DECARBONIZE ATLANTA

A Roadmap to Achieve Carbon Neutral Buildings

April 2021 | American Cities Climate Challenge

Image by David Mark from Pixabay

Authors and Acknowledgements

Decarbonize Atlanta was developed under the guidance of the City of Atlanta Mayor's Office of Resilience and with support from the Bloomberg Philanthropies American Cities Climate Challenge. The Climate Challenge is an initiative that empowers 25 of the largest U.S. cities to implement near-term climate goals and become primary drivers of progress towards meeting America's pledge on climate. Recognizing that cities account for more than 70% of global carbon emissions – and that mayors have significant authority over cities' highest emitting sectors: transportation and buildings – the Climate Challenge aims to enhance the work already being done by mayors across the U.S. and to support cities in the fight against climate change.

American Cities Climate Challenge

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Executive Summary

The City of Atlanta has a long legacy of pioneering climate commitments. The City's 2015 Climate Action Plan[1] mapped out ambitious carbon reduction goals across energy, water, waste, and transportation. In 2017, the City of Atlanta took even more ambitious action, committing to the targets set in the Paris Climate Agreement, as well as a transition to a 100% clean energy future by 2035. Additionally, climate action was core to the *Resilient Atlanta*[2] and *Clean Energy Atlanta*[3] strategies that were released in 2017 and 2018, respectively. These progressive commitments represent critical steps to remedy climate change. However, the climate crisis demands even more of us. Cities must go beyond a pledge to shift to clean power production; they must actively reduce the harmful effects of the worst carbon emitters. In Atlanta, energy used in buildings accounts for 64% of community-wide carbon emissions.[1] To avoid the most severe impacts of climate change, Atlanta must commit to complete equitable decarbonization of buildings by 2050.

Climate change is not just a future threat to Atlanta; it is a real and ever-present global crisis. Setting ambitious targets and milestones is a critical first step. However, the time for merely setting goals has passed. The City needs to take urgent and immediate action to adopt and implement the policies that are necessary to achieve the 2035 and 2050 targets for equitable decarbonization outlined in this roadmap. Many of the approaches being undertaken by other cities to advance building decarbonization in their jurisdictions are not possible in Atlanta due to the political, legal, and regulatory frameworks in Georgia that render them infeasible. The City of Atlanta has a challenging journey ahead due to the lack of State-level policies and incentives to advance energy efficiency and renewable energy goals, coupled with recently enacted State-level policies designed to limit cities' ability to advance decarbonization through building electrification policies. Meeting the carbon reduction targets will require significant political will, dedicated staffing and budgetary resources, and successful partnerships with residents, the private sector, Georgia Power, Southern Company Gas, and the State of Georgia.

What is *Decarbonize Atlanta*?

The term decarbonization describes the intentional process to sustainably reduce or remove carbon from a system. A decarbonized building is one that is highly efficient, grid-enabled, operates on 100% clean energy, and, from construction through demolition, results in zero net carbon emissions. Burning coal and natural gas for local energy generation results not only in carbon emissions but also to the poor air quality that contributes to childhood asthma rates of 12% in Atlanta.[3,4]Building decarbonization will reduce citywide greenhouse gas (GHG) emissions,

[1] *Atlanta Climate Action Plan*, City of Atlanta, Feb. 2016, v2. https://atlantaclimateactionplan.files.wordpress.com/2016/02/atlanta-climate-action-plan-07-23-2015.pdf
[2] *Resilient Atlanta*, City of Atlanta, Nov. 2017, https://resilientcitiesnetwork.org/downloadable_resources/Network/Atlanta-Resilience-Strategy-English.pdf
[3] *Clean Energy Atlanta*, City of Atlanta, 6 March. 2019, https://www.100atl.com/
[4] *2020 Georgia Data Summary, Asthma in Children*, Georgia Department of Public Health, 22 Jan. 2021, dph.georgia.gov/document/document/2020-georgia-child-data-summary-pdf/download.

reduce extreme weather events, and improve air quality, reducing asthma rates and emergency room visits as well as creating an overall better quality of life for the residents of Atlanta.

