CITY OF CHAMBLEE

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Sustainability Roadmap

OCT 30, 2024

01

ROADMAP OVERVIEW

Towards a more sustainable, climate friendly Chamblee

The City of Chamblee is a thriving community leading the way towards environmental and operational progress in a fiscally responsible way. Chamblee was one of the first communities awarded a Livable Centers Initiative planning study from the Atlanta Regional Commission. The City has maintained a focus on active planning and zoning codes to favor pedestrian-friendly development for a diverse community. With city limits stretching from I-285 to I-85, the recent explosion in residential, retail, and office development can be attributed to intentional strategic planning.

> **Chamblee adopted a Sustainability Plan in September 2020.** The plan outlines key steps to a sustainable future for Chamblee and its citizens in seven key areas: land use, transportation, materials management, energy, water, food, and governance/outreach.

While the City's current Sustainability Plan outlines broad areas of focus and suggested policies, the City of Chamblee looks to act on that Plan, by creating and implementing a roadmap of clear goals over a determined period specifically related to energy, efficiency, renewables, and carbon emissions for its building and fleet operations. To that end, the City contracted to establish an action Roadmap and defined targets to address these topics.

This document is that Roadmap.

THE ROADMAP - BIG PICTURE

RENEWABLE ELECTRICITY — Generate clean energy & create resiliency

ELECTRIFICATION RENEWABLY POWERABLE — Use clean energy & reduce maintenance

EFFICIENCY/ LOAD REDUCTION — Reduce consumption & emissions

Sustainability milestones

This roadmap will help focus and direct efforts to ensure complete decarbonization is done in the most cost-effective, smartest, and most responsible manner possible for the Chamblee community as a whole.

Roadmap guiding principles

These principles and concepts illuminate this plan:

HIGH INTEGRITY – NO GREENWASHING OR OVERLY AMBITIOUS GOALS

A transparent, accurate, and realistic approach to sustainability is critical to the City. This means a data-driven, fact-based Roadmap, which balances available finances with strong progress.

ACTIONABLE AND VISIBLE

Chamblee wants strong, continuous progress towards sustainability. Roadmap steps should be clear and implementable. Progress should be visible and educational, inspiring residents and visitors to live sustainably as well.

BE FISCALLY RESPONSIBLE

This includes:

- Considering total lifecycle cost – internalizing operating expense costs and benefits
- Avoiding debt – paying from current revenue sources
- Not replacing less sustainable equipment before it's worn out with more sustainable alternatives

REALISTIC

Full decarbonization of typical commercial/institutional buildings and many parts of vehicle fleets at a reasonable cost is ready for prime time. This Roadmap can be achieved via current technologies. Sustainability action needs to occur within the context of the City's core mission of serving its citizens, and thus follow non-disruptive, financially reasonable timelines.

HUMBLE OPTIONALITY

This Roadmap is based on what is currently known from a technology and price standpoint. It is structured to position the City to adapt and respond with confidence.

Total annual municipal operational energy use and carbon emissions

Today

HOW DO CITY OF CHAMBLEE FACILITIES GENERATE CARBON EMISSIONS TODAY?

- Using electricity generated off-site by fossil fuel based power plants
- Direct combustion of natural gas on-site for heating and hot water
- Direct combustion of gasoline/diesel from vehicle uses

148,000 Gallons
10,000 Therms
TOTAL FOSSIL FUEL USE

1,409,000 KWH
TOTAL ELECTRICITY USE

1,320
M TONS

68%

FOSSIL FUEL CO_2E

50 **3%**

NATURAL GAS CO_2E

570*
M TONS

29%

ELECTRICITY CO_2E

EQUAL TO:

470 gas cars

OR

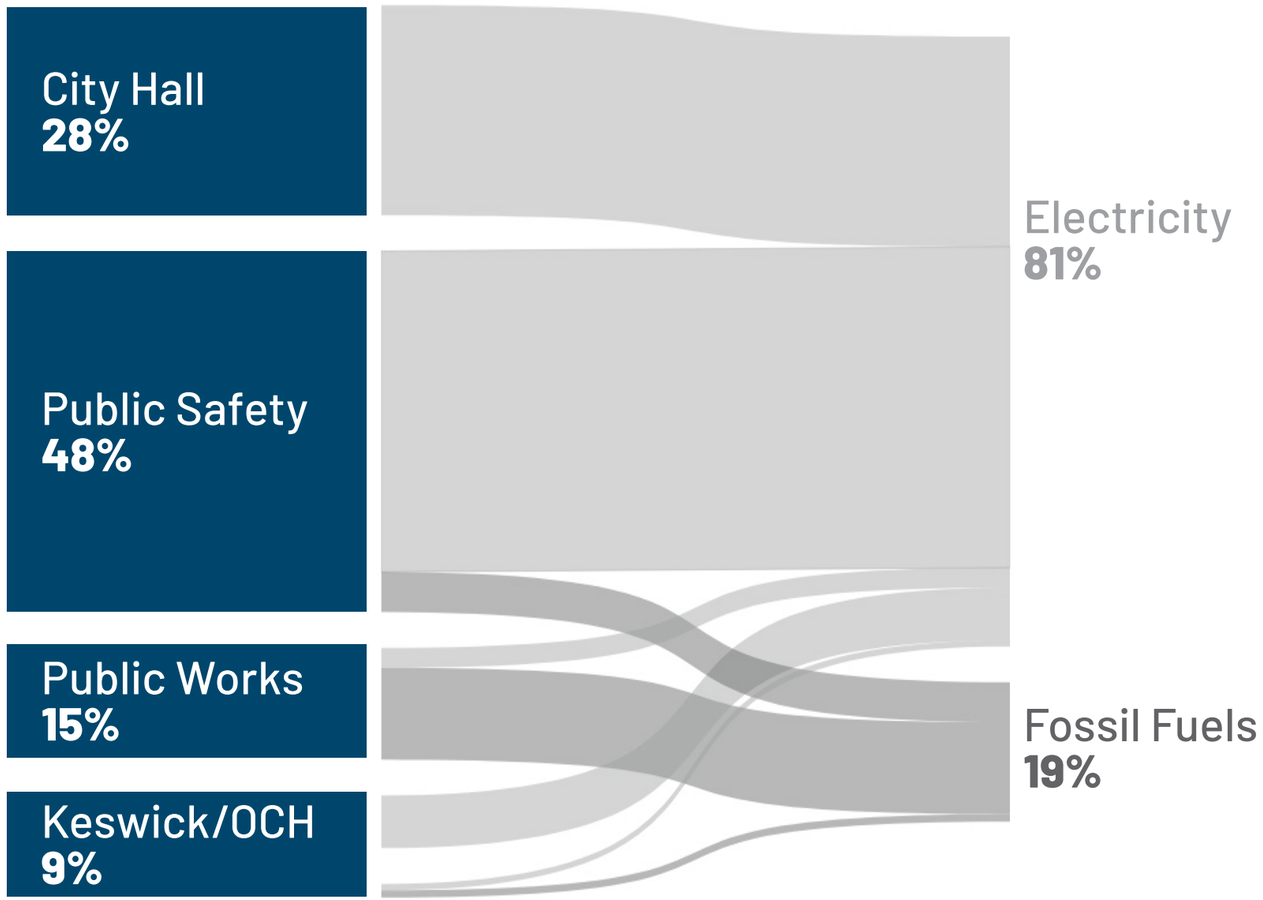
260 homes

*Electricity emissions calculated using the EPA's egrid factor for the portion of the grid that supplies electricity to Chamblee

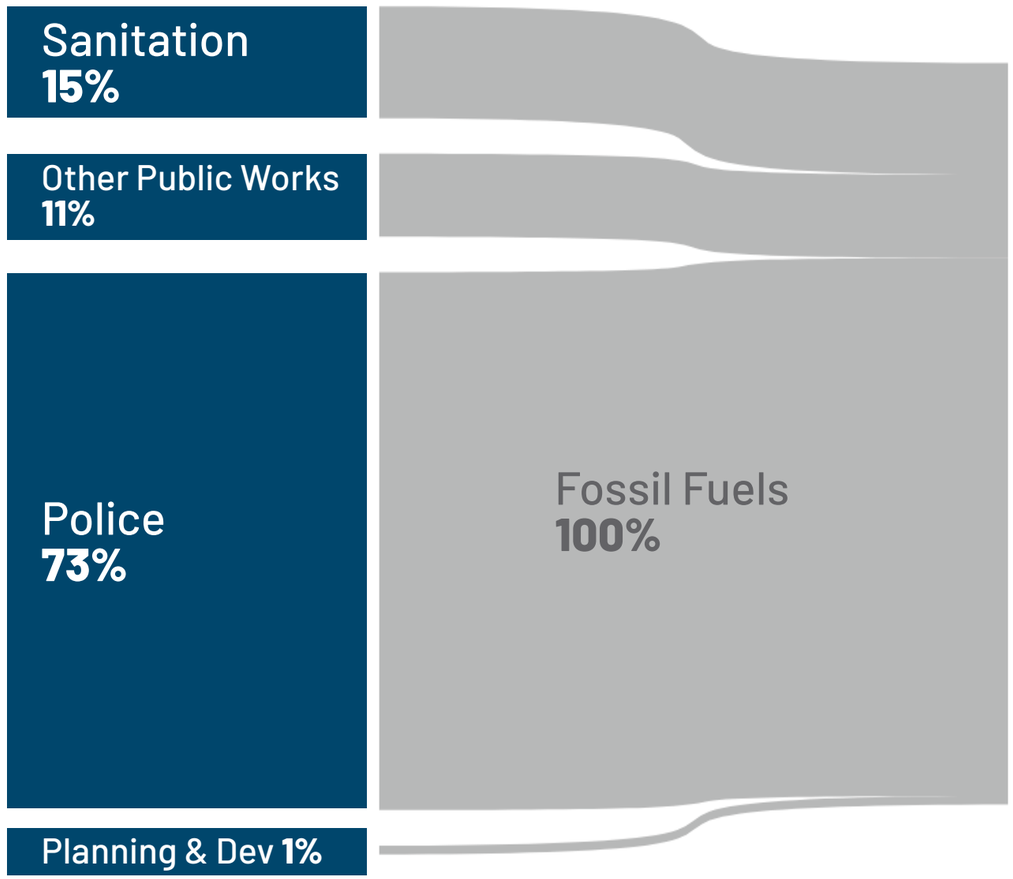
Annual energy use

The Details

TOTAL ANNUAL FACILITY ENERGY USE



TOTAL ANNUAL FLEET FUEL USE



Key findings

Chamblee can cost-effectively generate over 50% of its electricity with onsite solar in the near term. Remarkably, the City can generate a substantial portion of its electricity from onsite solar, and do so with life-cycle positive value. This transition eliminates the climate impact of dirty grid electricity by replacing it with a 100% clean source.

Chamblee can cost effectively reduce its carbon footprint by 30% by 2030. The combination of efficiency, fleet and facility electrification, and onsite renewables provide a remarkable 30% reduction in Chamblee climate impact. Implementation of this reduction is life cycle positive, based on the associated reduction in needed utility electricity, natural gas, and fossil fuels.

Major Federal incentives (25-40%) are available for renewable electricity systems. The Inflation Reduction Act established a base 25.5% direct pay incentive on the cost of solar installations. This increases when non-tax benefitted loans aren't used for funding, and in designated income areas.

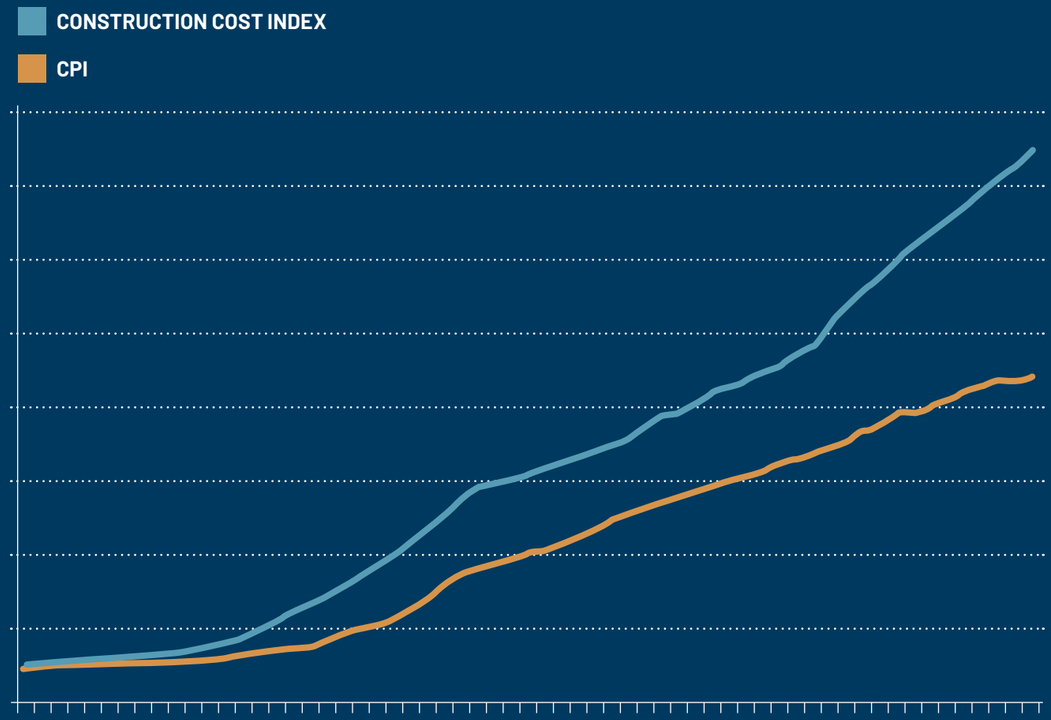
It is less expensive for the City to produce its own renewable electricity than purchase it from Georgia Power. Substantial opportunities exist for onsite solar, which will provide electricity cheaper than utility rates. The base 25.5% cost incentive available through the Inflation Reduction Act makes this a very attractive option for the City, in addition to other benefits, such as providing a start to electric islandability and a visible expression of the City's climate commitment to visitors and residents.

