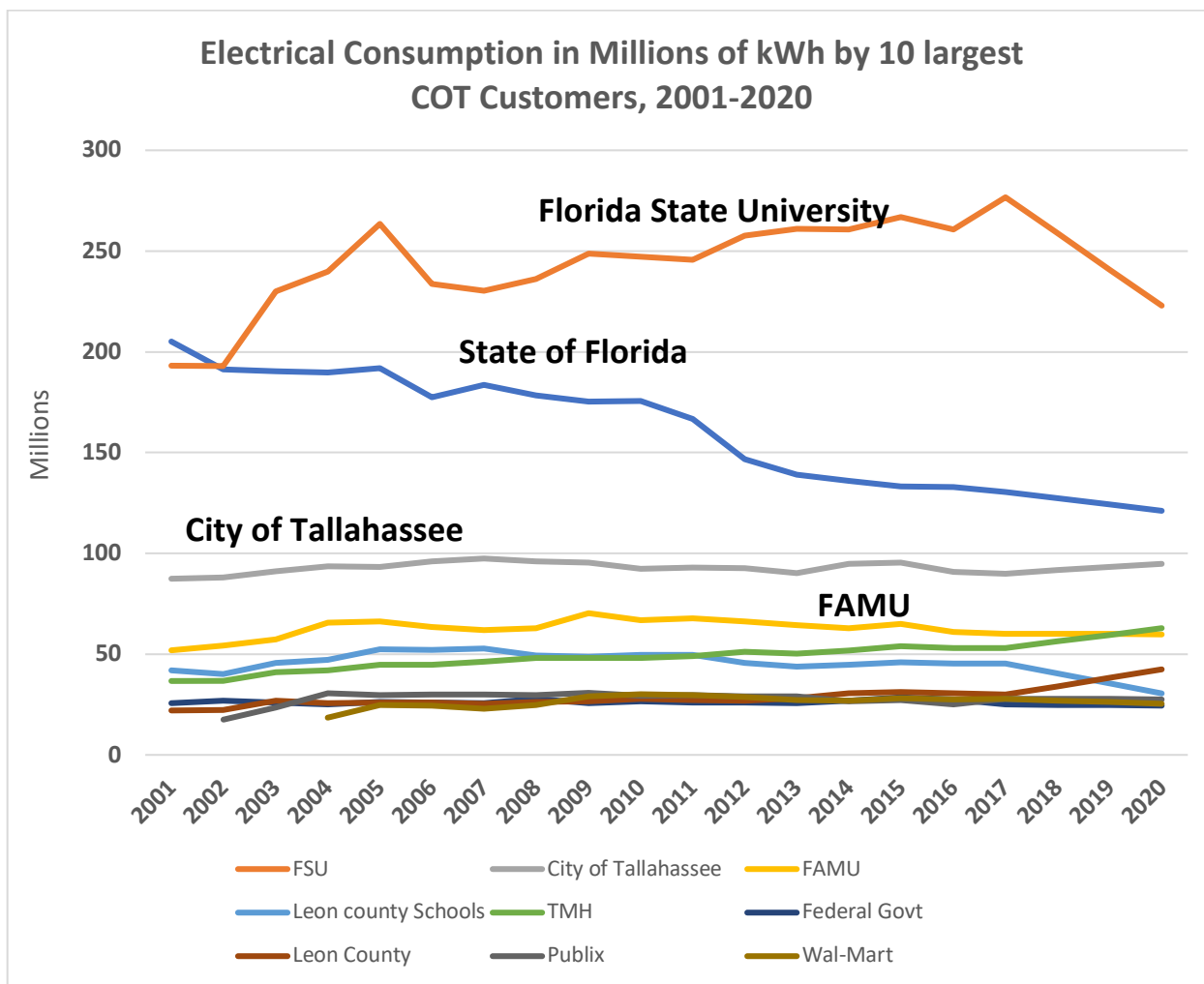
The ten biggest electric customers together used 27.2% of COT’s electricity in 2020. FSU alone accounted for 8.5%, and state government for 4.6%. Consumption patterns can change rapidly over time and these 2020 values were considerably dampened by COVID confinement. The biggest 2020 declines were at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

Total Energy Consumption in kWh and Percentage of Total Electricity Consumption for 10 Biggest Tallahassee Electric Customers, 2020¹⁴				
	kWh	kWh %	Revenue	Revenue %
Florida State University	222,940,572	8.5%	\$ 15,466,226	6.2%
State of Florida	121,117,778	4.6%	\$ 9,234,184	3.7%
City of Tallahassee	94,949,517	3.6%	\$ 8,574,152	3.4%
Tallahassee Memorial HealthCare	62,888,379	2.4%	\$ 4,123,906	1.6%
Florida A & M	59,899,762	2.3%	\$ 4,033,773	1.6%
Leon County	42,442,782	1.6%	\$ 4,458,755	1.8%
Leon County School Board Leon County	30,503,622	1.2%	\$ 2,334,600	0.9%
Publix Markets	27,634,499	1.1%	\$ 2,132,790	0.9%
Wal-Mart	25,389,794	1.0%	\$ 1,811,291	0.7%
Federal Government	24,449,257	0.9%	\$ 1,839,986	0.7%
Totals	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.