Decarbonize Atlanta is a roadmap to assist the City in its efforts to significantly reduce the carbon emissions of buildings. The roadmap was developed by for the City of Atlanta by New Buildings Institute (NBI), Southface Institute (Southface), and Greenlink Analytics (Greenlink) through a partnership with Bloomberg Philanthropies' American Cities Climate Challenge (Climate Challenge). The organizations jointly conducted a thorough assessment of opportunities to achieve equitable decarbonization in Atlanta's existing buildings and new construction, prioritizing actions that have the potential to be the most impactful and viable to advance decarbonization goals given the current racial, political, and economic landscape in Atlanta. Through this analysis, the partners created a step-by-step roadmap to guide City of Atlanta leadership and staff on a path to enacting and fully implementing building decarbonization by 2050. *Decarbonize Atlanta* focuses on six distinct and feasible areas of action that when enacted together have the potential to produce a 53% reduction in carbon emissions from building energy use by 2035 (as shown in Figure 1):

1. Equity-centered green bank
2. Lead-by-example municipal building policy
3. New construction codes
4. Energy performance requirements for existing buildings
5. Time-of-lease and time-of-sale performance disclosure
6. Embodied carbon regulation

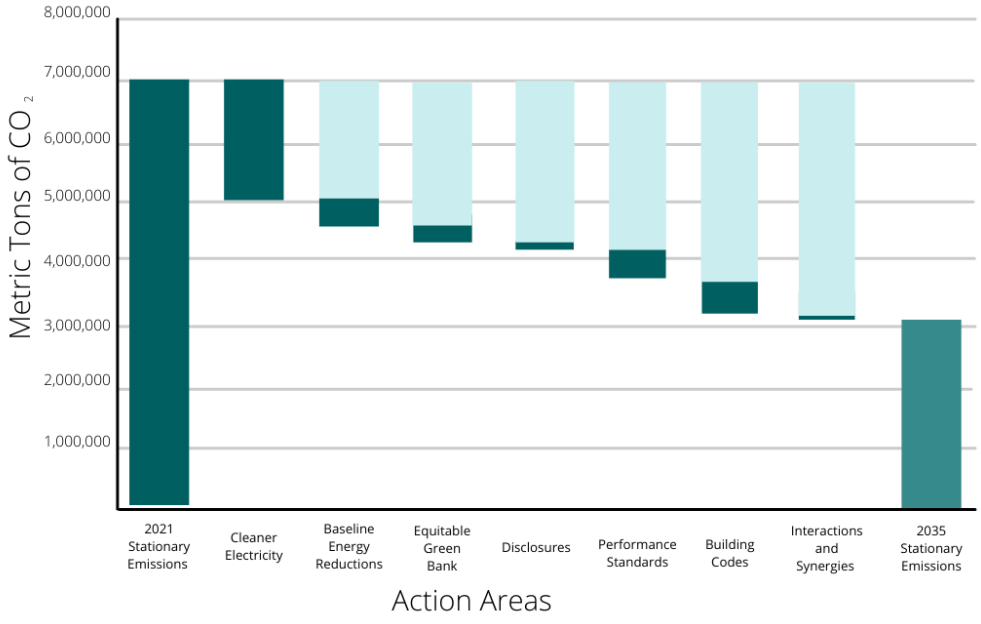


Figure 1: Impact Potential of Decarbonization Policies

In addition to the carbon reduction benefit of these policies, it is estimated that more than 3,000 new jobs across the building industry will be created to support implementation and compliance. The City can achieve this significant carbon reduction by enacting the policies and programs identified in this document in conjunction with already-planned clean energy improvements to the electricity grid.

2021

Establish incentive structure for voluntary stretch code

Begin stakeholder process to update municipal building policy

Define goals for embodied carbon policy implementation

Launch PACE program

Achieve 80% benchmarking compliance

Develop RCx, lighting retrofits, and/or building labeling policy

2022

Begin training for code update, one year before it becomes mandatory

All municipal building systems are catalogued

Review options for embodied carbon into municipal projects

Launch incentives and education programming

2023

Adopt updated energy code with amendments to address renewable energy, electrification, and grid integration

Draft update to existing municipal building policies to ensure net zero operational carbon by 2035; pass update through City Council

Include embodied carbon disclosure in codes

Incentivize low EC development

Enact building performance standard policy

Enact time of lease/time of sale energy performance policy

2024

Implement new municipal zero carbon policy

Create Office of Building Performance to oversee existing building policy implementation.

Create building retrofit accelerator program, resource hub, workforce development

2025

Begin training for the next code update

All municipal buildings have plan to replace fossil fuel end uses

2026

Adopt updated energy code

Expand embodied carbon in code by materials and systems to tackle highest impact materials first

Policy Implementation Timeline

It is critical for the City to recognize that aggressive short-term actions must be taken to ensure long-term climate benefits are realized. The carbon reductions identified above assume the passage and implementation of these policies are well underway by 2025, as these decarbonization actions will take several years to generate savings.

While 2035 and 2050 may seem far away, for the City's clean energy and decarbonization targets to be met, formidable policy action and investment must be taken by Atlanta's leadership, starting today. The recommended actions included in this timeline show which actions would result in the decarbonization of Atlanta's buildings by 2050.

This roadmap provides actionable guidance and critical strategies that must be executed for the City of Atlanta to decarbonize the building stock. As a leader among U.S. cities, it is imperative that Atlanta take the steps to adopt the policies recommended in this roadmap.