Very substantial electric vehicle charging infrastructure incentives are available from the utility. The utility's "Make Ready Infrastructure" program covers the design, construction, and ongoing maintenance of all electric infrastructure behind the meter leading up to electric vehicle chargers that are either publicly accessible or designed for fleets that serve the public.

A substantial portion of Chamblee's climate impact comes from police patrol vehicles. Chamblee's police officers commute in their patrol vehicles, which in addition to normal duties, results in substantial fossil fuel use. At this time no pursuit-rated electric cruisers are available, and given the complexities of establishing office at-home charging, it is recommended that operationalization of police vehicle electrification occur in the future.

REASONS TO DECARBONIZE NOW VS LATER:

- Implementing the recommended decarbonization phases vs waiting until 2030 will save the equivalent of 210 cars' annual emissions.
- A 25-40% direct solar incentive is available from the Federal government today.
- Historically, construction escalation has substantially outpaced inflation.



Roadmap recommendations

ESTABLISH THE FOLLOWING CITY SUSTAINABLE OPERATIONS GOALS
The process of creating this Roadmap has resulted in the following recommended sustainability goals for Chamblee:

- Reduce total carbon emissions by **30% by 2030***
- Generate 50% of electricity with onsite renewables **by 2028***
- Establish complete fleet charging infrastructure and electrify all non-patrol passenger vehicles **by 2030**
- Maintain fiscally responsible net lifecycle cost of sustainability program

IMPLEMENT THE ROADMAP TO MEET THE CITY'S SUSTAINABILITY GOALS
This roadmap identifies a specific program over time for the City to achieve its climate goals in the most cost-effective, strategic way possible. The core recommendation of this Roadmap is for the City to implement this program.

IMPLEMENT THE IDENTIFIED, MULTIFACETED FIRST PHASE TO ESTABLISH A POSITIVE TRACK RECORD OF SUCCESS AND INSPIRATION The identified energy efficiency measures will optimize building performance and improve operations, resulting in a 13% reduction in energy use. Substantial solar is proposed for City Hall and the Public Works facility, initiating an inspiring renewable chapter visible to the public. Electric vehicle chargers at City Hall will initiate Chamblee's fleet conversion, with substantial climate and air quality benefits.

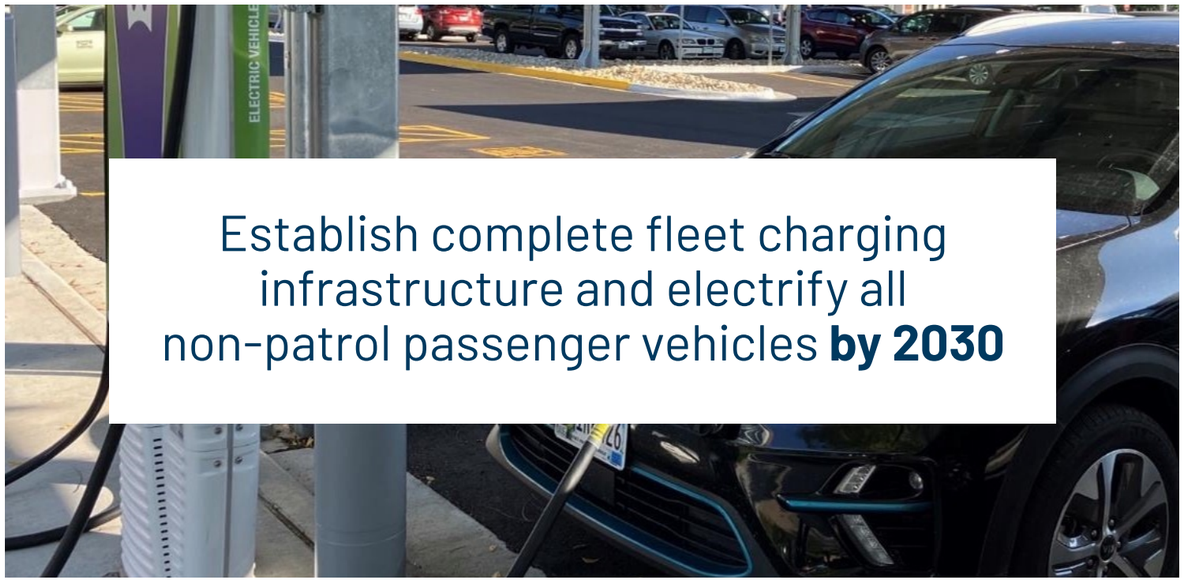
INITIATE VEHICLE ELECTRIFICATION WITH STANDARD FLEET USES, AND SEEK OPPORTUNITIES FOR PATROL VEHICLE ELECTRIFICATION IN THE FUTURE
Excellent, cost competitive electric fleet vehicles are available today. Starting a fleet electrification process will bring additional knowledge and comfort to the City as it considers future electrification of patrol vehicles and heavy equipment.

USE THE SUSTAINABILITY EFFORTS AS AN EDUCATION AND INSPIRATION PLATFORM TO CITIZENS Local news, web content and progress dashboards, classes, and signage are all ways to leverage the City's efforts to inspire residents to make positive change in their own lives.

*from 2024 baseline

Sustainability goals

Reduce total carbon emissions by **30% by 2030**



Establish complete fleet charging infrastructure and electrify all non-patrol passenger vehicles **by 2030**

Generate **50%** of electricity with onsite renewables **by 2028**

Maintain fiscally responsible net lifecycle cost of sustainability program

Decarbonization roadmap over time – by facility

EFFICIENCY DETAILS READ MORE ▶

BUILDING ELECTRIFICATION DETAILS READ MORE ▶

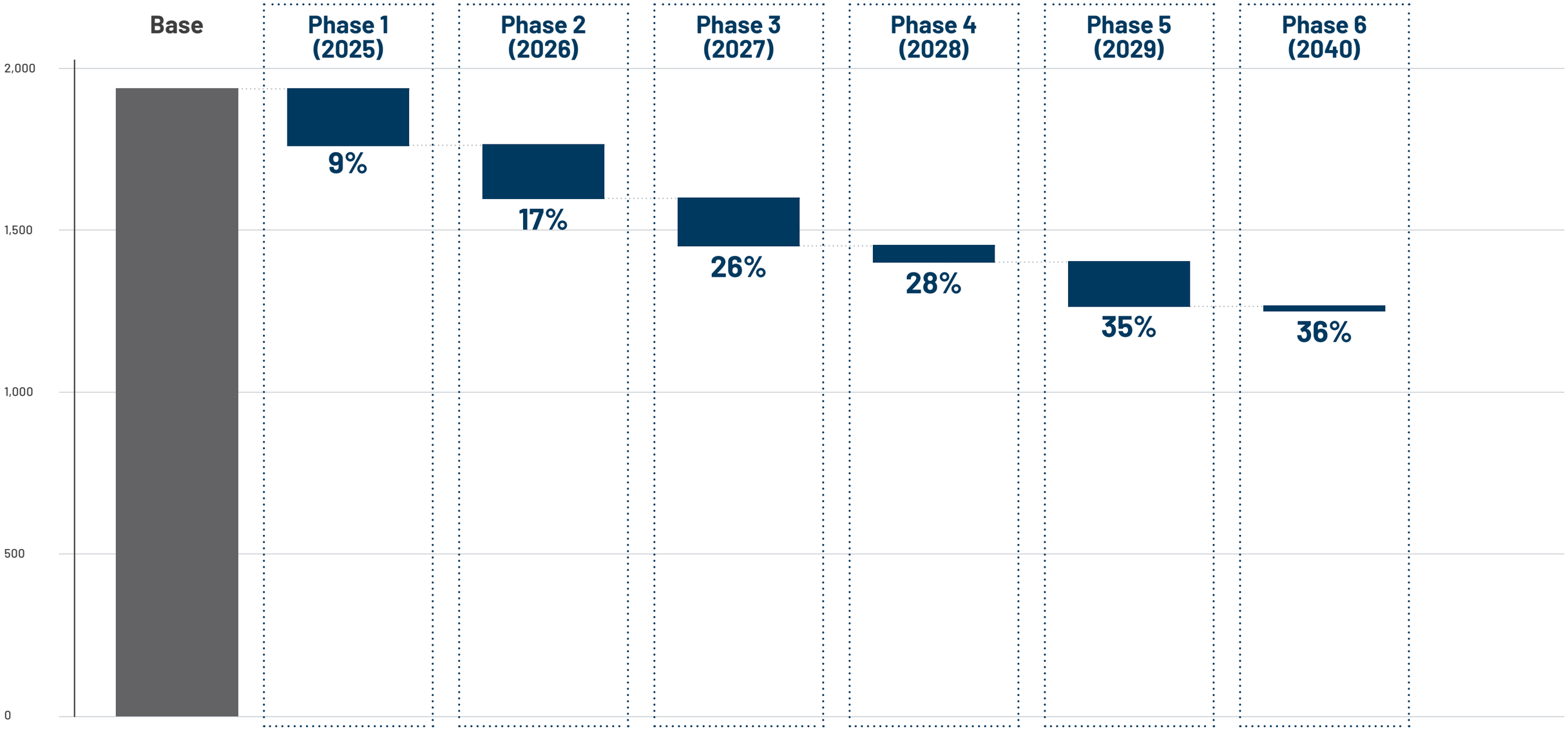
VEHICLE ELECTRIFICATION DETAILS READ MORE ▶

ON-SITE RENEWABLES DETAILS READ MORE ▶

FACILITY	EFFICIENCY/LOAD REDUCTION	FLEET ELECTRIFICATION	ON-SITE RENEWABLES	EFFICIENCY/LOAD REDUCTION	FLEET ELECTRIFICATION	ON-SITE RENEWABLES	EFFICIENCY/LOAD REDUCTION	FLEET ELECTRIFICATION	ON-SITE RENEWABLES	EFFICIENCY/LOAD REDUCTION	BUILDING ELECTRIFICATION	ON-SITE RENEWABLES	EFFICIENCY/LOAD REDUCTION	FLEET ELECTRIFICATION	ON-SITE RENEWABLES	EFFICIENCY/LOAD REDUCTION	BUILDING ELECTRIFICATION	ON-SITE RENEWABLES
	PHASE ONE (2025)			PHASE TWO (2026)			PHASE THREE (2027)			PHASE FOUR (2028)			PHASE FIVE (2029)			PHASE SIX (2040)		
City Hall	X		X	X														
Public Safety Building	X			X	X	X											X	
Public Works Building	X		X	X				X									X	
Old City Hall	X			X						X	X	X						
Keswick Community Building	X			X		X											X	
Keswick Park	X			X						X								
Dresden Park	X			X											X			

CO_2 reduction by phase – reducing climate harm

CUMULATIVE CO_2 REDUCTION, METRIC TONS



Decarbonization action benefits and costs

Total lifetime implementation cost	**($15.3m)**
Avoided equipment replacement cost	**$1.2m**
Lifetime project operating savings	**$9.0m**
Total incentives (IRA and utility rebates)	**$2.3m - $3.0m**
Total lifecycle cost of sustainability program	**($2.2m - $2.9m)**

The table above provides the potential costs and benefits of the sustainability program identified in this Roadmap for the City.

- **Total lifetime implementation cost** is the full cost to implement the program.
- **Avoided equipment replacement costs** are the costs of long term upkeep (such as replacing worn out HVAC equipment) that won't need to be spent by the City because the systems are replaced with an environmentally friendly alternative as part of the sustainability process.
- **Lifetime project operating savings** are reductions in operating cost, primarily utilities, resulting from the sustainability actions. These are aggregated over the useful lives of the improvements.
- **Total incentives** are local, State, and Federal incentives. Note that the US Inflation Reduction Act provides a very substantial 25-40% of total cost direct pay incentive for projects.
- **Total lifecycle cost of sustainability program** is total construction cost less all the avoided cost and savings/incentive streams – total net cost to the City of Chamblee.

Notes:

- Construction costs and utility savings should be considered American Association of Cost Engineering schematic/planning estimates with an accuracy of +30/-20%. A full discussion of cost estimating approach is provided here.
- Incentives and grants are not guaranteed.
- For determining savings benefit, this Roadmap uses ASHRAE useful life guidelines where available, and industry standard where not. Where overall systems have a composite of components with varying useful lives, an average was applied.