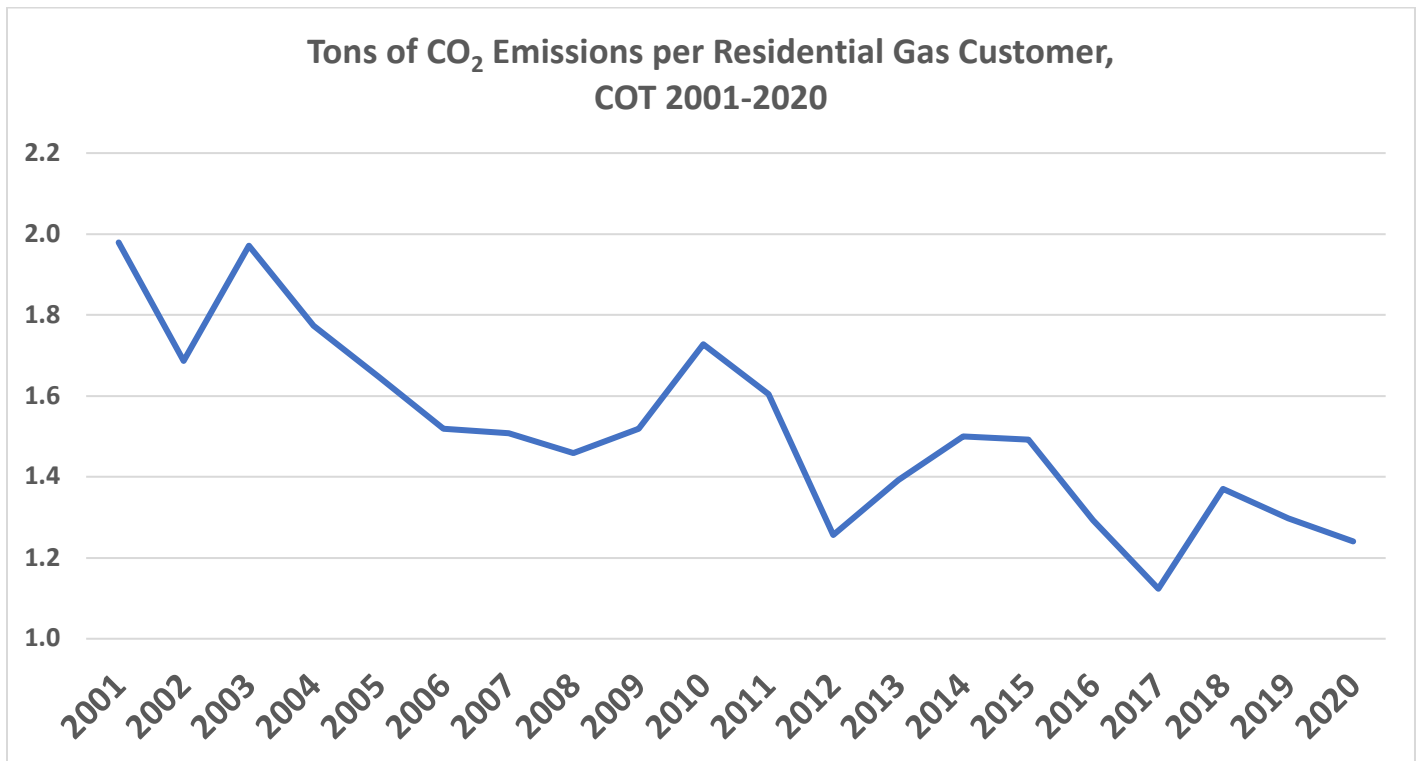
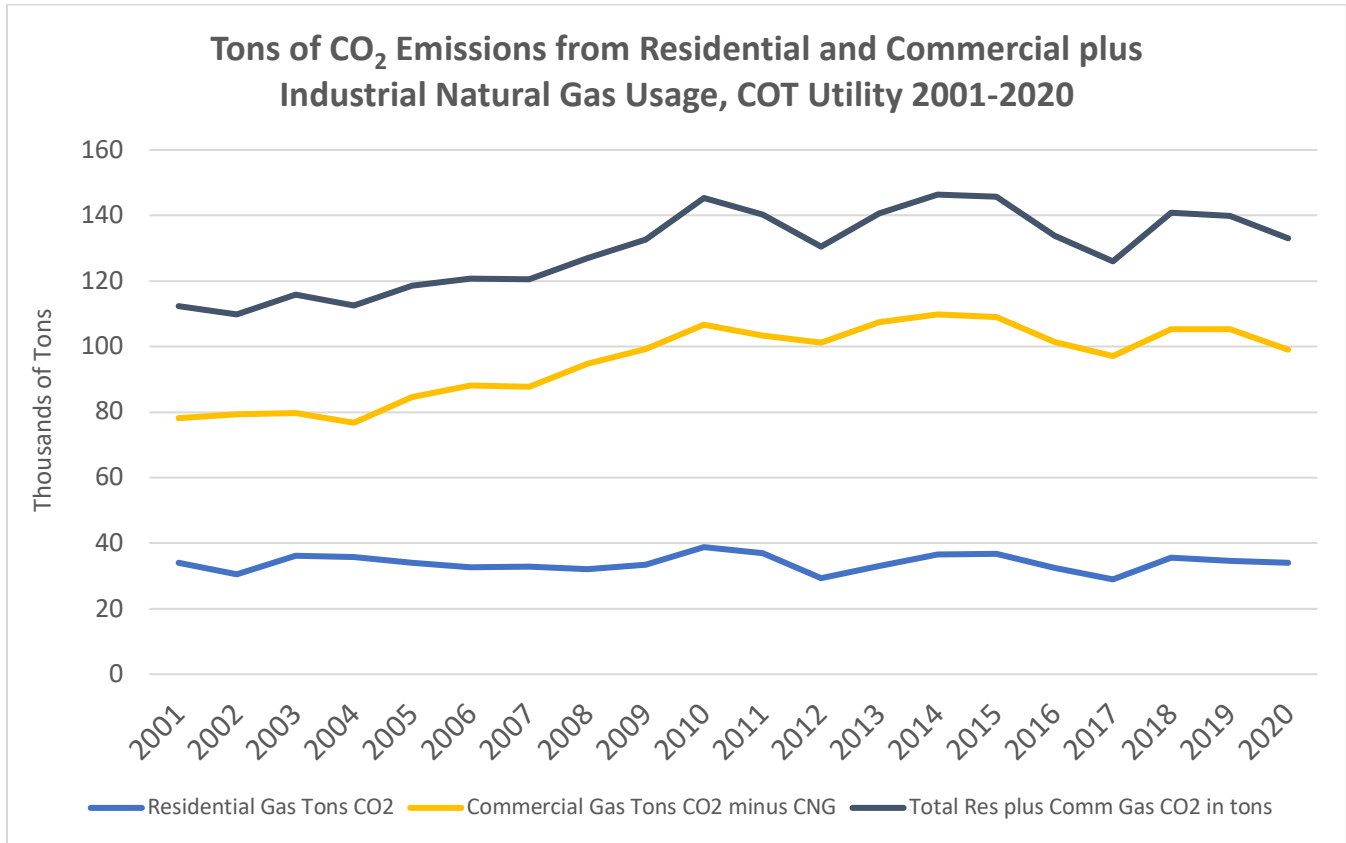
¹⁴ City of Tallahassee Electric Utility Staff, 2022.



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 CO₂ 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 CO₂ releases attributable to residential customers have remained essentially the same in 2001 and 2020. This is because annual CO₂ 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.



