Town of Cary

2018 Inventory of Community Carbon Emissions

A BRIEF SUMMARY OF INVENTORY FINDINGS

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Acknowledgements

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Contents

2018 GHG Inventory

This report uses metric tons of carbon dioxide equivalent, of "MTCDE", to count and report emissions, which is an international standard unit. All forms of greenhouse gas (GHG) emissions are converted to this common unit.

In 2018, the entire Town of Cary (TOC), including all residents, businesses, and government operations created 1,714,500 MTCDE GHG emissions, or 10.2 tons per person[1]. Using fossil fuels created 96% of those emissions. Smaller sources include landfills, sewage treatment plants, and from the use of refrigerants in buildings and vehicles. By activity, fifty-nine (59%) are associated with buildings and 37% from transportation, mainly cars and trucks. TOC's lands and forests absorb about 14,932 MTCDE emissions per year, equivalent to 0.87% of Town's GHGs emissions.

A common way of segregating emissions is by "Scope" with Scope 1 being those emissions that occur within a municipality's boundaries, Scope 2 being those emissions associated with the grid-supplied energy used within the municipality's boundaries, and Scope 3 being emissions that are associated with a community but occur outside of its geographic boundaries. 99% of emissions in the Cary GHG inventory are either Scope 1 or Scope 2.

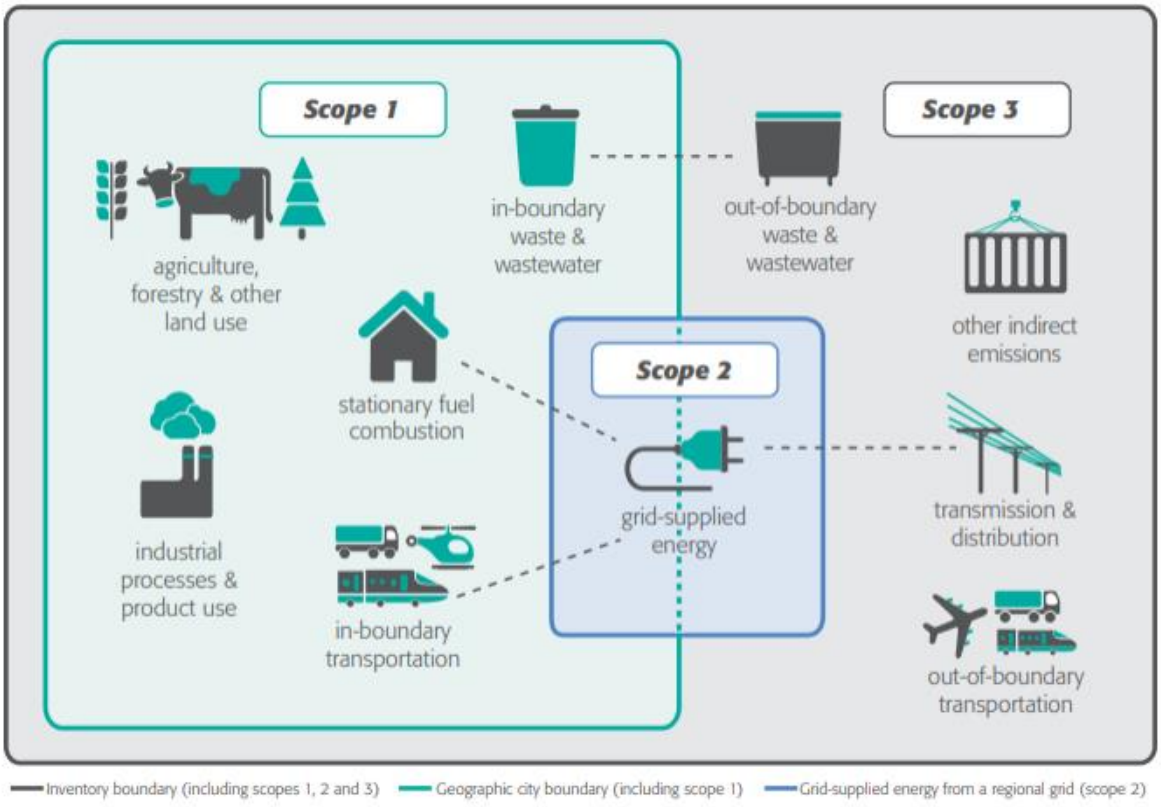

Figure 1: Scope 1, 2, and 3 Carbon Emissions

[1] All report calculations, tables, and data sources are in 2018_TOC_GHG_Inventory.FINAL.xlsx