Phase One summary – immediate action

SUMMARY

Efficiency

- Retrocommissioning – all buildings
- Automation planning and design
- Utility data visualization
- Air leak sealing – City Hall and Public Works

Electrification

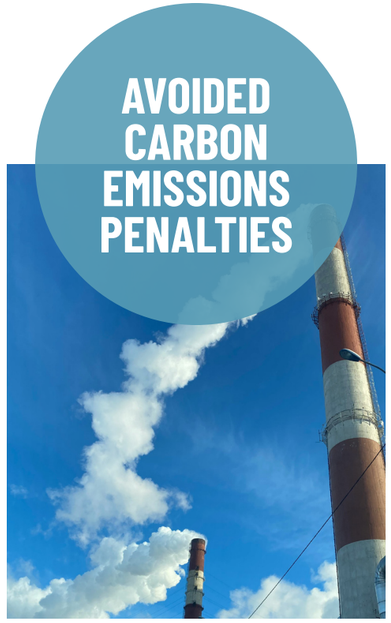
- 9 Electric Vehicle Chargers at City Hall

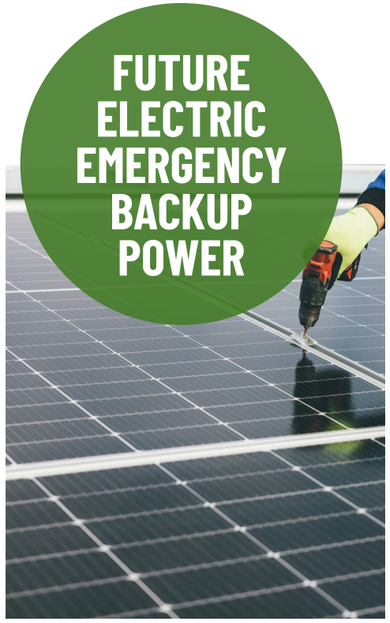
Renewable Electricity

- City Hall – 157 kw-DC array
- Public Works Annex – 33 kw-DC array

Total lifetime implementation cost	**($2.0m)**
Lifetime project operating savings	**$2.1 m**
Total incentives (IRA and utility rebates)	**$0.5m-$0.6m**
Phase One sustainability program lifecycle savings	**$0.6-$0.7m**

Sustainability cobenefits





While the City is taking responsibility and reducing its environmental footprint, its core mission is to provide governmental services to its residents and visitors. Recognizing this, this Roadmap seeks to look broadly at the sustainability measures and identify additional benefits beyond operating cost reductions.

AVOIDED CARBON EMISSIONS PENALTIES As climate change becomes an increasingly current (rather than future) reality, carbon emissions penalties are starting to be applied by leading organizations to internal operations, and by governing bodies as regulation.

FUTURE ELECTRIC EMERGENCY BACKUP POWER Installing on-site solar as proposed for overall renewable power for the City has the added benefit of being combinable in the future with batteries to provide emergency backup power.

IMPROVED INDOOR AIR QUALITY The efficiency measures, electrification, and air sealing of City Hall and Public Works will improve indoor air quality.

COMMUNITY DECARBONIZATION EDUCATION AND LEADERSHIP – WALK THE TALK Chamblee's Sustainability Plan identified decarbonization of the City's operations as a way to lead, inspire, and educate its residents to take similar actions in their own lives.

COMMUNITY WELL-BEING Transitioning to clean energy improves overall quality of life by reducing noise pollution, improving indoor air quality, and creating safer, more comfortable living and working environments for residents and workers.

ENERGY INDEPENDENCE Decarbonizing buildings reduces reliance on external energy sources, fostering energy independence and insulating the city from geopolitical tensions or supply disruptions that could drive up costs or compromise security.

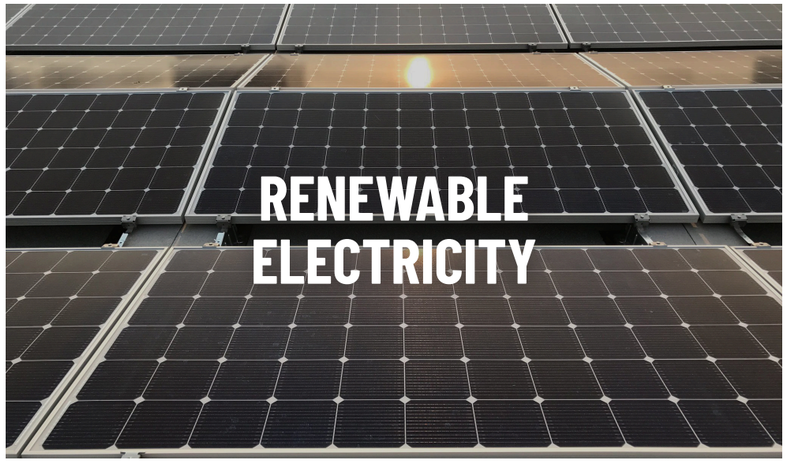
LOCAL JOB CREATION The proposed decarbonization elements will support the local economy with construction and related field work.

02

ROADMAP DETAILS BY TOPIC

Reducing Chamblee's carbon footprint

Eliminating Chamblee's carbon footprint requires action in three main areas:



EFFICIENCY & LOAD REDUCTION Reducing building energy use, and thereby reducing carbon emissions, lowers the amount of renewable energy needed for total decarbonization. Efficiency also reduces the peak energy load demand on HVAC systems (load reduction), sometimes enabling electrified replacements to be smaller, less costly systems. Efficiency is typically the least expensive decarbonization element, and often includes additional benefits, such as indoor air quality improvements.

ELECTRIFICATION – ELIMINATING FOSSIL FUELS AND ENABLING RENEWABLE POWERABILITY Eliminating use of fossil fuels, through conversion of natural gas heating and cooking in buildings and internal combustion engines to their electrically powered alternatives, allows the buildings and vehicles to be powered by renewable electricity. Converting operations from fossil fuels to electricity is typically the most costly and challenging aspect of decarbonization.

RENEWABLE ELECTRICITY Renewable electricity can be obtained either from solar electricity generating systems located on City properties or facilities, or from offsite sources. At this time, the utility does not have a good renewable electricity purchase option, so focusing on onsite renewable electricity is recommended for the City.

Note that these three activities aren't necessarily implemented sequentially. **This roadmap identifies the most cost-effective and high-value phasing plan for implementation.**

ENERGY USE AND CARBON EMISSIONS

By the numbers: buildings, fleet & infrastructure

The following outlines all components included in this Roadmap and their associated energy use and carbon emissions.

The baseline for each building is built by averaging data from mid 2023 through mid 2024. Data that appeared to not represent typical or current use was excluded.

		ANNUAL KWH			ANNUAL THERMS			ANNUAL FUEL GALLONS					ANNUAL TOTAL	
NAME	SQUARE FEET	GROSS USE	COST	CO_2e MTONS	USE	COST	CO_2e MTONS	UNLEADED USE	DIESEL USE	COST	CO_2e MTONS	KBTU	TOTAL CO_2e MTONS	TOTAL COST
BUILDINGS														
City Hall	29,800	440,957	$78,873	184	0		0					1,504,545	184	$78,873
Public Safety Building	48,500	673,520	$107,822	281	2,864	$1,948	15					2,584,450	296	$109,770
Public Works Building	14,500	41,820	$14,252	17	6,578	$4,473	35					800,490	52	$18,725
Old City Hall	7,740	110,420	$27,083	46	0		0					376,753	46	$27,083
Keswick Community Building	3,500	13,112	$2,393	5	530	$360	3					97,738	8	$2,753
FLEET														
Public Works								13,264	25,068	$134,162	341	4,791,500	341	$134,162
Planning and Development								1,865		$6,528	17	233,125	17	$6,528
Police Department								108,144		$378,504	962	13,518,000	962	$378,504
TOTAL	**104,040**	**1,279,829**	**$230,423**	**534**	**9,972**	**$6,781**	**53**	**123,273**	**25,068**	**$519,194**	**1,320**	**23,906,602**	**1,907**	**$756,397**

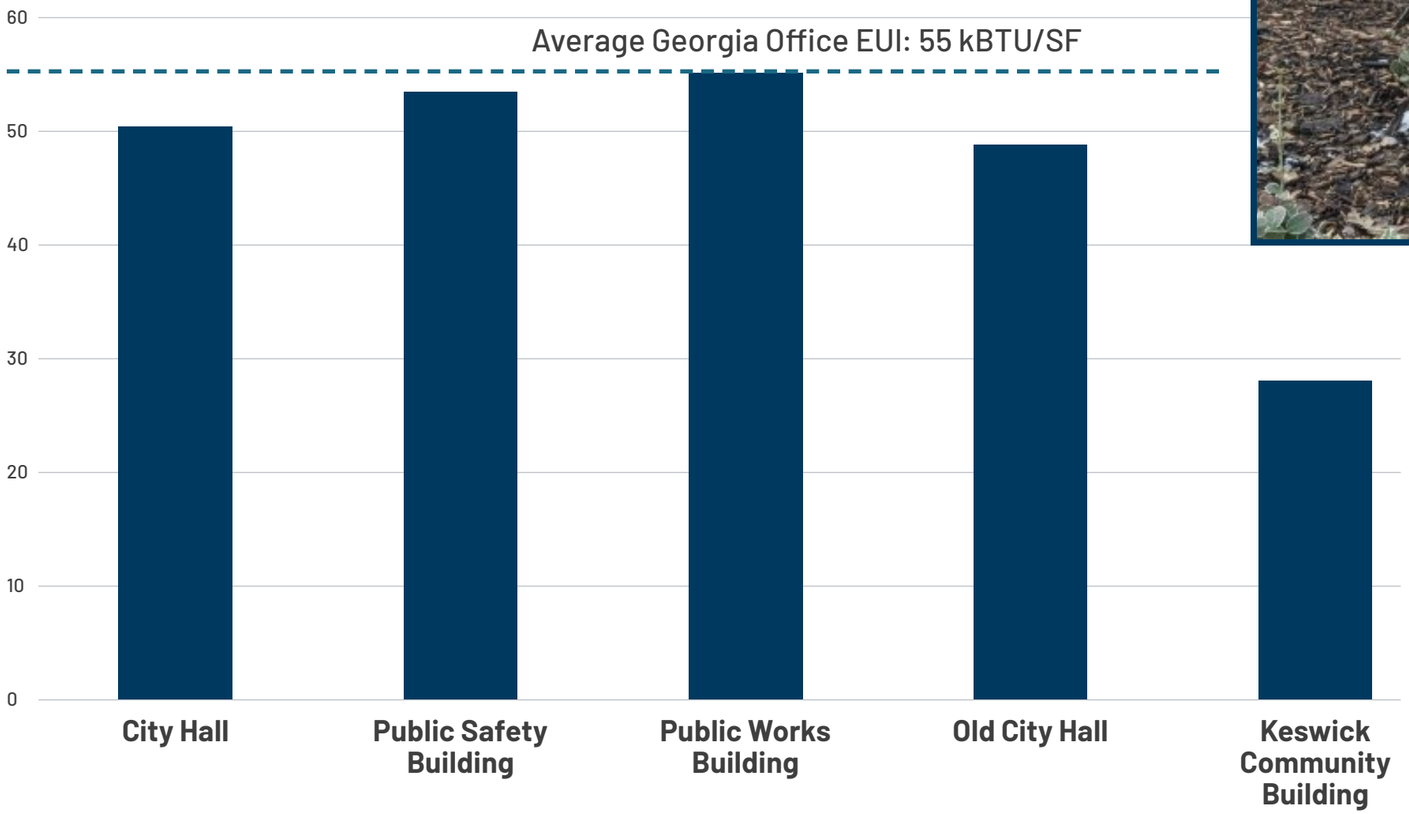
Efficiency and load reduction - buildings