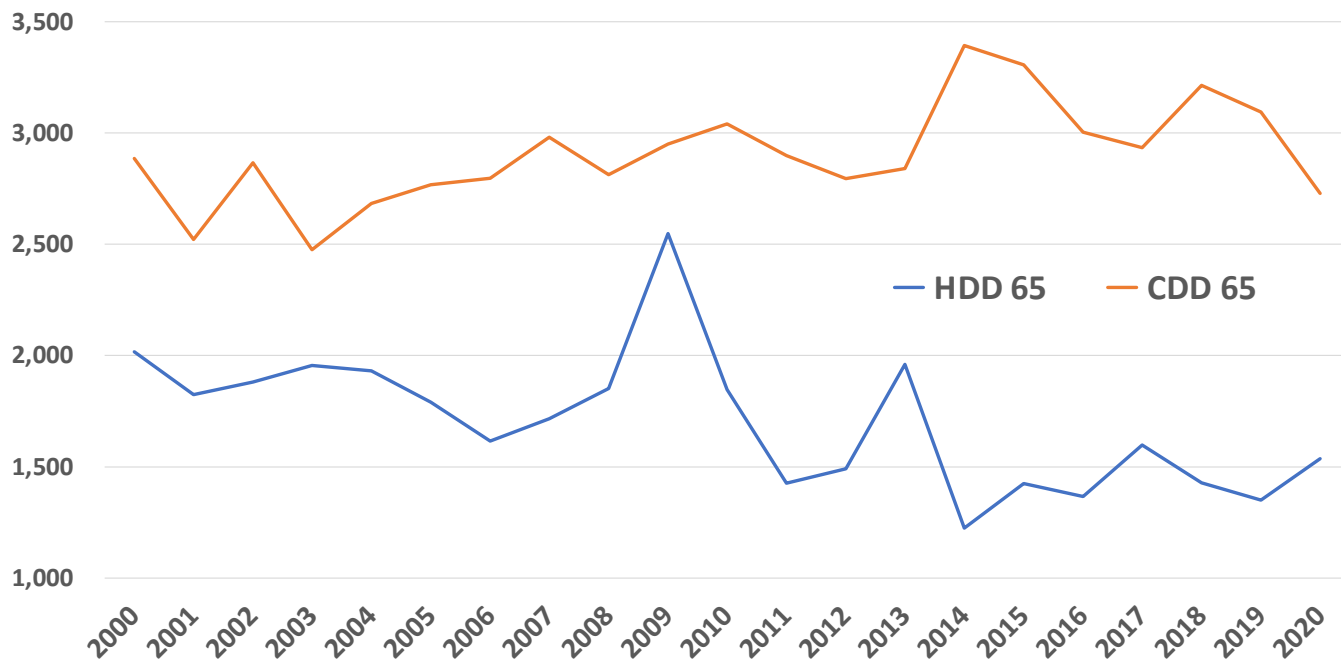
Tallahassee Heating and Cooling Degree Days (HDD/CDD)¹⁵

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



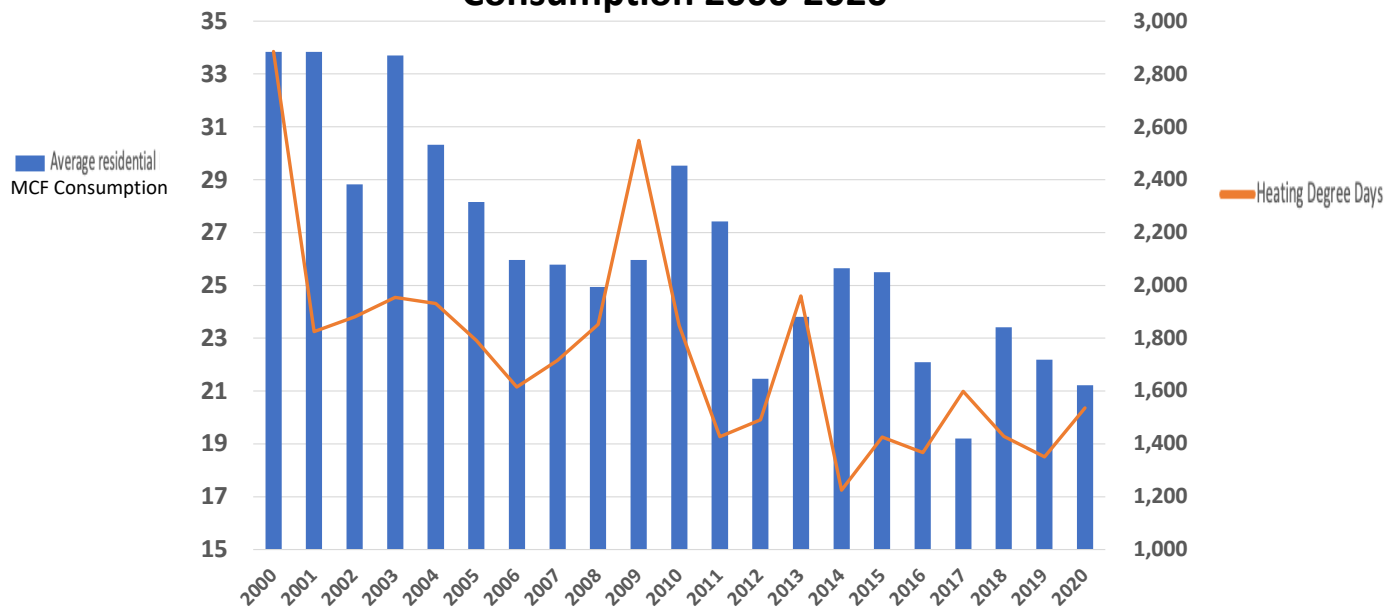
The annual number of heating degree days (requiring energy for heating interior spaces) in Tallahassee has fallen by 24% - from 2,017 in 2000 to 1,536 HDD by 2020. This trend suggests that on average 24% less electricity, natural gas and other fuels are required for year-round heating needs. Indeed,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

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

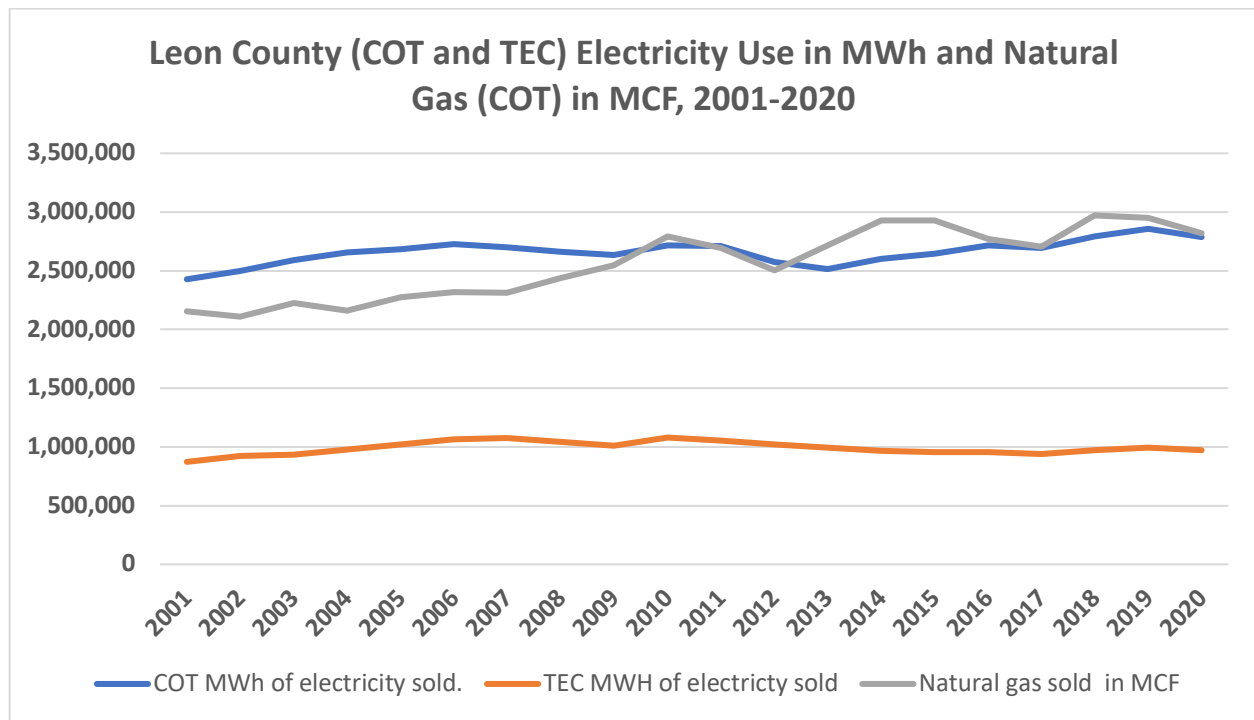
discussion and accompanying chart showed average residential natural gas consumption use falling significantly as heating degree-days fell over the last two decades.