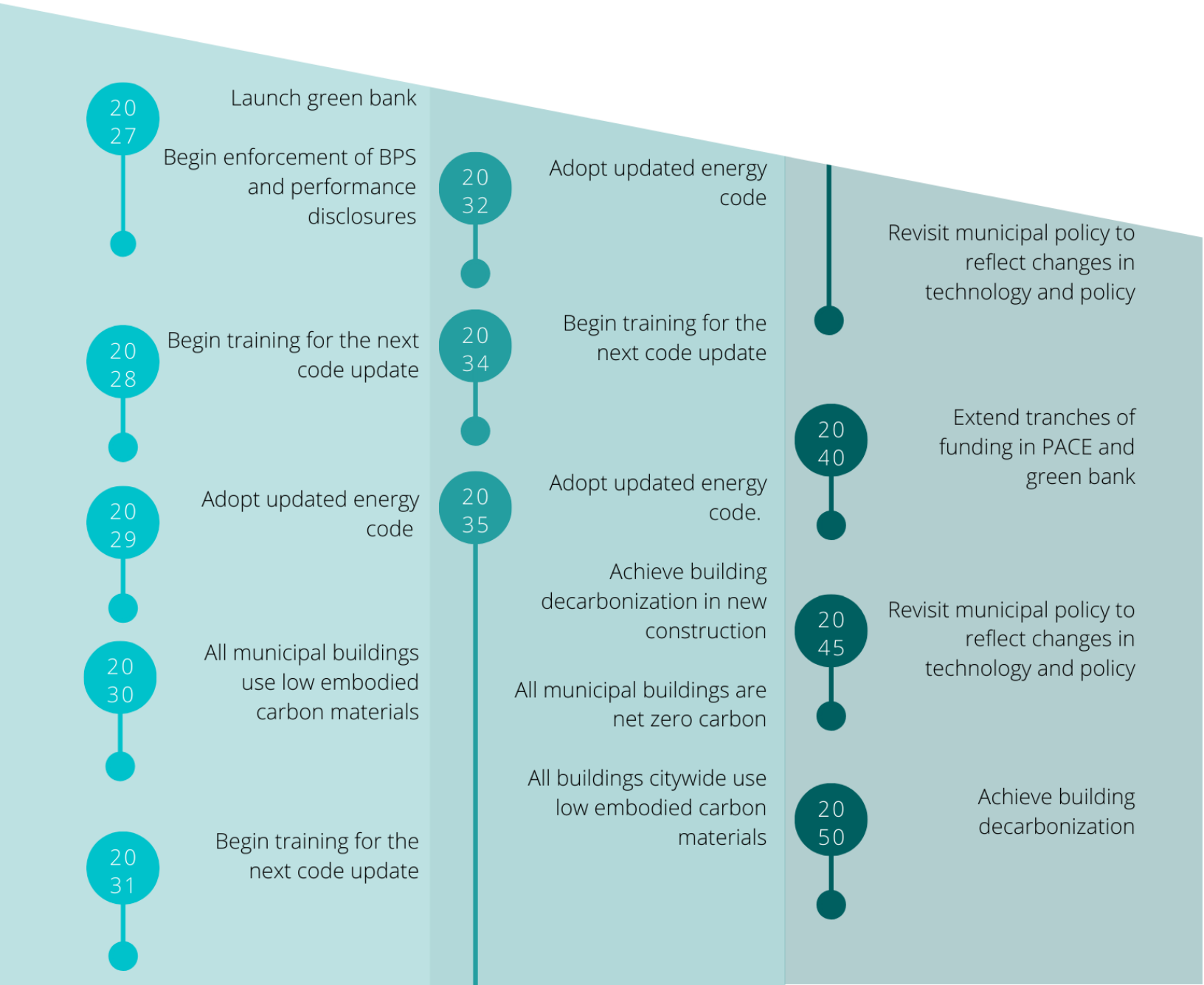


Table of Contents

Introduction

Purpose

This document, or "roadmap," contemplates pathways for Atlanta to pursue to achieve a fully decarbonized building stock by 2050. This roadmap includes a comprehensive and actionable set of decarbonization solutions to achieve equitable decarbonization of Atlanta's existing building stock by 2050, looking through the lens of the current racial, political, and economic landscape. It includes detailed milestones and considers equity, stakeholder, and timeline considerations to identify the optimal path forward. This roadmap offers both a summary as well as comprehensive recommendations for the City of Atlanta to undertake to meet its building decarbonization goals.

This document is best used to inform and equip City leadership and staff with a technical resource to engage and garner support from stakeholders and policy leaders to execute Atlanta's decarbonization strategy. The roadmap explains the complexities and nuances of decarbonization and clarifies the role of not only the City but affected stakeholders in these decarbonization efforts. The roadmap also offers budget projections, cost-savings, and cost-avoidance projections associated with the recommended solutions where available.