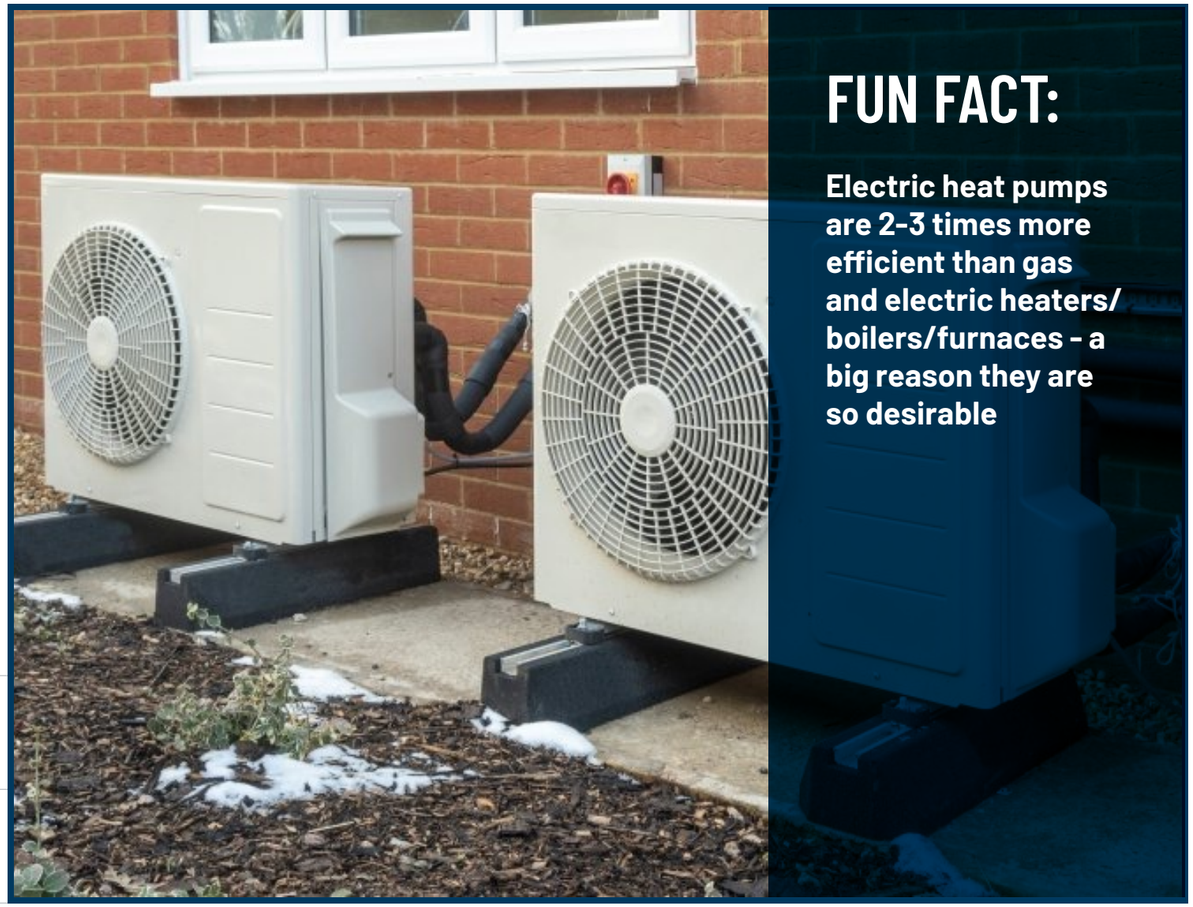
HOW EFFICIENT ARE THE CITY'S BUILDINGS TODAY?

The City's buildings vary in efficiency today, with some comparing favorably to similar buildings in similar climates, especially City Hall, which utilizes a heat pump system. Others have room to make significant efficiency progress as a part of potential efforts by the City to reduce its climate harm.

City of Chamblee Energy Use Index

kBTU/SF/YEAR





FUN FACT:

Electric heat pumps are 2-3 times more efficient than gas and electric heaters/ boilers/furnaces - a big reason they are so desirable

Recommended efficiency measures

This Roadmap has identified a number of ways to cost-effectively reduce energy use and climate harm. These "low-hanging fruit" are generally the most cost-effective solutions available and have immediate impacts. Subsequent sustainability efforts will then be achievable at a lower comparative cost, with smaller peak heating and cooling loads placed on electrified equipment and less required renewable generation.

Efficiency opportunities include:

LED BUILDING AND SPORTS FIELD LIGHTING LED lighting is highly efficient (even better than fluorescent) and also has very low maintenance – a winning combination. City Hall, Public Safety, and Public Works all have LED lighting, and in some cases also include vacancy sensors to shut lights off automatically. Old City Hall and the Keswick Community Center do not have LED lighting, and are recommended for retrofit with both LED lights and vacancy controls. The City also has extensive sports lighting, including for tennis and basketball courts and play fields at Keswick and Dresden Parks. These are also recommended for LED lighting and controls systems.

RETRO-COMMISSIONING Retro-commissioning is the process of ensuring Chamblee's existing building systems are operating as intended and designed - dampers opening properly, motors working efficiently and at the right speed, flow rates correctly adjusted, etc. This regularly results in savings and improved functionality. The process typically involves a combination of adjusting and limited replacement of misfunctioning existing mechanical equipment.

ACTIVE ENERGY MANAGEMENT Active Energy Management employs remote building automation system monitoring with advanced analytics capability, coupled with the retrocommissioning process, to identify deficiencies and previously unrecognized inefficiencies in system operations. Long-term monitoring ensures the retrocommissioning project provides continuous improvement in operations and savings. This program also provides best practice recommendations and training.

STREET LIGHTS Nearly 2500 street lights exist within the City limits, operated by Georgia Power and paid for by Chamblee. As such, the lights are not directly the City's sustainability responsibility, but they are indirectly. About 60% of these are LED, with the remaining lights lower efficiency high-intensity discharge bulbs. Replacing those bulbs would save a significant amount of electricity. It is also likely that if the City took over ownership and operation of the street lights, that they could save money generally as well as reap the benefits of the more efficient LEDs. It is suggested that:

- The City actively request Georgia Power finalize conversion to LED lamps as soon as possible; and
- Investigate in more detail the possibility of owning and operating the street lights.

BUILDING ENVELOPE/DUCT SEALING Air leakage is the uncontrolled migration of conditioned air through the building envelope, typically via sealing cracks where dissimilar materials meet. It can be caused by pressure differences caused by wind, mechanical systems, and the natural buoyancy of warm air (stack effect). Leaks are typically detected via infrared cameras. Sealing focus areas include HVAC ductwork, doors and windows, plumbing and electrical penetrations, and the joint between roof deck and walls/parapet. Envelope improvements also provide better air quality by sealing the interior from outside pollutants as an added benefit. In addition, Old City Hall experiences overheating in the south-facing front atrium. Here, solar reducing window film is recommended.

RECOMMENDED EFFICIENCY/LOAD REDUCTION MEASURES BY FACILITY

FACILITIES	RETRO-COMMISSIONING	BUILDING ENVELOPE	LIGHTING
City Hall	X		
Public Safety Building	X		
Public Works Building	X	X	
Old City Hall	X	X	X
Keswick Community Building	X		X

Electrification – enabling renewably powerable systems

The primary source of climate change worldwide is fossil fuels. Finding alternative ways to power our needs is the core strategy for eliminating climate harm. The City uses fossil fuels directly in two ways: to power its fleet, and heat its buildings, which together account for 80% of its energy use.

While combustion-based systems can be powered with renewable, biobased combustion fuels, it is not a solution that is scalable to full societal decarbonization and is not readily available in the marketplace. Renewable electricity, on the other hand, is a mature, affordable and rapidly expanding option. Therefore, focusing on an electricity-based approach is a core element of decarbonization, working hand in hand with obtaining fully renewable electricity. The process of converting systems from fossil fuels to electricity is known as "electrification".

Replacing fossil fuel combustion also improves local indoor and outdoor air quality, and reduces the risk of carbon monoxide poisoning, among other benefits. However, widespread electrification requires adequate electric grid infrastructure to handle the increased demand - the transition must be planned and executed carefully to ensure cost-effectiveness and minimize disruption.

Vehicle Electrification

As stated above, vehicle fuel use is responsible for a large portion of Chamblee's carbon footprint. Electric vehicles are rapidly becoming available in the marketplace, particularly passenger vehicles and pickup trucks. Thus vehicle electrification is an excellent focus area for improving Chamblee's sustainability.

The City provided data to characterize its fleet vehicles, which fall into several categories of vehicles of different sizes and which serve different purposes. Within each of these fleet segments, the options for electric vehicles to replace internal combustion vehicles vary in maturity, suitability, availability, and financial viability. Electric vehicle options for each fleet segment has been evaluated, as well as the charging infrastructure that will be required to support vehicle operations, and created a phasing plan to support the City's long term transition to electric vehicles.

SUBSTANTIAL GEORGIA POWER ELECTRIC VEHICLE INCENTIVE Georgia Power, like many electricity utilities around the country, has worked with their regulators to create a program where Georgia Power can provide financial support to add EV charging on your site, called their Make Ready Infrastructure Program. Georgia Power can invest up to $300K per site to cover costs related to design and construction, and covers the ongoing cost of maintaining their electrical equipment; while Chamblee is responsible for purchasing, installing, owning, and maintaining the charging hardware as well as any software and support. This program can lower the cost of Chamblee's fleet electrification efforts, but it comes with requirements for easements and other terms and conditions. It also precludes the use of the Federal Alternative Fuel Vehicle Refueling Infrastructure benefit, which covers 30% of the cost of an EV charging project, capped at $100K per charging port, available as a direct cash payment. Where an EV charging project has a total project cost over $1M in cost (as would likely be the case for all the charging infrastructure needed to support the operations fleet), the Federal program is more valuable than the Georgia Power program.

When customers choose to own their own electrical infrastructure – such as when the Federal Alternative Fuel Vehicle Refueling Infrastructure program provides more value, Georgia Power can also provide a rebate for the purchase of chargers. The Electric Vehicle Charger Plus Rebate program offers up to $20K per site in rebates. Terms and conditions apply.

Note that the majority of vehicle fossil fuel use occurs in police vehicles. This is in part due to police vehicles being used for officer commute transport, enabling greater service flexilibity. Electric police vehicles are beginning to be available in the marketplace; however, the operational ability of Chamblee's police operations to transition to EVs is beyond the scope of this Roadmap. This Roadmap addresses the required charging infrastructure for electrification of the police fleet, but does not address the appropriate timing for this transition (charging infrastructure for the Public Safety building is shown in the phasing plan for 2026 as a working model only). Based on the rapid technological evolution of electric vehicles, it is believed that operationally suitable electrified patrol vehicles will be available in the mid- to long-term.

Using bio-based combustion fuels is not likely to be a long-term scaleable option for the ground transportation sector, so this analysis is focused strictly on battery electric vehicles.

02. ROADMAP DETAILS BY TOPIC

EXISTING FLEET

The City of Chamblee provided data to characterize their fleet vehicles, which can be approximated by six categories.

- **Light-Duty Passenger Vehicles – Sedans & SUVs.** Used for transporting people and small amounts of cargo.
- **Light Duty Pickups –** Used for transporting people, cargo, and supporting maintenance activities.
- **Medium-Duty Pickups –** Operations, maintenance, & hauling.
- **Light-Duty Police Patrol –** These are pursuit-rated police patrol vehicles with significant up-fits.
- **Medium & Heavy Duty Sanitation –** These are the trash and recycling collection vehicles, and heavy transport trucks.
- **Medium & Heavy Duty – Other –** These are the trucks supporting Stormwater, Road, and Building Maintenance.

REQUIRED CHARGING INFRASTRUCTURE

There are three different types of chargers, varying by physical size and electrical capacity, resulting in substantially different charging speeds:

- **Level 1** portable chargers are those typically provided with electric vehicles, plugging into standard 120v wall outlets. They output 1-2 kw, resulting in a charge rate of 2-3 range miles per hour. These are not suitable for long term outdoor use and do not meet safety and operational needs of typical institutional/commercial use.
- **Level 2** outputs AC power from 6-20kW, adding 15 to 40 miles of range per hour depending on the vehicles type and power level. Level 2 charging requires a 208 volt or 240 volt AC service. Note the charge rate range within Level 2 charger as a category is fairly large – a typical Level 2 home charger does not have the output of more substantial commercial Level 2 chargers. For this reason, this Roadmap segments Level 2 chargers into light, medium, and heavy categories.
- **Level 3** outputs DC power at 50-350 kW, and typically requires a major 480 volt AC service. Similar to Level 2, Level 3 chargers come in a range of capacities. The fastest Level 3 chargers can charge an empty long range electric vehicle in 20 minutes.

FACILITIES	VEHICLE TYPE						
	LIGHT-DUTY PASSENGER	LIGHT-DUTY PICKUP	MEDIUM-DUTY PICKUP	LIGHT-DUTY POLICE PATROL	MED/HVY DUTY SANITATION	MED/HVY DUTY OTHER	TOTAL
City Hall	8	1	-	-	-	-	9
Old City Hall	-	-	-	-	-	-	-
*Public Safety	17	5	-	71	-	-	93
Public Works	2	13	6	-	17	10	48
Parks	-	1	-	-	-	-	1
Total	**27**	**20**	**6**	**71**	**17**	**10**	**151**
* Many public safety vehicles park at home overnight.							

02. ROADMAP DETAILS BY TOPIC

Similar to available chargers, charging needs for the City also vary:

- **Recharge after average daily trip.** The City's fleet average daily trip mileage is less than 50 miles a day. A lighter duty charger which can recharge this amount easily overnight or even during the day is a good baseline system to meet the need.
- **Recharge from empty.** There are certainly times when fleet vehicles are driven the ~250-300 mile range of a current electric vehicle. Enabling full recharging of these vehicles overnight is a need.
- **Fast, full recharge.** Particularly for patrol vehicles, the ability to quickly recharge or "top up" for certain situations is an operational priority.