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 CO₂ 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.



CO₂ production from natural gas is simply proportional to the amount used (in MCF), while CO₂ production from electricity is the product of amount used (seen here in MWh) and carbon intensity (tons of CO₂ released per MWh distributed).

Solar Energy

Solar Energy Capacity¹⁶

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.¹⁷ In fact, customer capacity more than doubled over the 2019-2021 period alone.

¹⁶ 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.

¹⁷ 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.¹⁸

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 CO₂ reductions here and across the nation and world.

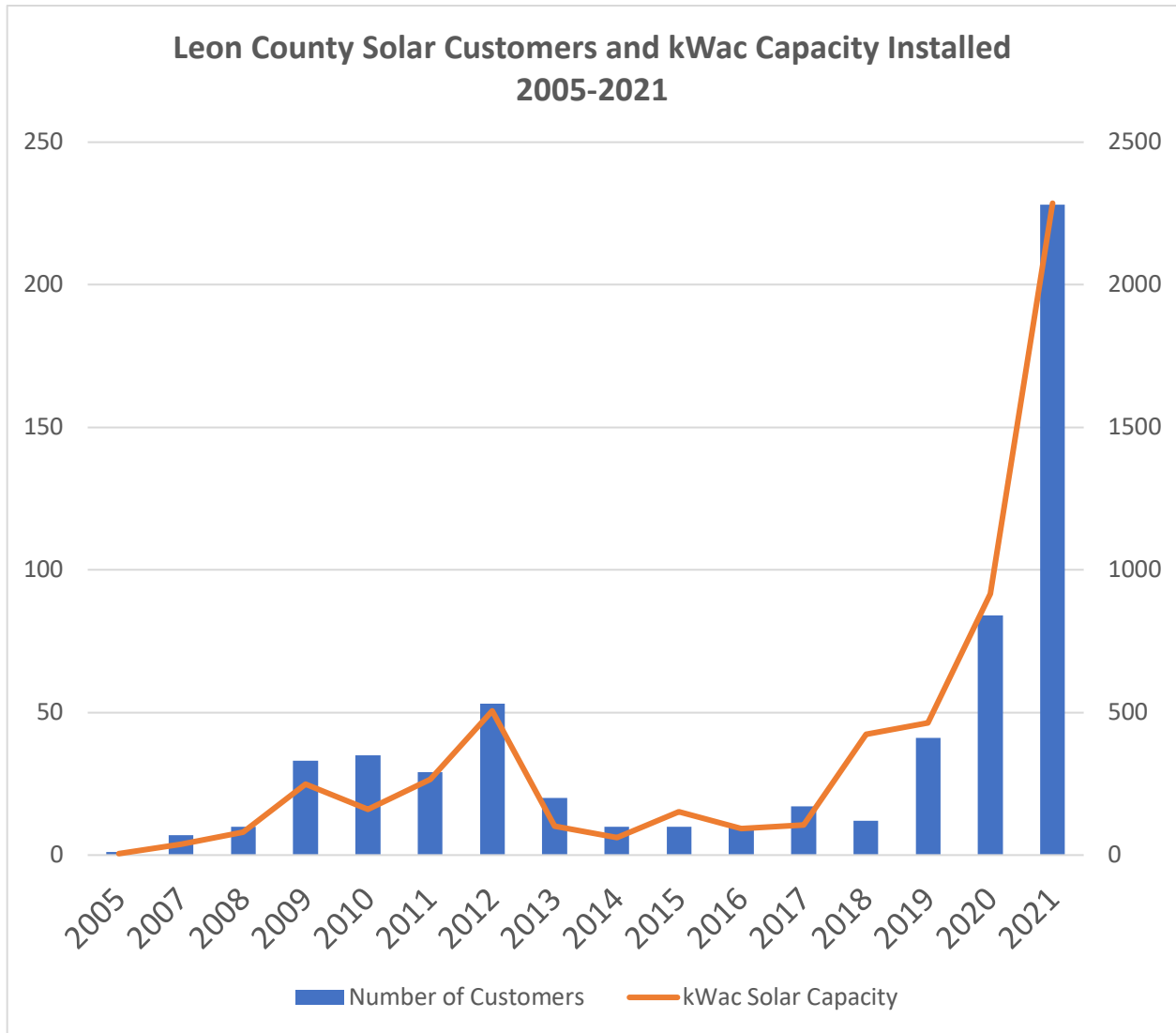
Source: Communications with Steve Urse, April 2022.

Installed Solar Generation Capacity, Leon County (COT+TEC) 2005 to 2021												
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