Diagram From:
https://ghgprotocol.org/sites/default/files/standards_supporting/GPC_Executive_Summary_1.pdf

Table 1: GHG Emissions by the Numbers

GHG Emissions	Percent	GHG Emissions (MTCDE)
Total Emissions	100%	1,715,153
Forest / Land Use Sequestration	**0.87%**	**-14,932****
By Source		
Electricity	42%	712,112
Gasoline	26%	438,233
Natural Gas	15%	256,368
Diesel	11%	191,827
Tank Fuels	3%	48,794
Refrigerants / ODS	3%	48,668
Landfill/WWTP Methane	1%	19,150
Agriculture	0%	-
By Economic Sector		
Commercial	31%	525,042
Residential	25%	433,093
Transportation	37%	630,060
Industrial	3%	59,139
Industrial Process and Refrigerants	3%	48,668
Waste Management	1%	19,150
Agriculture	0%	-
By Category		
Fossil Fuels (Buildings)	59%	1,017,275
Fossil Fuels (Transportation)	37%	630,060
Non-Fossil Fuels	4%	67,165
By Scope		
1	57%	984,436
2	42%	712,112
3	1%	18,604

** estimated for informational purposes only – not subtracted from the totals

GHG Emissions by the Charts

BY SOURCE (OR ACTIVITY)