Based on the current passenger and patrol vehicle fleet and available charging technologies, the following charging network is recommended to meet the City's vehicle electrification goal:

CHARGING INFRASTRUCTURE TO SUPPORT THE CITY'S NEEDS

The table on this page shows the electric vehicle charging equipment that will be required to support the fleet based on the type of vehicles and the way they are operated, with some flexibility for future changes.

- Light-Duty Vehicles that return to a City-owned property nightly can be supported by a cost-effective Level 2 charger.

		LEVEL 1	LEVEL 2		LEVEL 3	
Common Use		Home	Home/Employee/Fleet/Public		Fleet	Fleet/On-Road
Amps@Volts		12@240	32@208/240	80@208/240	40@480	200+@480
Power (kW)		1.4	7.7	19.2	30	120+
Range Per Hour	3 mi/kWh	4	23	58	90	360+
	1.5 mi/kWh	2	12	29	45	180+

- Public Safety vehicles that are parked at home will require a robust at-home charging program to support a transition to electric.
- Public Safety vehicles will also be supported by fast charging at the Public Safety Building, and potentially other locations around the patrol area.
- Medium and heavy duty vehicles in the Public Works department require higher power Level 2 or Level 3 chargers to support their operations.
- The Public Works facility is crowded and should be evaluated for long-term fit for its use before investing heavily in charging infrastructure.
- A mix of incentives (Utility and Federal) will provide a significant reduction in the cost of fleet electrification – the best approach varies by site.

Additional details are provided under the individual buildings sections, below.

FACILITIES	CHARGING PORTS REQUIRED						
	LEVEL 2 CHARGERS			LEVEL 3 CHARGERS			
	8.3 KW (40A@208V)	8.3 kW (40A@208V)	8.3 kW (40A@208V)	30 KW (40A@480V)	120 kW (40A@208V)	180 kW (40A@208V)	TOTAL
City Hall	-	9	-	-	-	-	9
Old City Hall	-	-	-	-	-	-	-
*Public Safety	-	10	-	-	-	4	14
Public Works	-	26	20	-	-	4	50
Parks	1	-	-	-	-	-	1
Total	**1**	**45**	**20**	**0**	**0**	**8**	**74**

* Transition to electric vehicles for the public safety fleet will require a program for at-home charging of take-home vehicles.

ELECTRIC VS FOSSIL FUEL VEHICLE EFFICIENCY

Electric vehicles are far more efficient than their fossil fuel ancestors. This is due to two primary factors:

- The substantial majority of the fuel energy in internal combustion motors creates waste heat rather than forward movement
- Nearly all deceleration/braking energy in electric vehicles is recaptured and used to recharge the battery

Building electrification

Chamblee uses natural gas to heat Public Safety, the Keswick Community Center, and Public Works. Electricity is used to heat City Hall and Old City Hall. Electric indoor heating can be provided by either heat pumps or electrical resistance (used at City Hall and Old City Hall). Heat pumps are an outstanding technology, because they generate 2-3x units of heat energy for every unit of electricity they use. It does this by capitalizing on the physical principle of highly pressurized gaseous media generating heat. Heat pumps are essentially air conditioners running in reverse – putting heat into the building while exhausting cold outside. Electrical resistance heating is very inefficient, and also triggers electricity demand charges with large electricity peaks. The Old City Hall heating and cooling system is fairly old, and will need replacement in the mid-term – when replaced, should be replaced with a heat pump based system (discussed in the individual building section, below).

Electrical capacity

A substantial consideration in the electrification of the buildings as well as the addition of electric vehicle chargers to the buildings' electrical system is whether there is enough electrical service capacity (such as the service transformer, main panels, and main switchgear) at each facility to handle the increase in electricity demand. Building electrification and electric vehicle charging are both large electricity uses, and frequently, adding both to a facility will outstrip its electrical capacity. However, given Chamblee's high cooling loads, it is unlikely that shifting heating to heat pumps is unlikely to exceed the electrical capacity already available for cooling, so added load here is limited to the new electric vehicle load. This roadmap has performed a preliminary assessment of the existing electrical system capacity, the existing peak electrical loads, and the additional electrification load to determine if the existing electrical system needs to be upgraded and if so, how. Any required upgrades are reflected in the total electrification costs outlined in this report.

Renewable electricity

THE INFLATION REDUCTION ACT (IRA) is the largest investment ever made by the Federal government to slow climate change and reduce reliance on the fossil fuels responsible for the climate crisis. It invests $386 billion over 10 years in clean energy spending and tax incentives, quickens deployment of clean energy technologies, lowers energy costs, delivers energy resiliency, and strengthens domestic clean-energy manufacturing.

The legislation offers a baseline 25.5% (30% when no tax-benefited financing is used to pay for the project) rebate for all qualified construction costs in direct pay or tax credit funding for renewables, ground source heat pumps, and other advanced decarbonization measures funded through tax-privileged financing mechanisms. Under the IRA, both tax-exempt and taxpaying entities can receive federal incentives for installing clean energy technologies. Taxable entities receive tax credits, a dollar-for-dollar reduction on their end of year tax liability; tax-exempt entities receive the same value as a Direct Payment to the entity.

In addition, there are opportunities for stackable "bonus credits" of 10% each for domestically produced content in construction materials, as well as income qualified areas (which it appears portions of Chamblee are covered by). This Roadmap conservatively assumes the City receives the only the base 25.5% renewables incentive, but does not incorporate any of the additional credit opportunities.

Onsite solar – optimizing size, type, timing, and location

As part of this Roadmap, each City facility was assessed to identify the appropriate size and location for cost-effective solar systems. These systems are designed to minimize cost by avoiding smaller arrays and maximize value by not oversizing the array to the point that lower solar sell-back rates to Georgia Power are triggered.

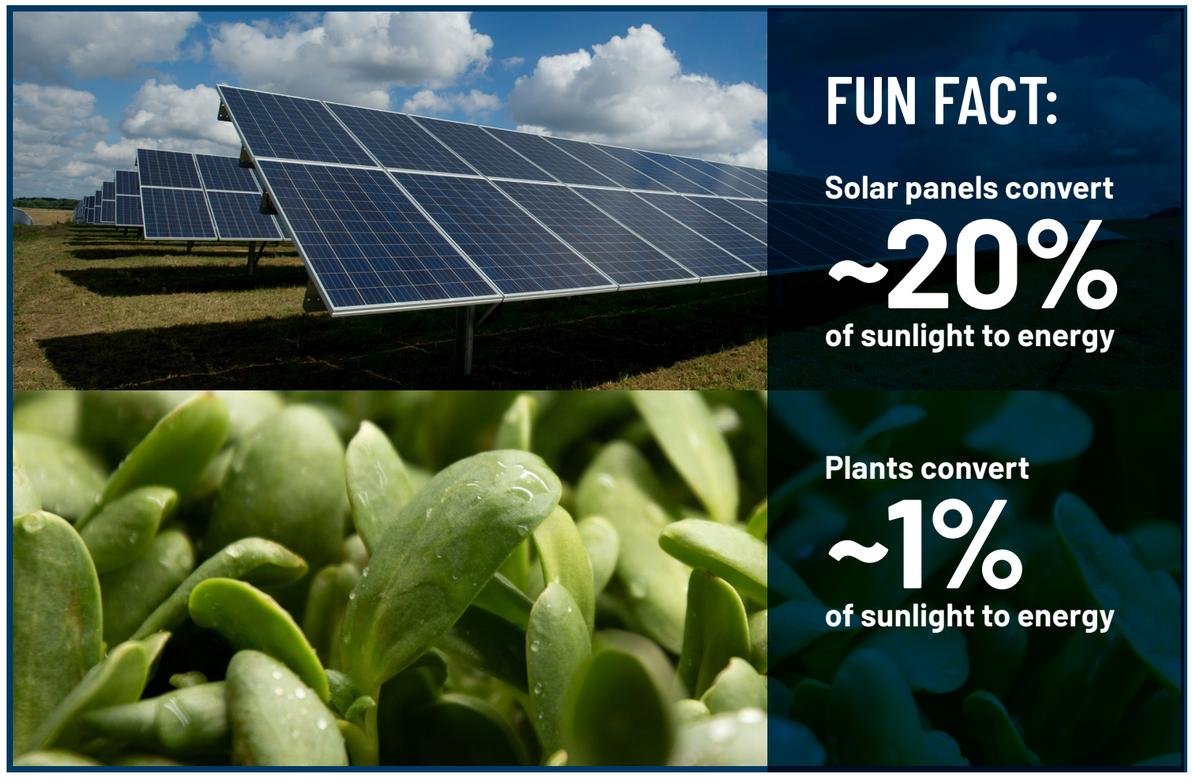
Georgia Power's onsite solar parameters include:

- Customers are to be compensated for any excess solar production sent to the grid as long as the system is less than 250 kW-AC.
- Any excess solar is credited back to the customer at the avoided cost rate of $0.04487 plus an additional $0.04/kWh (this is lower than the production value of the solar used by the facility).
- Systems must not exceed 125% of the preceding years metered peak demand of the premises.

This Roadmap also included a preliminary assessment of existing planning and zoning requirements and is reflected in the placement and estimated costs of the arrays.

Each rooftop system identified was strategically aligned with the roadmap timing based on the roof age and when there is a planned reroofing project. Solar PV systems are 25-30-year assets and should be aligned with rooftops that are either new and do not need to be replaced for 25-30 years, or are old enough to need to be replaced now so solar can be added at the same time. Roofs that are in the middle of their life would require a solar PV system to be removed and then replaced to redo a roof, which is costly and not efficient.

While ground and roof mount solar is typically less expensive than solar on overhead solar shade structures/carports, these have the benefit of community visibility and reduced heat island effect.



SOLAR OUTPUT, OPERATIONS, AND MAINTENANCE

Solar arrays represent a new asset for the City which require ongoing maintenance and replacement. Solar PV is a 25-30 year asset. However, the DC to AC inverters have a shorter expected lifespan at 15 years, and so most of the solar arrays will require yearly inverter replacement beginning in 2040. This cost is relatively minor compared to the initial installation cost but should be accounted for in long term O&M planning.

Furthermore, solar panels have an expected degradation of 0.4% to 0.5% of production per year over their lifespan. This is accounted for using a factor of 0.4% per year in this Roadmap.

More details about each proposed array can be found in the individual building sections below.

The City of Chamblee can cost-effectively self-generate 54% of its electricity with solar panels.

RECOMMENDED ONSITE SOLAR

FACILITIES	SOLUTION TYPE	SIZE (KW-DC)	ESTIMATED ANNUAL PRODUCTION (KWH)	BUILDING ELECTRICITY OFFSET*
City Hall	Solar PV – Carport (single slope)	157.0	224,316	51%
Old City Hall	Solar PV – Rooftop	26.2	34,596	31%
Public Safety Building	Solar PV – Carport (large carport, SE parking lot)	124.3	186,894	28%
Public Safety Building	Solar PV – Ground Mount	135.2	192,087	29%
Public Works Building (Potential Annex)	Solar PV – Rooftop (small roof mount)	32.7	45,688	N/A
Keswick Community Building	Solar PV – Rooftop	4.4	5,913	45%
TOTALS		**480**	**689,000**	

*Based on 2024 pre-electrification usage

Onsite renewable electricity

Generate **50%** of electricity with onsite renewables **by 2028**

21%
Renewable Electricity

2025

CITY HALL & PUBLIC WORKS

51%
Renewable Electricity

2026

PUBLIC SAFETY & KESWICK

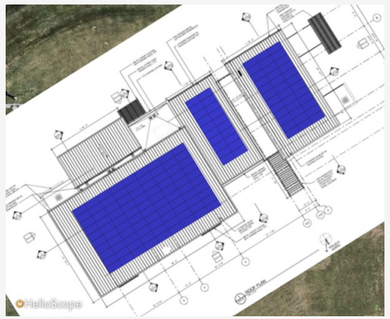
54%
Renewable Electricity

2028

OLD CITY HALL

TBD
Renewable Electricity

2029



DRESDEN PARK

Bringing it together – full Roadmap details

DECARBONIZATION PHASING IS BASED ON FOUR KEY CONCEPTS:

1. Electrify buildings at the time of replacement of the existing fossil fuel based system;
2. Don't install solar until there is a matching electric load at a given facility;
3. Spread costs across years to enable absorption into City's budget; and
4. Within the context of the above, decarbonize at the earliest possible time, subject to any operational considerations, to begin accruing decarbonization benefits.