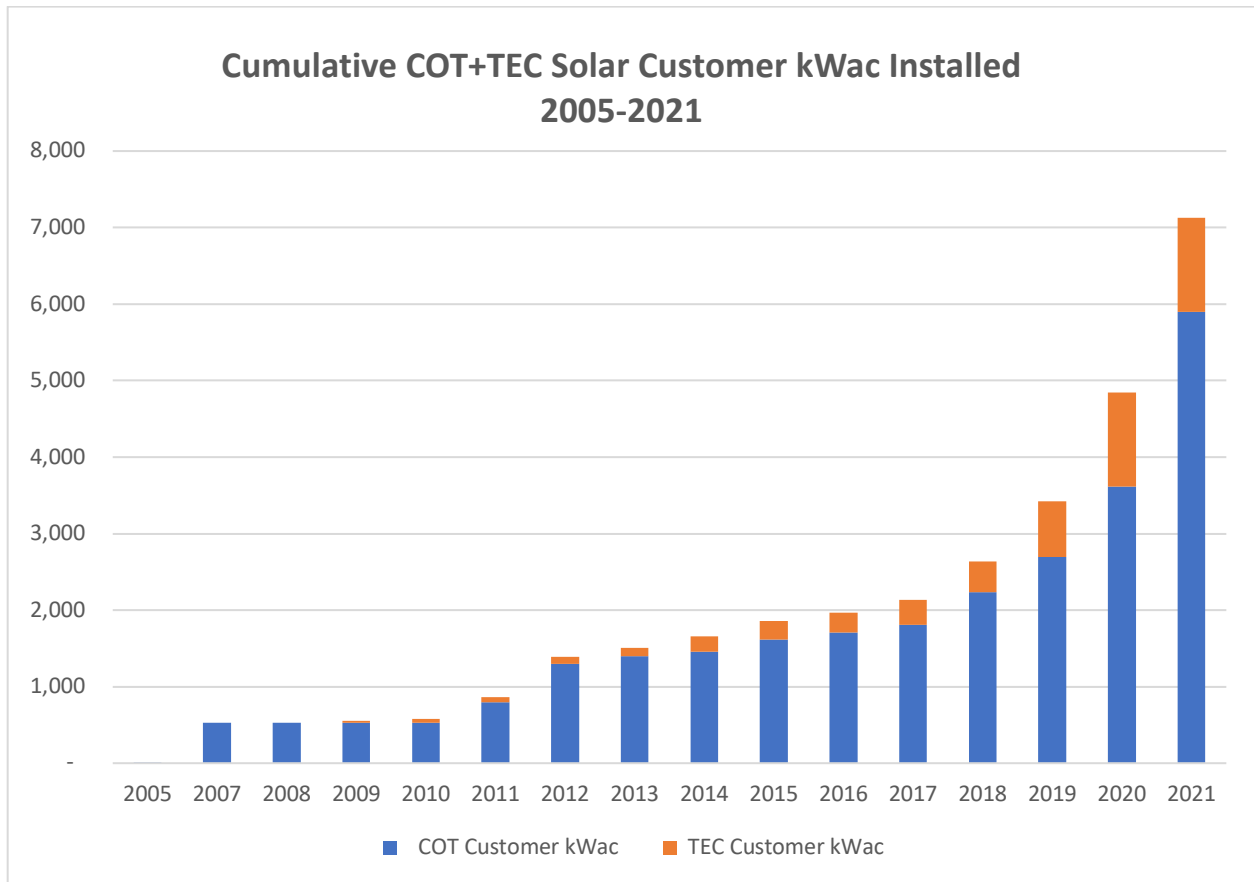
In 2017 Leon County Talquin customers had approximately 379 kWac of PV capacity in place which expanded almost 700% to 2,511 kWac by the end of 2021.¹⁹ Current solar applications are increasing at a rate of approximately 10% per month. TEC is in the process of constructing a utility-owned solar generating farm

¹⁹ 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.

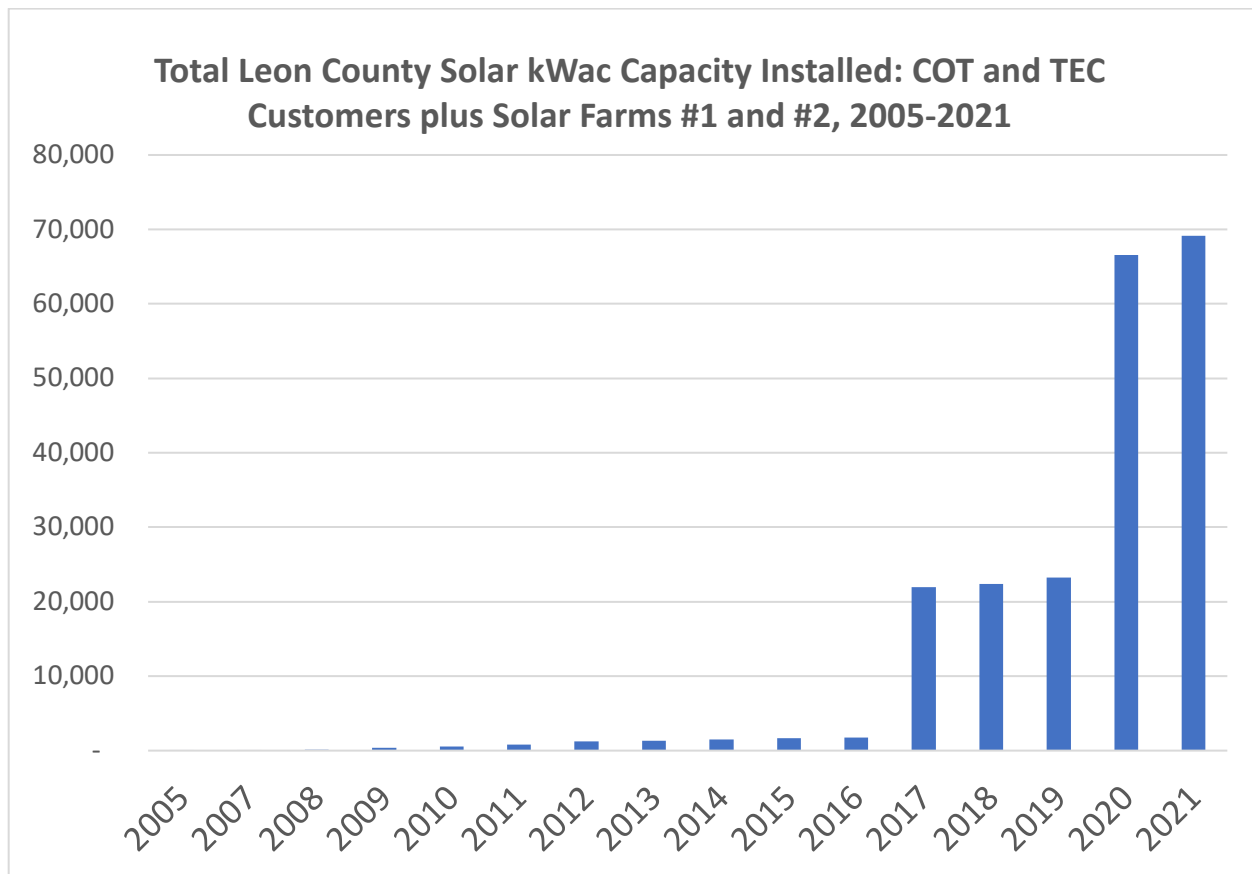
located in counties nearby but not in Leon County. TEC has committed to a Leon County connected system in the future once current projects are complete.²⁰



²⁰ 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.



CO₂ 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 CO₂ 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.²¹ 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.²² Another source suggests 10,716 kWh or 1,072 kWh per installed kWac.²³

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

²¹ Private communications COT, Bob Seaton, August, 2022

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

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

following table to estimate annual kWh production for all other Leon County customer installed kWac capacity.²⁴ 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 CO₂ emissions by 48,818 tons in 2021.²⁵ This constitutes 3.01% of all Leon County stationary sources emissions for that year.

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

²⁵ CO₂ 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.²⁶

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

²⁶ Michael Ohlsen, City of Tallahassee Electric & Gas Utility, May 2022.

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

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

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.²⁷ TEC also has an active energy audit program but data from this program is currently not available.