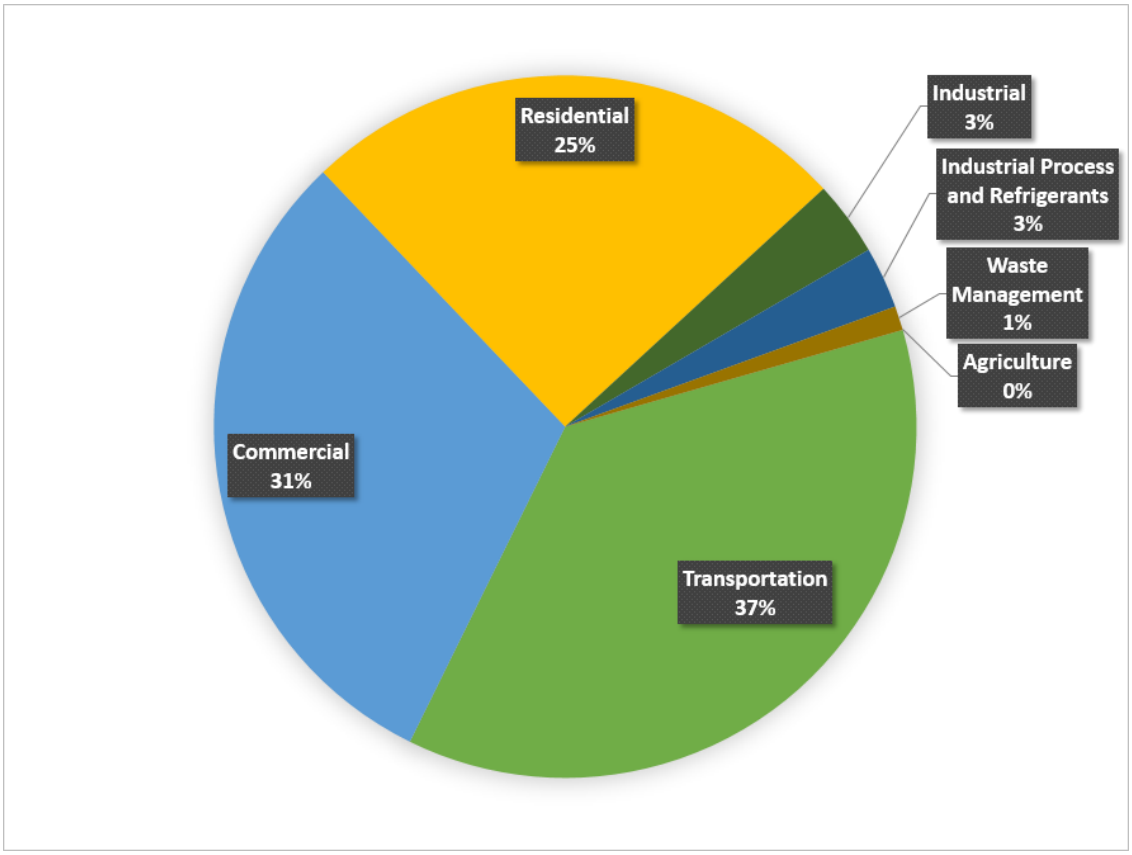

Figure 2: 2018 Emissions By Activity

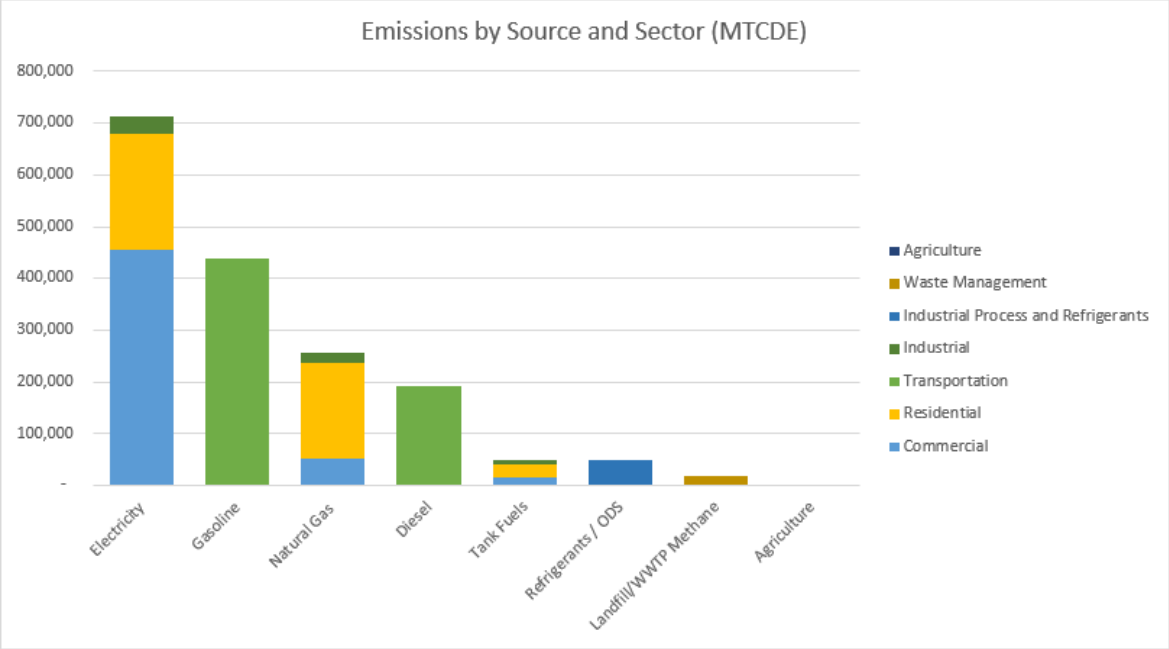

Figure 3: Carbon Emissions by Source and Sector

BY SECTOR

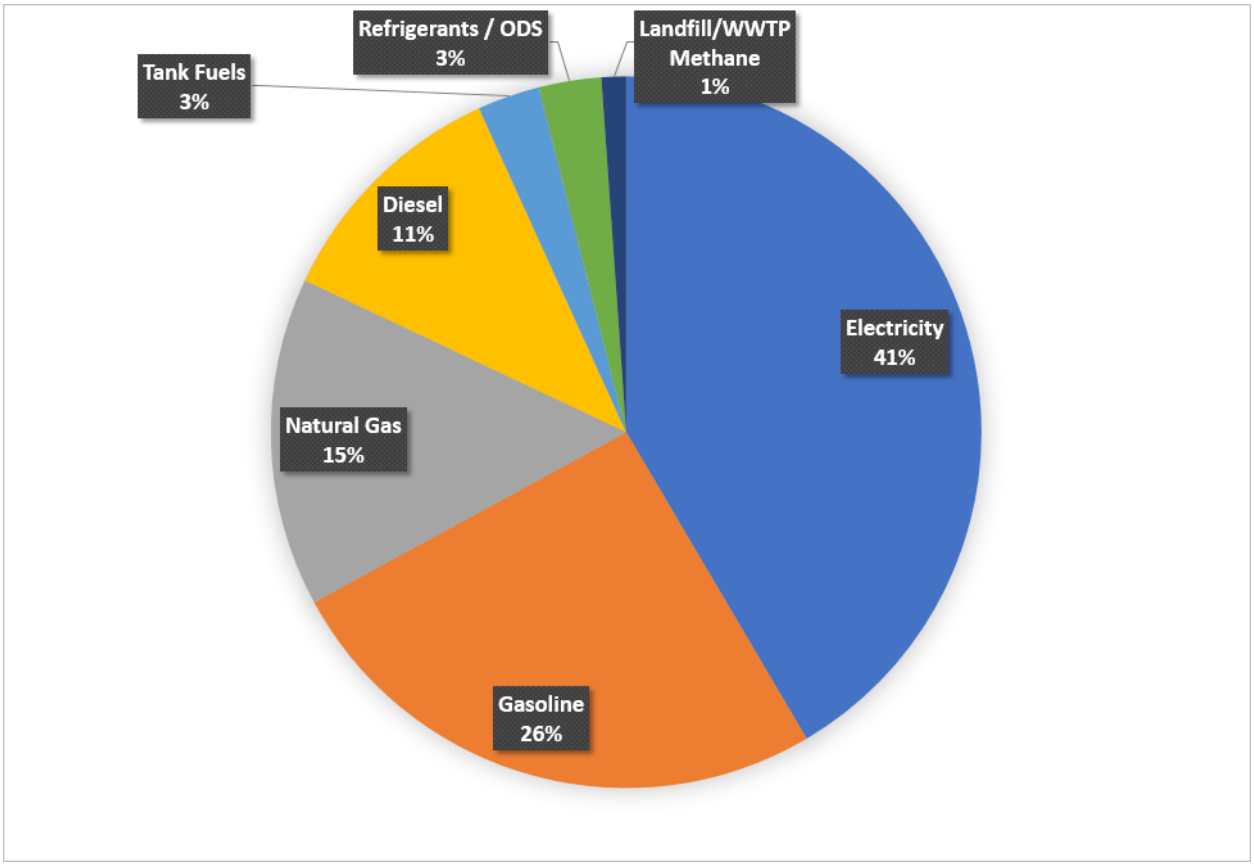

Figure 4: Carbon Emissions by Sector

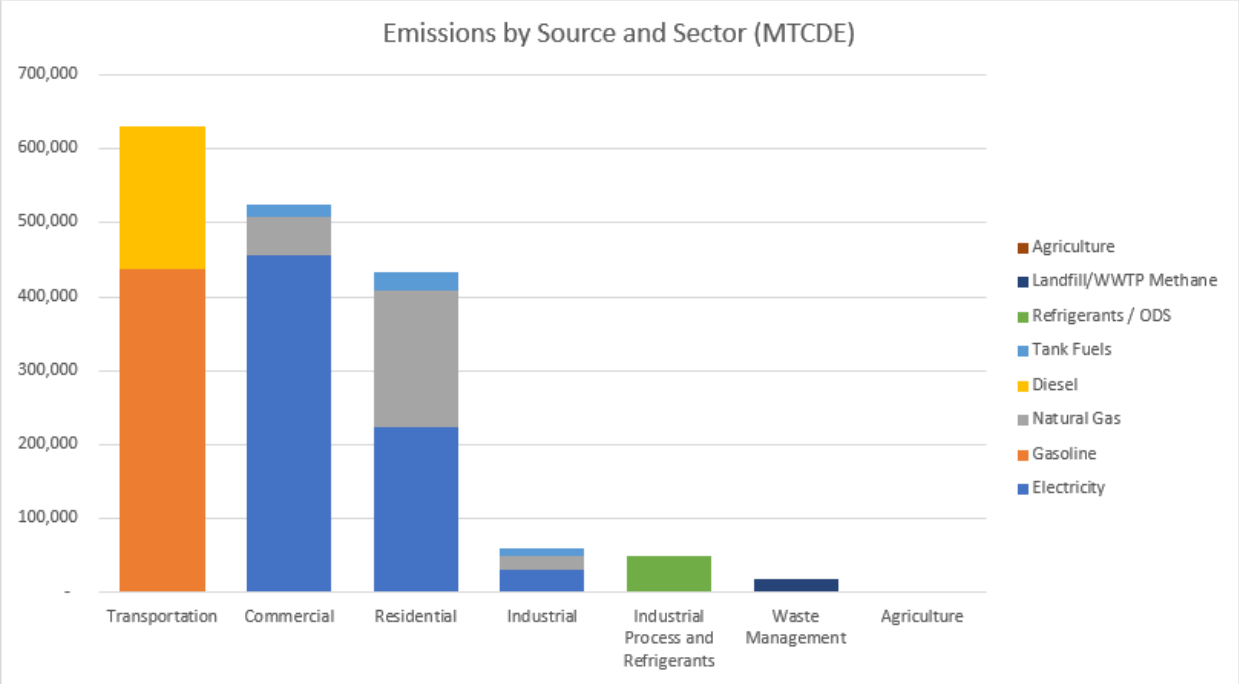

Figure 5: Carbon Emissions by Sector and Source

By source, electricity consumption creates 42% of emissions, followed by gasoline (26%), natural gas (15%), and diesel (11%). Propane and fuel oil are not extensively used. In 2018 more than half of the greenhouse gas emissions were generated from fossil fuels[2].

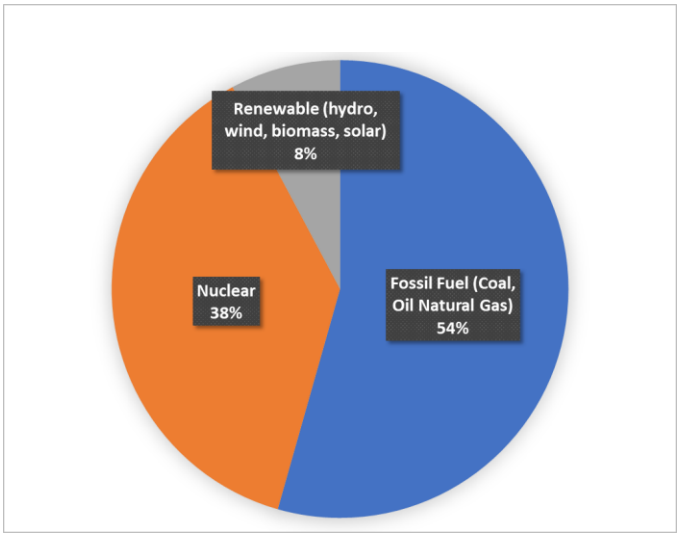

Figure 6: North Carolina's Energy Mix by Source in 2018

TOC's per-capita emissions are 10.2 tons, which is less than the state of North Carolina's average of 14.68[3]. TOC's relatively newer building stock is probably more efficient on average, but TOC is also a residential and commercial services community with less industry. Statewide, industry is 17% of all emissions compared 3% in TOC. In other words, the inventory does not count emissions related to all goods and services consumed in TOC but produced elsewhere. As referenced in Cary's Environmental Advisory Board's March 2019 Carbon Reduction Recommendations, and the 2017 booked edited by Paul Hawken called *Drawdown*, carbon emissions can be broken down on many different scales. We acknowledge that the typical carbon accounting methods for municipalities do not capture some of the biggest

[2] EPA Emissions and Energy Integrated Resource Database (EGRID) 2018

[3] North Carolina Inventory of GHG Emissions, 1990-2030. NCDEQ Division of Air Quality, January 2019. Per-capita emissions calculated by dividing reported 2017 emissions of 150.8 MMT by the 2017 population of 14.68 million.

systemic sources of carbon emissions, like food that is grown and wasted as part of food supply chain practices outside of Cary's limits.