02. ROADMAP DETAILS BY TOPIC

	ANNUAL KWH SAVINGS	ANNUAL KWH $ SAVINGS	ANNUAL THERM SAVINGS	ANNUAL THERM $ SAVINGS	ANNUAL FUEL GALLON SAVINGS	ANNUAL FUEL $ SAVINGS	IMPLEMENTATION COST
PHASE ONE (2025)							
Efficiency	125,000	$18,000	1,000	$500	0	$0	$356,000
Fleet Electrification	-29,000	-$4,000	0	$0	2,000	$9,000	$187,000
Renewables	270,000	$38,000	0	$0	0	$0	$1,467,000
PHASE TWO (2026)							
Efficiency	3,000	$0	0	$0	0	$0	$258,000
Fleet Electrification	-795,000	-$111,000	0	$0	35,000	$140,000	$513,000
Renewables	385,000	$54,000	0	$0	0	$0	$1,849,000
PHASE THREE (2027)							
Fleet Electrification	-430,000	-$60,000	0	$0	38,000	$151,000	$2,196,000
PHASE FOUR (2028)							
Efficiency	61,000	$9,000	0	$0	0	$0	$1,039,000
Building Electrification	2,000	$0	0	$0	0	$0	$321,000
Renewables	35,000	$5,000	0	$0	0	$0	$345,000
PHASE FIVE (2029)							
Renewables	352,000	$49,000	0	$0	0	$0	$2,179,000
PHASE SIX (2030)							
Renewables	0	$0	0	$0	0	$0	$581,000
PHASE SEVEN (2040)							
Building Electrification	-94,000	-$13,000	10,000	$7,000	0	$0	$3,977,000
TOTAL	**-115,000**	**-$15,000**	**11,000**	**$7,500**	**75,000**	**$300,000**	**$15,268,000**

Combined financial analysis

The Summary Table below shows the net costs of sustainability for the initial Roadmap horizon (2024-2040), combining all the elements discussed above. This number is calculated by taking the gross cost to decarbonize and subtracting out what the City would spend otherwise, lifetime project savings, and incentives and grants.

FINANCIAL NOTES:

1. To avoid complicating the financial analysis of projects outlined in this Roadmap, all costs are presented in 2024 dollars with no inflationary or escalation factors applied.
2. Building electrification can lead to increased annual utility costs due to the existing utility rate structures, where electric demand charges are high and the cost per unit energy of electricity is typically higher than natural gas.
3. For determining savings benefit, this Roadmap uses ASHRAE useful life guidelines where available, and industry standard where not. Where overall systems have a composite of components with varying useful lives, an average was applied.
4. Financial Disclaimer: McKinstry is not engaged in providing legal, tax, or financial advice. The information provided herein is intended only to assist you in your decision-making and is broad in scope. Accordingly, before making any final decisions you should consider obtaining additional information and advice from your accountant or other financial advisers who are fully aware of your specific circumstances.

PHASE	TOTAL LIFETIME IMPLEMENTATION COST	AVOIDED EQUIPMENT REPLACEMENT COSTS	LIFETIME PROJECT OPERATING SAVINGS	TOTAL INCENTIVES (IRA AND UTILITY REBATES)	TOTAL LIFECYCLE COST OF SUSTAINABILITY PROGRAM
Phase 1 (2025)	$2,010,000	$0	$2,070,000	$540,000	-$600,000
Phase 2 (2026)	$2,620,000	$6,000	$2,890,000	$780,000	-$1,056,000
Phase 3 (2027)	$2,196,000	$0	$1,630,000	$300,000	$266,000
Phase 4 (2028)	$1,705,000	$440,000	$370,000	$100,000	$795,000
Phase 5 (2029)	$2,179,000	$0	$2,160,000	$560,000	-$541,000
Phase 6 (2030)	$581,000	$0	$0	$0	$581,000
Phase 7 (2040)	$3,977,000	$730,000	-$160,000	$0	$3,407,000

Total lifetime implementation cost	**($15.3m)**
Avoided equipment replacement cost	**$1.2m**
Lifetime project operating savings	**$9.0m**
Total incentives (IRA and utility rebates)	**$2.3m – $3.0m**
Total lifecycle cost of sustainability program	**($2.2m - $2.9m)**

Estimate level of accuracy and scope

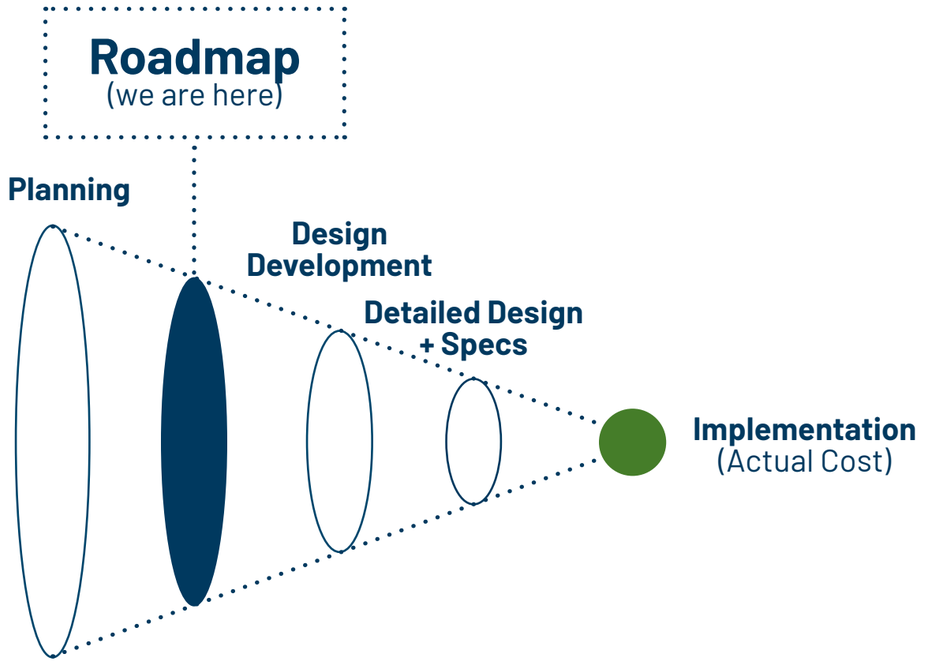
The cost and savings figures provided in this report are estimates. The American Association of Cost Engineering (AACE) provides an estimate classification, ranging from one to five, one being most detailed and costly. This roadmap provides an AACE Class 4 estimate, described as properly used for "schematic design or concept study". This level is appropriate for projects like a sustainability roadmap, which involves multiple complex systems, and decisions that are still in flux. The Class 4 estimate has a margin of error between -20% to +30%, acknowledging the degree of certainty at this stage. Note that estimates for later, future phases are subject to a greater level of uncertainty.

WHY A CLASS 4 ESTIMATE WAS SELECTED:

- **Early planning and level of certainty:** At this stage, the sustainability roadmap is still in the schematic phase. There are broad goals around reducing carbon emissions and improving energy efficiency, and a schematic level of understanding of how each measure will be approached, but detailed engineering designs, equipment selections, and system layouts still lay ahead.
- **Appropriate spending based on point in decision making:** A Class 4 estimate gives the City room to consider decarbonization options prior to committing to complete design/development and bidding, which would require significant additional cost beyond that represented by this Roadmap.
- **Multiple pathways:** A sustainability roadmap typically explores various strategies, such as upgrading HVAC systems, renewable energy, or various efficiency measures. These options can have different cost implications, and a Class 4 estimate allows us to capture a range of potential costs and savings depending on which path is ultimately chosen.

FUTURE DESIGN DEVELOPMENT AND INCREASING ACCURACY

Roadmap cost and savings estimates are based on a schematic level of design and specification of the decarbonization elements, meaning there are specific identified strategies are a number of items to be addressed during detailed project design and development, such as:



- Actual system design, including electrical and piping routing, detailed equipment (heat pumps, piping, etc) sizing, and equipment specification
- Detailed existing structural capacity assessment for increased roof loads (solar)
- Subsurface conditions and detailed existing utility assessment (conduit routing for solar and EV chargers)

Final costs will not be known until the actual contractor bids are received, reflecting the actual local competitive environment, real-time equipment pricing, constructor's actual expectations for construction time, etc.

ESTIMATE SOURCES

- **Actual costs and operating savings of recent similar projects:** McKinstry is a large national company with a substantial database for project costs and observed operating savings for an array of energy conservation, renewables, and mechanical, electrical, and plumbing improvements. This information formed the backbone of the estimates.
- **RS Means:** RS Means is a widely used construction cost database, offering detailed pricing information for a range of construction materials, labor, and equipment. For HVAC systems, it provides cost data on various components such as air handlers, chillers, boilers, and ductwork, as well as installation labor.

Available Incentives

SCOPE	INCENTIVE	PROGRAM NAME	FORMULA OR COMPETITIVE	NOTES
Solar	25.5-30% of Solar Project	Federal - 48 Investment Tax Credit	Formula	
	10% of Solar Project	Federal - 48 Low Income Bonus for Investment Tax Credit	Competitive	Only applicable for Public Safety Building, Public Works Building, and Keswick Community Building
Roof Replacement	30% of Incremental Roof Costs	Federal - 48 Investment Tax Credit	Formula	Reflective Roof with Bi-facial PV Panels Roof Mounted (only include SF under solar panels)
EV Charging	30% per charger	Federal - 30C Tax Credit	Formula	Only applicable for Public Safety Building, Public Works Building, and Keswick Community Building
	$500 per charger	Georgia Power – EV Charger Rebate	Formula	Level 2 chargers only and max 5 per account
Fleet Electrification	30% of Incremental Costs per EV	Federal - 45W Tax Credit	Formula	
	Varies - substantial	Georgia Power Make-Ready Program	Formula	See narrative
	14.5% of Vehicle Cost	Diesel Emissions Reduction Act (DERA) Competitive Grant	Competitive	Requires 85.5% Matching
Water Conservation	$50 per fixture	DeKalb County – Water Conservation Rebate	Formula	1.28 gpf and max 3 fixtures
	$100 per fixture	DeKalb County – Water Conservation Rebate	Formula	1.1 gpf and max 3 fixtures
	$250 per heat pump water heater	Georgia Power – Plumbing Rebate	Formula	Max is $50,000 per building per year and 50% of equipment cost
HVAC Upgrades	$0.10 per kWh saved	Georgia Power – Custom Equipment Rebate	Formula	Max is $75,000 per building per year
	$0.10 per kWh saved	Georgia Power – Building Tune Up	Formula	Max is $75,000 per building per year
	$400 per air source heat pump	Georgia Power – HVAC Rebate	Formula	<65 kBTU/hr and Max is $50,000 per building per year and 50% of equipment cost
	$80 per ton air source heat pump	Georgia Power – HVAC Rebate	Formula	65 kBTU/hr to 135 kBTU/hr and Max is $50,000 per building per year and 50% of equipment cost
	$50 per HP on VFDs	Georgia Power – HVAC Rebate	Formula	Max is $50,000 per building per year and 50% of equipment cost
	$50 per ECM motor on VAV Boxes	Georgia Power – HVAC Rebate	Formula	Max is $50,000 per building per year and 50% of equipment cost
	$75 per Smart Thermostat	Georgia Power – HVAC Rebate	Formula	Max is $50,000 per building per year and 50% of equipment cost
BAS Controls Upgrades	$0.10 per kWh saved	Georgia Power – Custom Equipment Rebate	Formula	Max is $75,000 per building per year
	$0.10 per kWh saved	Georgia Power – Building Tune Up	Formula	Max is $75,000 per building per year
	$7-$25 per Lighting control	Georgia Power – Lighting Rebate	Formula	Max is $50,000 per building per year and 50% of equipment cost
LED Lighting	$2-$15 per Lamp	Georgia Power - Interior LED Retrofit	Formula	Max is $50,000 per building per year and 50% of equipment cost
	$10-$15 per kit	Georgia Power - Interior LED Retrofit Kit	Formula	Max is $50,000 per building per year and 50% of equipment cost
	$10-$25 per fixture	Georgia Power - Interior LED New	Formula	Max is $50,000 per building per year and 50% of equipment cost
LED Streetlighting	$10-$100 per fixture	Georgia Power - Exterior LED New	Formula	Max is $50,000 per building per year and 50% of equipment cost
	$10-$120 per fixture	Georgia Power - LED Pole-Mounted Fixtures	Formula	Max is $50,000 per building per year and 50% of equipment cost

03

INDIVIDUAL BUILDINGS

City Hall

YEAR BUILT: **2022** SQUARE FEET: **29,800**

City Hall houses the majority of City departments as well as City Council chambers.

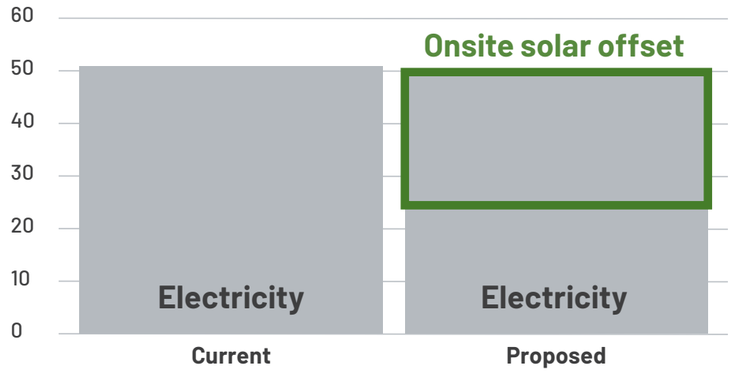
EXISTING SYSTEM The building HVAC needs are met by multiple roof mounted packaged RTUs. The RTUs are DX cooling and include electric heating (selected units). The RTUs are part of a VAV system that utilize reheat (Titus electric duct heaters) for final zone tempering. This is an all electric building with electric reheat, electric heating coils, electric baseboard, electric cabinet heaters, etc. The building utilizes an EST (Energy System Technology) DDC system (Niagara platform-based system). Domestic hot water needs of the building are met by multiple smaller electric units.