²⁷ Michael Ohlsen, City of Tallahassee Electric & Gas Utility, June 2022

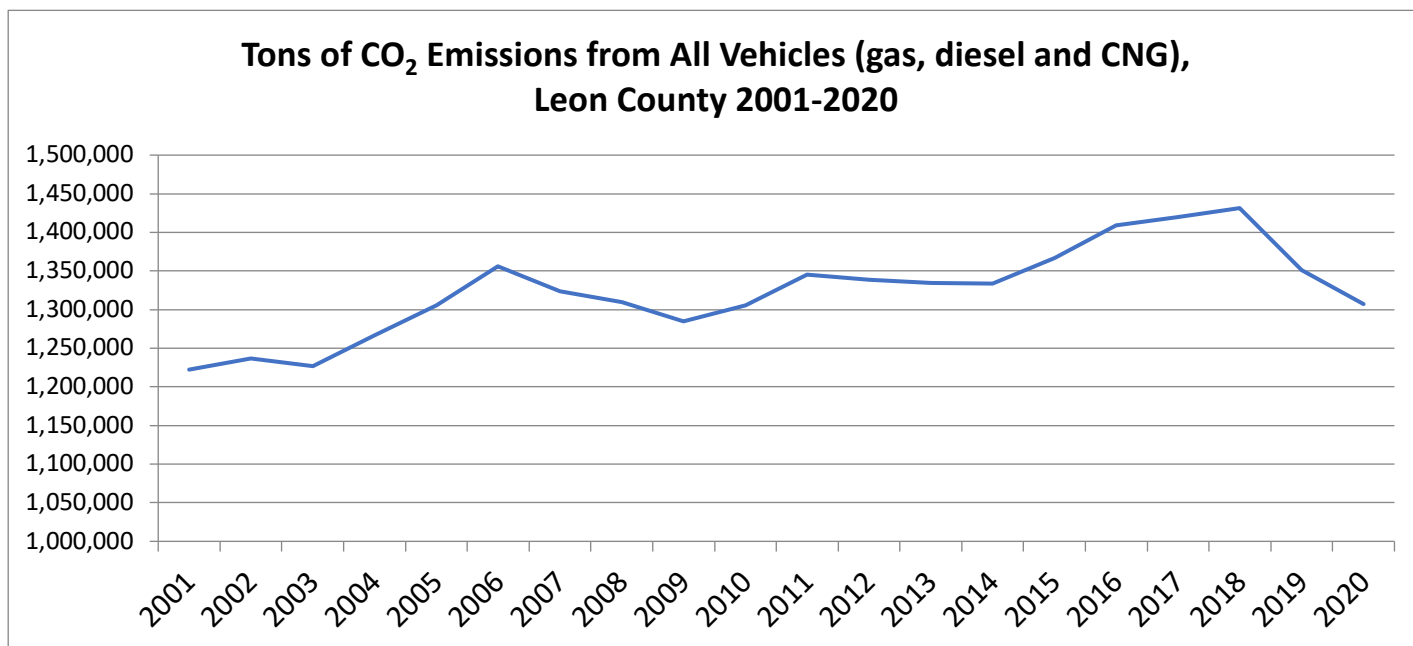
Despite these qualifications the following table estimates the potential reductions in CO₂ emissions if all these forecasted MWh savings have been realized. The potential ongoing annual reductions are forecast to reduce Leon County emissions by 44,028 tons of CO₂ in 2021 alone.

Year	Estimated Ongoing Annual Cumulative Savings (MWh)	COT Carbon Intensity Factor	DSM Tons of CO₂ Offset	Total Leon County Stationary & Mobile Tons of CO₂	Percent of Leon County Stationary & Mobile CO₂
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

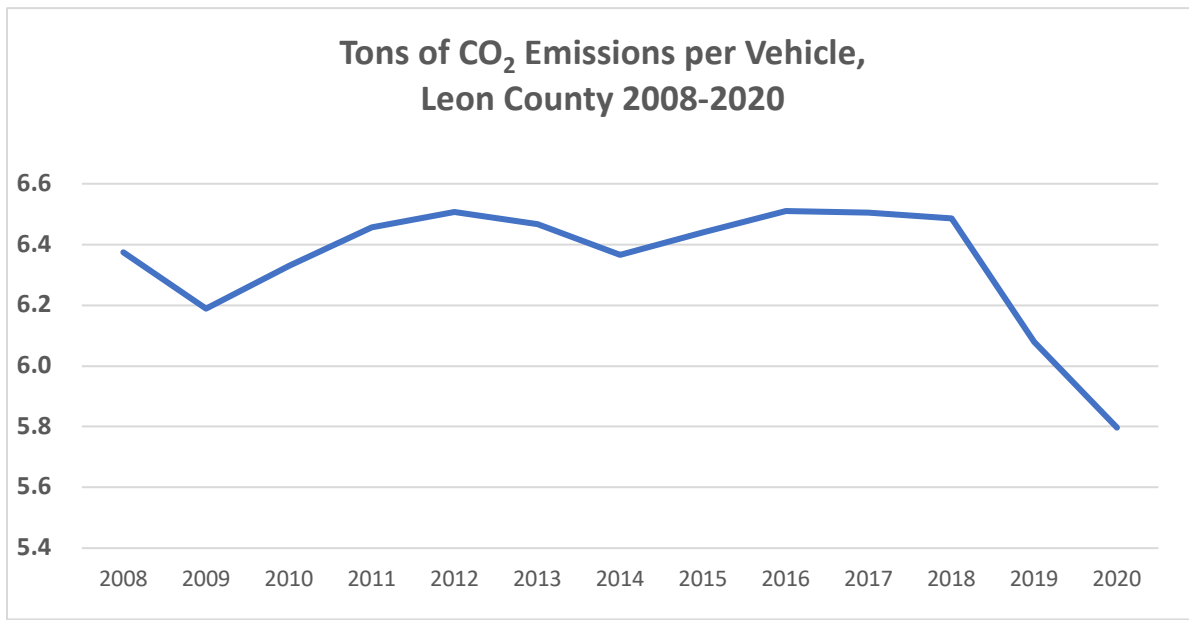
CO₂ Production Attributable to Leon County Motor Vehicles

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 2020.²⁸ This 10% increase corresponds to a gradual population increase. Accompanying that was a commensurate 7% growth in mobile CO₂ emissions thru 2018. The period 2019-2020 had unusually low emissions from mobile sources years because of COVID travel reductions.