Example Strategies to Achieve Deep GHG Reductions

If TOC develops a multi-stakeholder Climate Action Plan, this section highlights emerging structural changes needed to achieve deep reductions. It is not intended to be a comprehensive list, which would be included in a full Climate Action Plan.

Electrify transportation – shift away from gasoline and diesel vehicles

Transportation fuels cause 37% of all emissions in Cary. Of that, 74% is from on-road passenger cars, SUVs, and pickup trucks. Most of the remaining, 26%, comes from diesel tractor-trailers, buses, and box trucks.

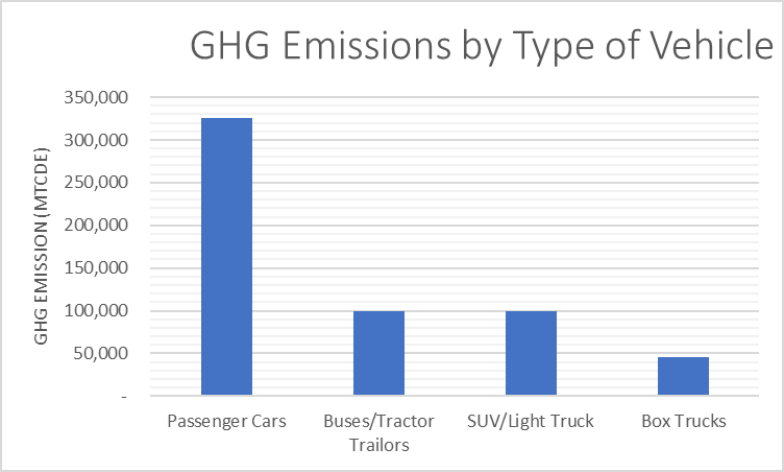

Figure 7: Greenhouse Gas Emissions by Vehicle Type

Like building electrification, shifting to electric vehicles (EVs) can eventually eliminate emissions. Even today, a fully electric vehicle produces only 1/3 the GHG emissions per mile compared to gasoline[4]. Today most major manufacturers are producing passenger EVs with ranges greater than 200 miles, and they are quickly developing mid and full truck options. The transportation industry is preparing for the switch.

TOC may consider strategies such as, but not limited to:

- Growing the EV market share by addressing barriers such as lack of awareness, insufficient charging infrastructure, and limited vehicle supply.
- Using planning tools to increasing charging infrastructure throughout TOC at commercial complexes, offices, apartment and multi-family complexes, and malls.
- At a state level, supporting energy codes and/or programs to encourage homes to be EV-charging-ready with 240V circuits in all garages.
- Working with dealers and the vehicle market to increase supply.

[4] US Depart of Energy's Alternative Fuels Data Center. https://afdc.energy.gov/

- Monitoring the number of registered EVs in town to set goals and to track progress, and track fleet average fuel economy for all gasoline and diesel vehicles registered in the Town.
- Developing an EV Implementation and Charging Plan to pursue above strategies together.
- Consider replacing two-stroke engines like lawn mowers, weed whackers, and leaf blowers with electric equipment.

Reduce the need for driving through planning

Emissions can also be reduced by:

- Encouraging mixed business/residential development.
- Increasing the population served by public transit.
- Expanding the ride sharing and, in the future, autonomous vehicles.

Promoting telecommuting and web conferencing

A positive outcome of the Covid-19 crisis has been be changing attitudes about working at home. TOC government and businesses can implement Work at Home Audits (WAHAs), which are systematic reviews of an organization's service model and staffing to determine what functions can be done remotely vs. on site, or by some combination thereof. A WAHA will recommend collaborative technologies for each service and options for flexible schedules. Organizations can count GHG emissions from their employee's commutes to track benefits of WAH strategies.