Lighting is all LED. All spaces appear to have occupancy sensors or are controlled (larger areas) by centralized switching.

A 1000A (480/277V, 3 phase, 4 wire) main distribution panel is located in the 1st floor electrical room.

Current and Proposed EUI

kBTU/SF/YEAR



This graph demonstrates the current EUI (Energy Use Index) for both Electricity and Natural Gas prior to any decarbonization; and then the proposed electricity used following efficiency and electrification measures.

PROJECT PHASING SUMMARY

PHASE 1 (2025)	PHASE 2 (2026)	PHASE 3 (2027)	PHASE 4 (2028)	PHASE 5 (2029)	PHASE 6 (2030)	PHASE 7 (2040)
• Retrocommissioning • Building Envelope • Flush Valves • Solar Carport • Fleet Electrification	Active Energy Manage-ment					

Electrification Scope

FLEET

Site Notes:
City has upgraded underground electrical feeders to EV charging stations located in the north parking lot, which were previously undersized.

03. INDIVIDUAL BUILDINGS

Fleet Overview:

- Nine Vehicles: Light-Duty Sedans, SUVs, and Pickups
- Assumed to be active ~50 wks / yr, 5 days / wk, 0600-1600.
  Parked 1600-0600 (14 hours).
- Estimated <45 miles per day avg for RAV4 fleet (some days well over 100 miles)
- Highly variable, but <10 miles per day typical for other vehicles parked here
- Assume replacement every 10 Years / 100,000 Miles

Charging Needs:

- Nine x 50A (10.4kW) L2 charging locations to support fleet vehicles parked at City Hall
- Expandable up to 15 Chargers
  (for fleet or employee use) without additional trenching.
- 150 kWh combined daily energy need for all nine vehicles.
- 21.6 kW combined Power Management setting for eight Vehicles (60A@208V3PH)
- Non-fleet use of chargers during
  day time is possible.

HVAC The City Hall HVAC is currently all-electric, but uses all resistance systems instead of heat pump heating, which results in high demand charges. It is recommended that the RTUs be replaced with heat pump type when the current new units are at the end of their useful life.

ELECTRICAL UPGRADE Electrical upgrade may be needed for fleet electrification only. Further 30 day metering is needed to determine if the main panel is adequate to support the charging load. Additional sub-panel and trenching infrastructure will be required.

Solar PV

PV System Type	**Solar PV - Carport**
PV System Size (kW DC)	**157**
PV System Size (kW AC)	**120**
Estimated Annual Production – 1st Year (kWh)	**224,316**
Offset (%)	**51%**

- Single slope carport – 5-degree tilt
- Carport system to be located in North parking lot.
- Proposed carport system offers good offset (production).
- Carport PV system would provide a good shade structure for parking area.
- PV carport is very visible for the public.

- An additional potential solar array was identified – a walkway canopy structure at the front of the building – but was not pursued due to the aesthetic impacts of blocking view to the main building façade.

Old City Hall

YEAR BUILT: **2002** SQUARE FEET: **7,700**

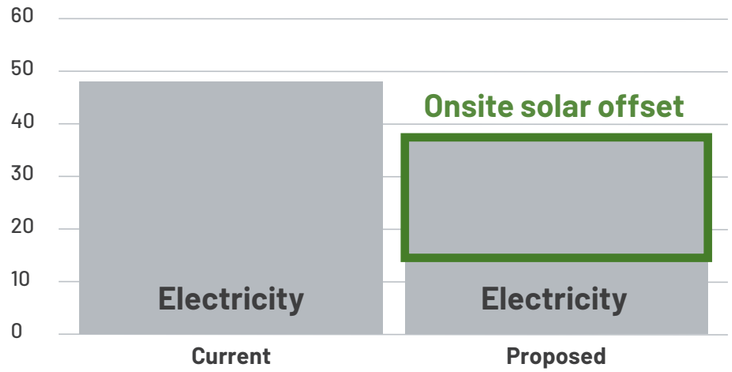
This building, the previous City Hall, is used only intermittently, for election polling, etc. Its future use is undetermined, and it is possible the City will surplus and sell the building.

EXISTING SYSTEM The HVAC system is an older, original to the building construction, VAV system. **If the building is retained and used regularly by the City, this system is due for upgrade and replacement in the near term.** The system has one Carrier AHU with a two circuit DX cooling coils. A VFD controls the single supply fan – there is no return fan. A pad mounted Carrier DX condensing unit is located northeast of the building in a fenced area.

The building has seven zones – each served by a ceiling plenum mounted Carrier 45 MUs / JCs. These Carrier units are fan powered VAV terminals with electric heating coils (designated as "PIUs" – plenum injection units). These units draw primary air from the main AHU supply duct and warm / return air from the return plenum to satisfy zone temperature requirements. The system utilizes plenum return back to the main AHU.

Current and Proposed EUI

kBTU/SF/YEAR



This graph demonstrates the current EUI (Energy Use Index) for both Electricity and Natural Gas prior to any decarbonization; and then the proposed electricity used following efficiency and electrification measures.

Other mechanical equipment includes:

- One EVH
- Four exhaust fans
- One Mitsubishi Electric heat pump. This heat pump serves the data closet / area and is on local controls.
- Domestic hot water is produced by two smaller electric water heaters. Both units appear to be original to the construction of the building

Each zone has a wall mounted thermostat. The system utilizes an older BAS from GCS (Global Control Solutions). The BAS system is not operating properly per discussions with City personnel, has limited communication capability, and does not have remote access capabilities. The system is obsolete.

Lighting in the spaces is a combination of fluorescent (T8, CFL, etc.), limited LED, and halogen. There were no lighting occupancy sensors noted during the site visit. As the lighting is older, a LED lighting upgrade is recommended but only after the future of the building (including interior space reconfigurations and building remodel) is known. If the building is to be remodeled, it is recommended that the lighting upgrade take place at that time. If the building is to be occupied in the existing configuration, the City could benefit from a lighting upgrade.

A 600A Siemens main distribution panel is located in the mechanical / electrical room. There are two electrical sub-panels – L1 and LM.

- Panel LM serves mechanical equipment.
- Panel L1 serves lighting, cubes / furniture, computer data closet, outlets, heat pump, etc.

PROJECT PHASING SUMMARY

Implementation is subject to the City's retention of this building.

PHASE 1 (2025)	PHASE 2 (2026)	PHASE 3 (2027)	PHASE 4 (2028)	PHASE 5 (2029)	PHASE 6 (2030)	PHASE 7 (2040)
Retro-commis-sioning	Active Energy Manage-ment		• Building Envelope • Lighting • Building electrification • Solar + roof replacement			

Electrification Scope

FLEET No fleet vehicles are located here; thus no charging infrastructure is proposed.

HVAC At this time, the future interior use of Old City Hall is unknown, making a detailed electrification recommendation difficult. At its core, however, a DX based cooling system with heat pump based heating makes most sense. This system would tie into the existing ducted supply/return distribution network. An updated controls system is also recommended.

ELECTRICAL UPGRADE Building conversion to a heat pump based heating system, if anything, is likely to have a smaller load, due to the very large peak demand of a fully electric resistance heating system.

Solar PV

PV System Type	**Solar PV - Rooftop**
PV System Size (kW DC)	**26.2**
PV System Size (kW AC)	**25**
Estimated Annual Production – 1st Year (kWh)	**34,596**
Offset (%)	**31%**

- Small ballasted rooftop PV system.
- Due to age of existing roof, along with expected life expectancy of new PV system, a new roof will be required and the building's structural will be require analysis.

Public Safety

YEAR BUILT: **2021** SQUARE FEET: **48,500**

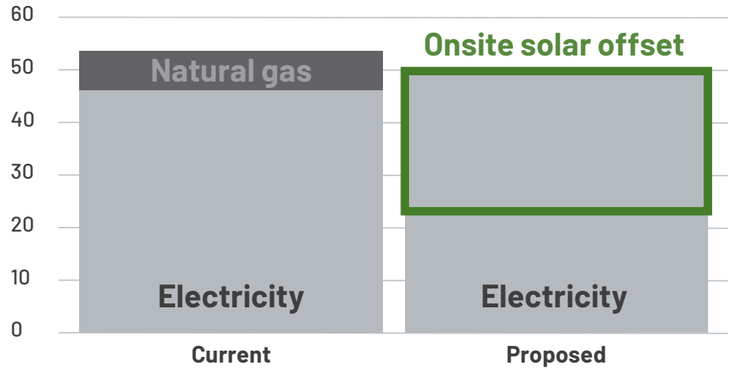
This building houses police headquarters and offices, K-9 holding kennels, sally port, intake and holding areas, specimen collection labs, evidence, forensics, 911 call center, municipal court and associated operations (court is held weekly on Monday, Tuesdays, and Wednesdays), and a large community room.

EXISTING SYSTEMS The building is served by approximately twenty-six packaged RTUs with DX cooling and natural gas heating. There is also one large dedicated outdoor air unit proving neutral air to the occupied spaces. There are also multiple single-zone split system systems (provides both heating and cooling to spaces). City staff was unsure of the type of system but based on a high-level review of the control GUIs – the system appears to be a VAV with electric reheat for final space tempering. The HVAC system is controlled by a Johnson Controls Verasys system.

Lighting is all LED. All spaces appear to have occupancy sensors or are controlled (larger areas) by centralized switching.

Current and Proposed EUI

kBTU/SF/YEAR



This graph demonstrates the current EUI (Energy Use Index) for both Electricity and Natural Gas prior to any decarbonization; and then the proposed electricity used following efficiency and electrification measures.

PROJECT PHASING SUMMARY

PHASE 1 (2025)	PHASE 2 (2026)	PHASE 3 (2027)	PHASE 4 (2028)	PHASE 5 (2029)	PHASE 6 (2030)	PHASE 7 (2040)
Retro-commis-sioning	• Active Energy Management • Flush Valves • EV chargers • Solar Ground Mount and Carport systems					Building electrifi-cation

ELECTRIFICATION SCOPE

FLEET As noted above, the operational decision for the police department to transition to electric pursuit vehicles is beyond the scope of this Roadmap. The following outlines required charging infrastructure for the Public Safety building. The current phasing plan shows installation of Public Safety charging infrastructure in 2026; this is subject to operational decisions around appropriate police vehicle electrification.

A complicating factor is that police patrol vehicles are taken home by the officers. To enable overnight/off shift charging, at home charging will be required, meaning Level 2 home chargers will need to be installed at officers' homes – a substantial topic that will need to be resolved. The infrastructure reflected below anticipates patrol vehicles being primarily charged at home, with some charging infrastructure, including high-speed Level 3 charging, provided at the Public Safety building. Installation of charging infrastructure is likely to "prime the pump" and help the City begin the long term transition to police EVs.

Note that there would be a net operating expense benefit to transitioning the police vehicles to EV. The Roadmap benefit calculations only reflect 25% of that net benefit, given home charging topic is not resolved.

Fleet Overview:

- 93 Vehicles: Sedans, SUVs, and Pickups (5 Admin, 70 Patrol, 18 CID)
- Vehicles assumed to be active 52 weeks per year, <5 days per week, <12 hours per day. Est'd ~50 miles per average vehicle, average day.
- Assume Replacement Every ~6 Years / 100,000 mi

Chargers Installed:

Charging primarily at home; robust home charging program required.

- (10) 50A (10.4kW) L2 charging locations for portion of Public Safety fleet which may be parked on site for long durations.
- (4) 180kW L3 charging locations to support charging when a quick turn-around is needed.
- 1800 kWh daily energy need, 400 kW Power Management Setting (assume 20 L3 charging sessions of 80kWh each, per day, plus L2)

HVAC At the end of their useful life (approximately 2040), the RTU units (RTUs with DX cooling / NG heating) should be replaced with heat pump RTUs with heat pump cooling / heating (1st stage of heating) and supplemental electric heating (2nd stage supplemental heating).

ELECTRICAL UPGRADE

- L2: New 100A breaker added to existing 208V distribution panel in main electrical room, location and capacity to be confirmed.
- L3: New Utility Service at 480V. Trenching to parking area of existing charging locations.
- 400A sub-panel will be located outdoors in the area of the chargers, re-feeding existing and new chargers with opportunity to add additional chargers for fleet or employee use.

Solar PV

ARRAY 1	
PV System Type	**Solar PV – Carport**
PV System Size (kW DC)	**124.3**
PV System Size (kW AC)	**100**
Estimated Annual Production – 1st Year (kWh)	**186,894**
Offset (%)	**28%**

Two separate arrays are recommended for the Public Safety building.

- Smaller carport PV system (7-degree tilt)
- Located closer to electrical service / electrical room (SE area of building)
- Shading accounted for in preliminary analysis. Based on preliminary analysis, system does not require any tree removal.