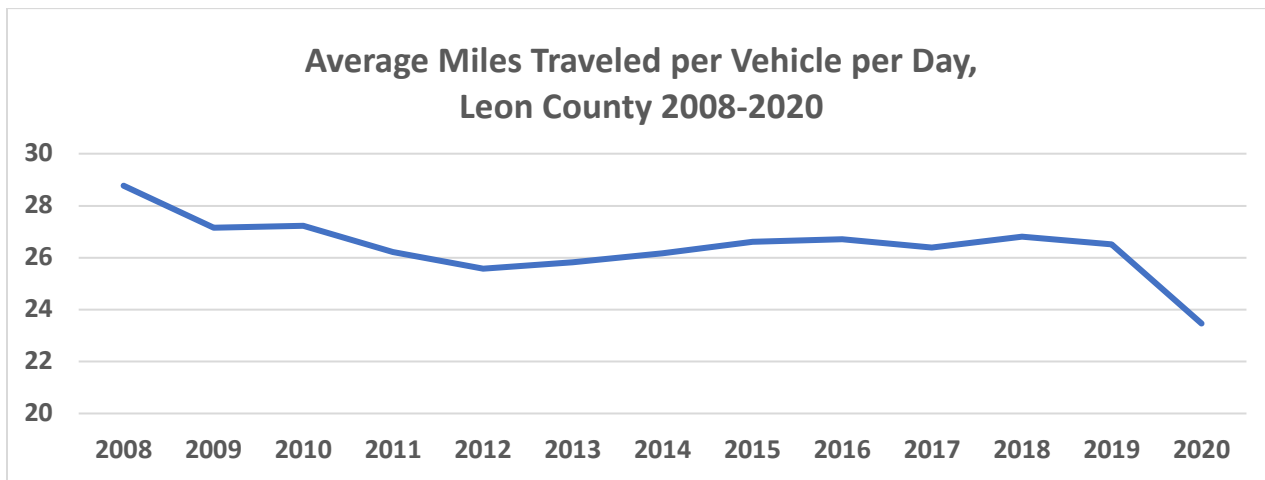


Tons of CO₂ emissions per vehicle across Leon County dropped by .58 tons or 9% over the 2008-2020 period. This is likely attributable to introduction of new more fossil fuel efficient and plug-in hybrid and electric vehicles. Average vehicle daily trip miles also fell over the 2008-2020 timeframe as well.

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



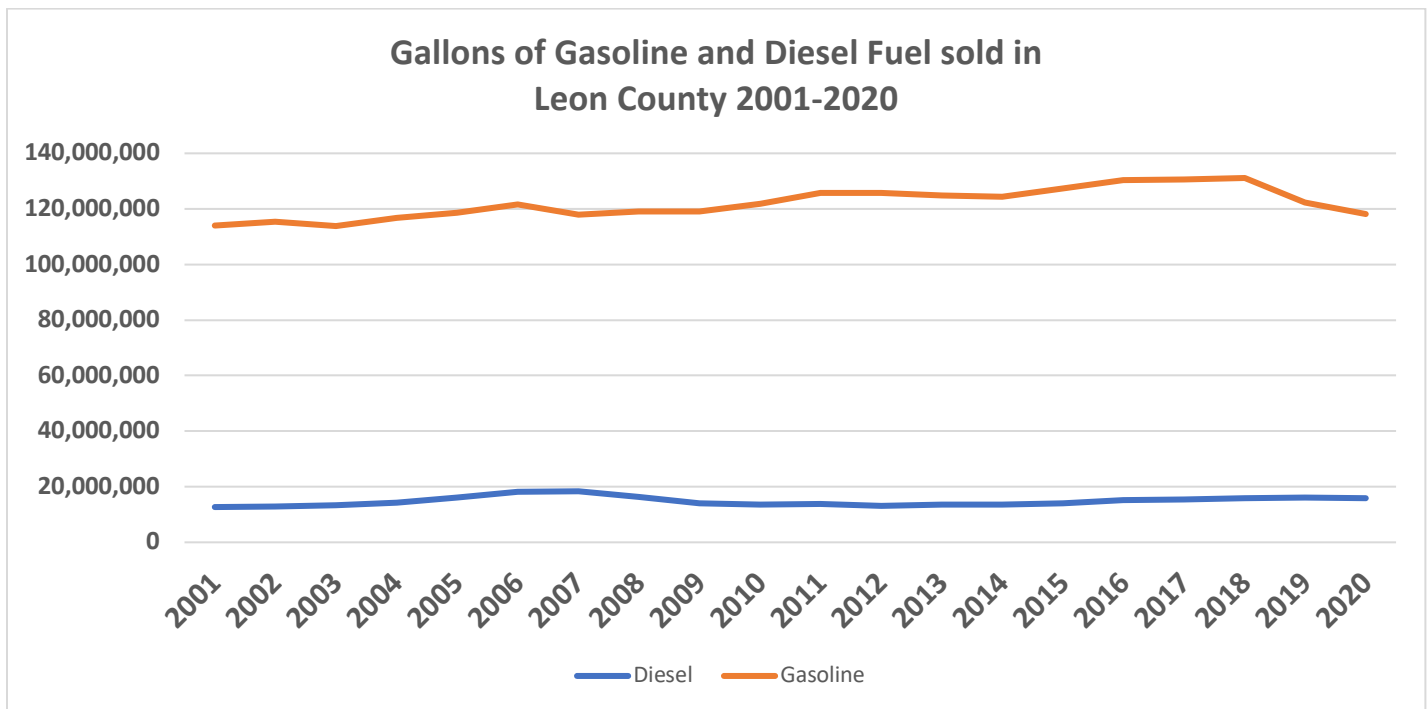
The average daily vehicle travel length fell from 29 miles a day in 2008 to a fairly stable 26 miles over the 2011-2019 period and to 23.5 miles in 2020. Nationally and locally individuals have tended to travel fewer miles in recent years and fewer still given COVID travel reductions in 2020.²⁹ Hence the relative drop in CO₂ 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.³⁰

²⁹ Florida Department of Transportation. Go to https://ftp.fdot.gov/public/folder/RedkVJJQbE_ZL0_9HyAF-A/Public_Roads

³⁰ 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 Sales³¹

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).³² While current penetration levels are still low, sales are continuing to accelerate each year as consumers and manufactures warm to the new technology.³³ 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%.³⁴ 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 2040.³⁵

³¹ 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>.