Electrify buildings – shift away from natural gas and tank fuels

Although natural gas is thought to be a clean fuel because it creates less smog, it is still a fossil fuel and eliminating it will reduce emissions by 15%. Switching to electricity can eliminate emissions because over time we anticipate that the electric grid will be powered with a greater and greater percentage of renewable technologies. Recent advances in technology make switching to 100% electric buildings more achievable and cost effective, and these solutions are still improving.

Communities like TOC can work to electrify buildings on the ground, while utilities and North Carolina Public Utilities Commission (PUC) work to supply clean electricity by improving the grid, enabling connection of large renewable projects, and improving energy storage. Duke Energy has set a goal to supply net-zero electricity by 2050.

Duke Energy also is tasked by the PUC to provide grid resiliency, which is the ability of the electricity grid to withstand storms and to get back up and running after a power outage. Through the Smart and Connected Communities Team the Town has been examining ways to pilot smart grid technology like pairing renewables with batteries to assure that power can be delivered no matter the weather or upset.

Starting the switch now is important. Utilities and developers often expand natural gas use out of convention, habit, and cost consciousness. Once natural gas is expanded and installed in new construction, it is difficult to switch later. Duke Energy reports that nearly half of its TOC residential customers (25,000 out of 54,000) already use electric heating- mostly heat pumps- so there is plenty of experience in TOC already.

Overall, TOC government and its citizens can:

- Encourage the state to adopt a more ambitious NC renewable portfolio standard and supporting regulatory policies to streamline interconnection of renewables like solar and wind to the grid.
- Consider policies like Community Choice Aggregation so communities can use joint buying power to buy clean energy.
- Encourage state energy codes for new construction that require air and ground source heat pumps for residential and commercial applications.
- Work creatively with developers and relators to encourage marketing of electrified home and commercial buildings as "GHG-free-ready" so homebuyers are confident they can eliminate GHG emission by purchasing clean energy.

Existing buildings are a major component of any community energy reduction plan. Programs that lower the cost of energy efficiency retrofits like incentives, low interest loans, or property assessed clean energy (PACE) loans can reduce barriers to doing existing building energy retrofits.

The importance of citizen engagement

During the review phase of this inventory the Environmental Advisory Board suggested that a key component in the Town's action regarding carbon reduction would be citizen engagement. This includes acknowledging that some of the tactics that are pinpointed in the Drawdown.org analysis as being most impactful on a global basis are not captured in the standardized methods for municipal carbon baselines. For example, the carbon impacts of Cary's citizens and businesses flying, their food waste, or their food production and transport are not fully captured by this inventory. Possible solutions to this are partnerships with nonprofits, citizen scientists, or universities to show citizens their own impacts on climate using innovative imaging like the dashboards seen on https://en-roads.climateinteractive.org/ or https://environmentaldashboard.org.

Resilience, Adaptation, and Equity

The Environmental Advisory Board and staff also identified that the concepts of resilience, adaptation and equity should be included in any joint planning efforts related to carbon reduction. Overall, the concept of resilience means to be able to bounce back quickly after an upset. Common examples of upsets are storms, flooding, fire, or outbreaks of disease. With our area growing and changing so fast, assuring that we not only plan for upsets, but also having a process for determining when it is time to adapt or change so that what comes after the upset is different and possibly better, is important. These concepts are addressed in Cary's Community Plan, as well as in the Triangle Regional Resilience Assessment. Policy and programs that are designed with equity in mind ask key questions like "who pays?" and "who benefits?" The Government Alliance on Race and Equity have a number of tools to assist governments and citizens who wish to include equity in their work.

Carbon Sequestration and Carbon Stock. What are these terms and why are they important?

Forests and other natural ecosystems safely store carbon as biomass in trees, plants, and soils where it does not cause climate change. The total biomass carbon stored TOC's 59 square miles would be known as TOC's "carbon stock". When trees and plants grow, they drawdown CO_2 from the air, adding to the carbon stock. When forests are removed for development, the carbon stock from that forest returns to

the air in the form of emissions. The net amount of carbon that TOC's lands draw down each year is called the "sequestration rate." This rate is reported as metric tons of CO_2e per year just like emissions.