ARRAY 2	
PV System Type	**Solar PV – Ground Mount**
PV System Size (kW DC)	**135.2**
PV System Size (kW AC)	**100**
Estimated Annual Production – 1st Year (kWh)	**192,087**
Offset (%)	**29%**

- Ground mount PV system located in area South of building.
- This location is much closer to electrical service / electrical room (SE area of building)
- Preliminary ground mount location accounts for required setbacks and right of ways.
- Ground mount PV system can be sized larger (currently sized and laid out to perimeter fence in parking lot).
- Shading is including is production modeling.

Note a third array was evaluated (large carports at the north parking lot) but not recommended due to its distance from the building's electrical service.

Public Works

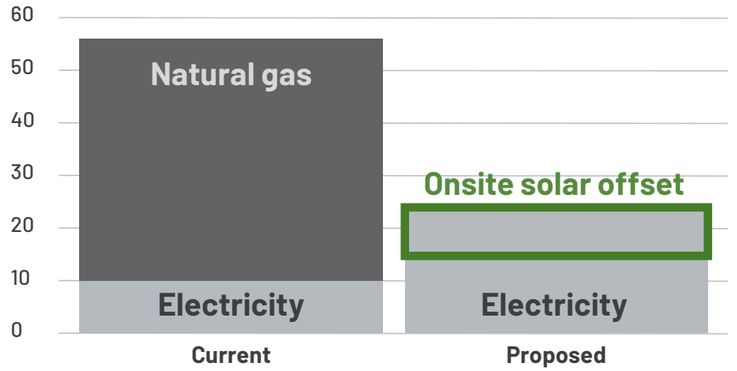
YEAR BUILT: **1980** SQUARE FEET: **14,500**

This building, acquired by the City in 2004, was previously a Frito Lay warehouse. It includes a two story office area and an open vehicle maintenance/storage area. At the time of the site visit, City staff noted that the City was purchasing the building located just to the North of the current Public Works for additional space. The state of this building is unknown as it was acquired at the end of the study period; however, potential solar was evaluated for the building.

EXISTING SYSTEMS The open shop is heated via four suspended natural gas fired unit heaters (standard efficiency). The shop space is not air conditioned. There are six wall mounted, louvered, propeller type exhaust fans that are used in the warmer month to ventilate the area. The exhaust fans are on switched local control. The HVAC needs of the two story office space are met by two residential style split system units with DX cooling and natural gas heating. Based on information on the nameplate, both units (indoor fan coil and outdoor condensing unit) were manufactured in 2019 with

Current and Proposed EUI

kBTU/SF/YEAR



This graph demonstrates the current EUI (Energy Use Index) for both Electricity and Natural Gas prior to any decarbonization; and then the proposed electricity used following efficiency and electrification measures.

installation occurring later in 2019 or early 2020. The office areas are divided into two zones – 1st and 2nd floor. Each office zone is controlled by a Honeywell local wall mounted programmable thermostat with no remote access capabilities. For the open shop / storage areas, the unit heaters are controlled by local wall mounted thermostats.

Most of the interior lighting appears to have been converted to LED (self-performed by the City)– both in the office area and open shop / storage area. Exterior lighting appears to be a combination of halogen, CFL, and LED. The lights in the open shop area are switched. The office spaces utilize occupancy sensors.

This building has a PV system attached to the south facing metal roof. The size of the system is estimated to be between 20 kW and 30 kW. There are four Sunny Boy inverters located on the north exterior wall of the building. It is unknown when the PV system was installed.

PROJECT PHASING SUMMARY

PHASE 1 (2025)	PHASE 2 (2026)	PHASE 3 (2027)	PHASE 4 (2028)	PHASE 5 (2029)	PHASE 6 (2030)	PHASE 7 (2040)
Retro-commissioning Building Envelope	Active Energy Management	EV chargers				Building electrifi-cation

Electrification Scope

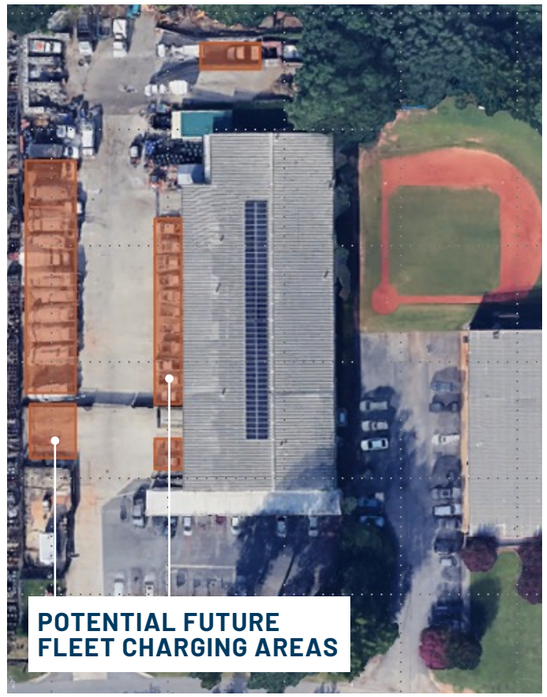
FLEET Note: Fleet operations at this location are crowded. Provision of full fleet charging infrastructure at this location will be costly, in part due to a required substantial service upgrade. Investment into charging infrastructure should be carefully contemplated in the context of long term real estate plans for the Public Works department.

SITE NOTES:

- Site supports multiple Public Works sub-teams, including Sanitation.
- Potential future acquisition of adjacent site is being considered.

FLEET OVERVIEW:

- 48 Vehicles: Light-Duty SUVs and Pickups, Medium Duty Pickups, Heavy-Duty Sanitation Vehicles and Semi Tractors.
- Duty Cycle, Daily Mileage, and Energy Needs Vary by Vehicle Use and Type.



CHARGING NEEDS

- (26) 50A (10.4kW) L2 charging locations for Light- and Medium-Duty vehicles.
- (20) 80A (19.2kW) L2 charging locations for Heavy-Duty Local-Use vehicles. (i.e. Trash & Recycling collection)
- (4) 180kW L3 charging locations to support charging for Semi Tractors, and when a quick turn-around is needed.
- 2000 kWh daily energy need, 400 kW Power Management Setting

HVAC At the end of their useful life (approximately 2040), the RTU units (RTUs with DX cooling / NG heating) should be replaced with heat pump RTUs with heat pump cooling / heating (1st stage of heating) and supplemental electric heating (2nd stage supplemental heating).

ELECTRICAL UPGRADE New service to allow capacity of 400 kVA needed for charging capacity.

Solar PV

Main building: The current array likely supplies a majority of the building's electrical use – no additional solar is recommended for the building.

Annex: The City recently acquired an adjacent building ("Annex") to serve expanded Public Works operations – the following is a potential solar array.

PV System Type	**Solar PV - Rooftop**
PV System Size (kW DC)	**32.7**
PV System Size (kW AC)	**30**
Estimated Annual Production – 1st Year (kWh)	**45,688**
Offset (%)	**N/A**

- Assumes new annex has a similar load to the main building.
- The preliminary design allows for a larger system to be added in the future if the load increases.
- Assumes each building is on their own separate meter.

Keswick Community Building

YEAR BUILT: **1989** SQUARE FEET: **3,500**

This building is used as a community (public rental space) building with various occupancy throughout the year including summer camps, sports camps, birthday parties, etc.

EXISTING SYSTEMS The HVAC needs are met by two residential style split system units with DX cooling and natural gas heating. Both units have ON / OFF type of control meaning that once the space setpoint is reached, the unit shuts off.

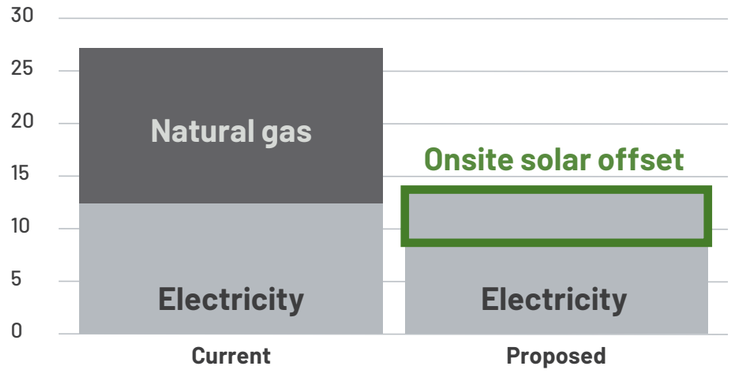
Domestic hot water is produced by an older natural gas fired Whirlpool CraftMaster unit. Based on the physical condition of the unit, the City may need to replace the unit in a few years.

Lighting in the spaces appears to be fluorescent (T8, CFL, etc.). There were no lighting occupancy sensors noted during the site visit.

A 225A main distribution panel is located in the mechanical / electrical room.

Current and Proposed EUI

kBTU/SF/YEAR



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PROJECT PHASING SUMMARY

PHASE 1 (2025)	PHASE 2 (2026)	PHASE 3 (2027)	PHASE 4 (2028)	PHASE 5 (2029)	PHASE 6 (2030)	PHASE 7 (2040)
Retro-commissioning Building Envelope	Active Energy Management Building Envelope Lighting Solar					Building electrifi-cation

Electrification Scope

FLEET OVERVIEW:

- 1 Vehicle: Light-Duty Pickup (in addition to UTV / Golf Cart / etc)

CHARGING NEEDS

- (2) 32A (7.7kW) L2 charging locations.

HVAC It is recommended that when the existing systems are at the end of their useful life, they be replaced with a commercial heat pump based systems with electrical resistance supplemental heat.

ELECTRICAL UPGRADE Preliminary review of the current service determined that the addition of two EV chargers does not require an expansion of the service.

Solar PV

PV System Type	**Solar PV - Rooftop**
PV System Size (kW DC)	**4.36**
PV System Size (kW AC)	**3.3**
Estimated Annual Production – 1st Year (kWh)	**5,913**
Offset (%)	**45%**

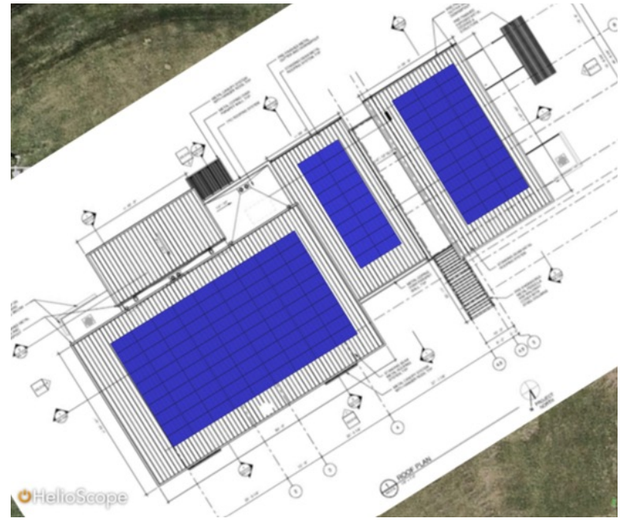
- Building is very small in building area and also has a very small electrical load.

Future Dresden Park Community Building

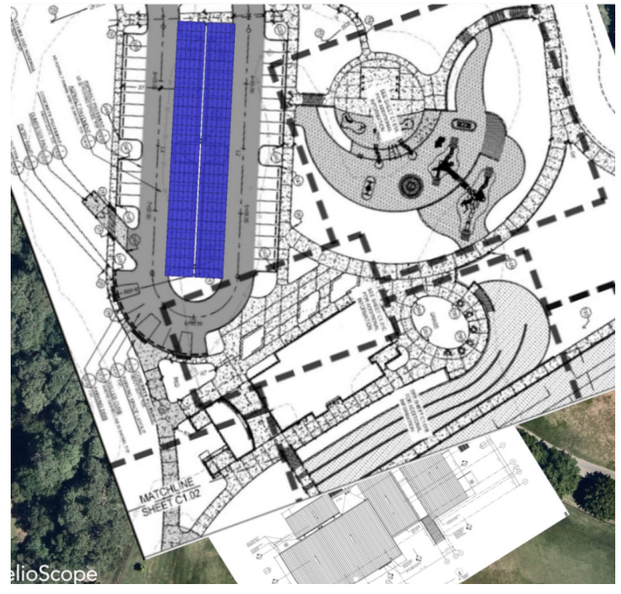
YEAR BUILT: **TBD** SQUARE FEET: **TBD**

This building is being constructed as part of a larger improvement to Dresden Park. It does not currently include solar in its plans. As part of this Roadmap, two array options, to be installed in 2029, are recommended for this building. Final scoping and sizing will depend on whether the building's load will be large enough to support the PV systems.

ARRAY 1	
PV System Type	**Solar PV - Rooftop**
PV System Size (kW DC)	**79.6**
PV System Size (kW AC)	**66.6**
Estimated Annual Production – 1st Year (kWh)	**102,609**
Offset (%)	**TBD**



ARRAY 2	
PV System Type	**Solar PV - Carport (single slope or inverted T)**
PV System Size (kW DC)	**176.6**
PV System Size (kW AC)	**150**
Estimated Annual Production – 1st Year (kWh)	**~248,000**
Offset (%)	**TBD**



THANK YOU

THANKS TO THE CITY STAFF WHO SUPPORTED THE CREATION OF THIS ROADMAP

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