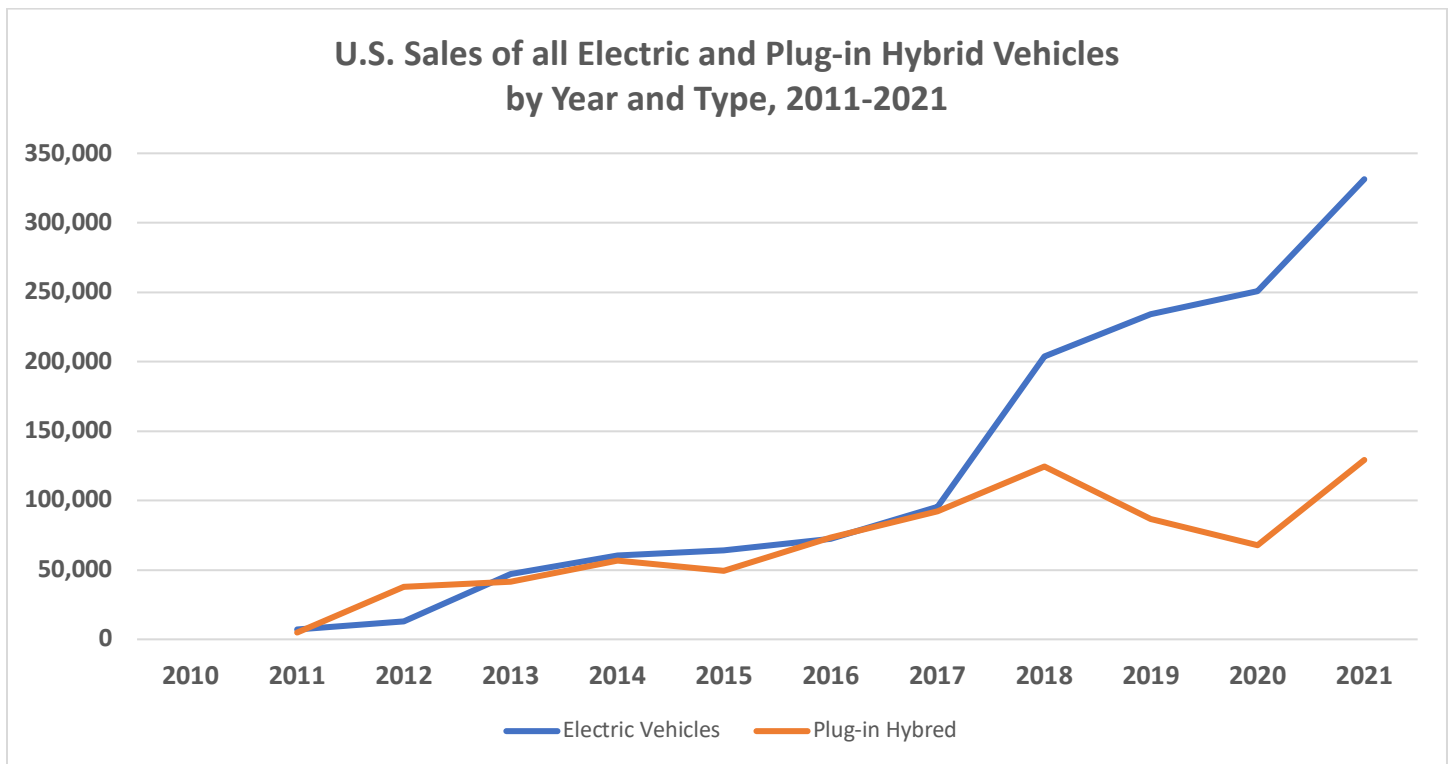
³² Numbers of electric and plug-in-hybrid vehicles sold in Florida: Auto Alliance website at <https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard> and <https://cleanenergy.org/blog/floridas-electric-vehicle-market-is-ready-for-lift-off/>; <https://www.gov.ca.gov/2022/02/25/california-leads-the-nations-zev-market-surpassing-1-million-electric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

³³ <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>.

³⁴ Florida Department of Transportation Infrastructure Master Plan, public webinar, April 2021

³⁵ 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 CO₂ 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.³⁶

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.³⁷

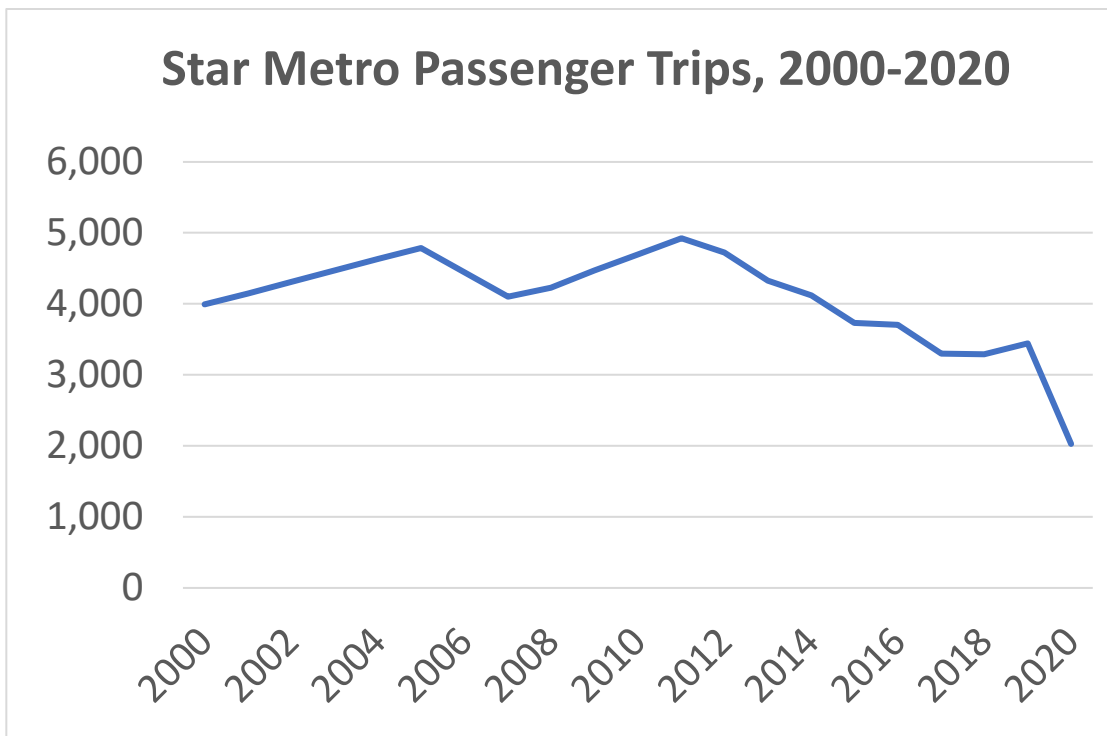
Bus Travel

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

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

³⁷ Ibid.

with a single year 42% drop in ridership in 2020 falling to only 2 million that year.³⁸ 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.

³⁸ 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/>.

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

The preceding table³⁹ reflects the potential reduction in CO₂ emissions in tons per year given the purchase and replacement⁴⁰ 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 CO₂ from Leon County’s atmosphere. Each of COT StarMetro’s 19 operating electric busses annually removes 115 tons (or 230,000 pounds) of county CO₂ emissions.⁴¹

³⁹ 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.

⁴⁰ 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.

⁴¹ 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 CO₂ 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 (≥ 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.⁴²

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

⁴² 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.

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 Infrastructure⁴³

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.

⁴³ Source: Tabular data provided by Tallahassee-Leon County Growth Management staff.

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

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.⁴⁴

Data Sources, Assumptions & Conversion Factors

Commercial CO₂ 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 CO₂ 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 CO₂ production generated from coal, natural gas, and renewables were applied to the proportion of

⁴⁴ 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 CO₂ 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 CO₂ 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 CO₂ 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.