Younger and middle age forests sequester carbon because they accumulate carbon stock as they grow. Undisturbed forests will continue to grow its carbon stock for more than 100 years. Managed forests like those in North Carolina's timber industry constantly sequester carbon by generating wood products exported and stored in construction and other products. Older natural forests safely store a lot of carbon but sequester less each year because growing trees are replaced dying trees at a similar rate.

In the North Carolina Climate Risk Assessment and Resilience Plan there is a Natural and Working Lands Action Plan that examines how the State, working with partners can use natural lands to mitigate some of the negative effects of climate change like flooding, heat, and habitat loss.

Estimating TOC's Carbon Stock and Sequestration Rates

For national GHG inventories, the Intergovernmental Panel on Climate Change (IPCC) developed a comprehensive model used in federal and state GHG inventories. ICLEI Local Governments for Sustainability released a downscaled version with some simplifications to help communities apply it[5]. Regardless, even the simplified methods require significant expertise in GHG accounting, geographic information systems (GIS), and in ecological sciences. The analysis often takes many months of time.

These methods are out of scope for this report. It is possible, however, to make a first-order estimate of TOC's sequestration rate by downscaling results from North Carolina's state GHG inventory produced by NCDEQ[6]. According to this report, as of 2017, NC lands remove 34 million metrics tons of CO_2 annually, the equivalent of 23% of state GHG emissions. Forests are by far the dominant driver and cover 53% of the state. By normalizing state sequestration on a per-forest-acre basis and multiplying that by TOC's 16,727 acres of tree canopy[7], and discounting that by 50% because suburban canopies are not as dense as natural forests, yields a rate of 14,932 MTCDE/year.

How can TOC manage land uses to combat climate change?

Land development and agriculture contribute to climate change. For example, when an acre of forest is converted into a parking lot, all the carbon in trees is returned to the air as CO_2 and the new parking lot can never recapture it. Communities can take ownership over their carbon stock, conserve it, and pursue activities to increase it. They can:

- **Increase awareness.** Communities can educate citizens on carbon sequestration, its role, and the impact that communities have on it.
- **Add carbon stock**. Pursue tree planting programs, re-afforestation, and land restoration to increase carbon stock and drawdown CO_2 from the air. Urban and suburban trees also have co-benefits, like reducing heat island effects and air pollution.
- **Be mindful and integrated**. When approving development that reduces carbon stock, try to find projects or measures elsewhere to compensate. Also, limit carbon stock loss by working with

[5] US Community Protocol for Accounting and Reporting of GHG Emissions, Version 1.2, January 2019. ICLEI.
[6] https://files.nc.gov/ncdeq/climate-change/ghg-inventory/GHG-Inventory-Report-FINAL.pdf
[7] North Carolina State University Center for Geospatial Analytics 2015 LIDAR tree canopy analysis showed a 43% tree canopy coverage within Cary's municipal limits.

developers to implement carbon-preserving practices that maintain forests and trees as opposed to developing large lawns and parking lots.

- **Count additions and subtractions and be willing to innovate**. Tree planting, afforestation, wetland restoration, and other actions can be quantified as GHG mitigation measures by counting the expected increase in carbon stock in metric tons. Showing these measures alongside other quantified actions to reduce GHG emissions, so the public can see the benefits of actions like tree planting next to energy conservation can be a meaningful way to demonstrate an integrated and multifaceted approach. If Cary includes sequestration in the GHG metrics that are tracked over time, then an accounting of land area developed, and the resulting emissions would also make sense to track. Innovative solutions to address the necessary balance within a community could include investing in land preservation to offset the carbon impacts of development, buying carbon credits with a preference for projects in the same region or state, support of regenerative agriculture or afforestation, and other win-win opportunities like creating passive recreational opportunities for people to spend time in natural vegetated areas while creating the benefit of large trees that will hold carbon for years to come, cool the area, create wildlife habitat, and absorb stormwater.