Current Climate and Goals

Since 2015, the City of Atlanta has adopted increasingly ambitious climate and resilience goals and strategies that rely on the continued improvement of energy performance in buildings. The four major goal-setting documents referenced in this roadmap include:

The City of Atlanta Climate Action Plan,[5] published in 2015, identifies Atlanta's greatest opportunities for climate action and sets targets and interim milestones for reducing GHG emissions from buildings, waste, water, and transportation. The Climate Action Plan set targets to reduce building energy use by 20% by 2020 and by 40% by 2030. These buildings-related goals were superseded in 2017 when the Atlanta City Council enacted the Clean Energy Resolution.

The Atlanta Clean Energy Resolution No. 17-R-3510,[6] passed in 2017, calls for 100% of all electricity consumed in Atlanta to be derived from "clean energy sources, highlighting energy efficiency and renewable energy as preferred options to meet the goals" by 2035. This Resolution called for the development of a plan for the City to achieve these goals, which led to the creation of *Clean Energy Atlanta*.

[5] *Atlanta Climate Action Plan*, City of Atlanta, Feb. 2016, https://atlantaclimateactionplan.files.wordpress.com/2016/02/atlanta-climate-action-plan-07-23-2015.pdf
[6] Resolution 17-R-3510A, City of Atlanta, 1 May 2017, http://atlantacityga.iqm2.com/Citizens/Detail_LegiFile.aspx?Frame=&MeetingID=2033&MediaPosition=&ID=12113&CssClass=

***Resilient Atlanta*[7], released in 2017 is an aspirational strategy that builds upon the strengths of regional growth, diversity, and integration while addressing key challenges that face the region: racial equity, economic inequality, gentrification, and climate change. The strategy includes a comprehensive and actionable set of visions, targets, and actions that seek to build capacity among residents and city systems alike to survive, adapt, and thrive regardless of chronic stresses or acute shocks. With equity at the center, a significant tenet of Atlanta's resilience strategy relies upon the prevention and adaptation to extreme climate events such as major floods or heat waves. A transition to 100% clean energy was a key action identified in *Resilient Atlanta*.

Clean Energy Atlanta[8], adopted by the Atlanta City Council in 2019, sets a framework by which to achieve a transition to 100% clean electricity by 2035, adhering to the vision identified in *Resilient Atlanta*. *Clean Energy Atlanta* explicitly acknowledges the City must do more than purchase large amounts of renewable energy credits (RECs), and should focus efforts on achieving its 100% clean energy goal through a combination of energy efficiency and local renewable energy generation. This plan, as well as the 2017 Clean Energy Resolution, focuses on a transition to clean energy sources for 100% of all electricity consumed in Atlanta; however, it does not address the energy consumed through on-site fossil fuel generation.

Why Building Decarbonization?

The logical next step to reducing the City of Atlanta's GHG emissions is establishing a goal for building decarbonization. The City's building and energy-related climate goals and strategies for meeting those goals to date have largely focused on securing cleaner electricity sources through a combination of on-site renewables (i.e. rooftop solar), energy efficiency, decarbonizing the local electric grid, and REC purchases. While that approach addresses a significant portion of carbon emissions associated with building energy use, it does not address the carbon emissions generated through on-site fossil fuel combustion, including, but not limited to, the use of gas heating, water heating, and cooking. Adopting a building decarbonization goal bridges that gap by addressing a systems approach to optimizing the building stock to reduce its carbon emissions and mitigate the effects of climate change.

Partners and Roles

A comprehensive, viable roadmap requires diversity of thought and expertise through the collaboration of both local and national partners. New Buildings Institute (NBI), the Southface Institute (Southface), and Greenlink Analytics (Greenlink) through the American Cities Climate Challenge (Climate Challenge) joined forces to assist the City of Atlanta in charting a practical and equitable roadmap to decarbonize new and existing city buildings through a broad suite of approaches targeting new construction, existing building energy performance, and embodied carbon, among others. The organizations collectively provided an evaluation of best practices for decarbonization policies, developed a suite of realistic policy options, completed a policy analysis

[7] *Resilient Atlanta*, City of Atlanta, Nov. 2017, https://resilientcitiesnetwork.org/downloadable_resources/Network/Atlanta-Resilience-Strategy-English.pdf

[8] *Clean Energy Atlanta*, City of Atlanta, 6 March. 2019, https://www.100atl.com/

and assessment of opportunities and challenges, and aligned actions with existing political timelines. Specific partner roles were defined as follows:

New Buildings Institute (NBI) is a nonprofit organization pushing for better energy performance in buildings. NBI works collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency. NBI also develops and offers guidance and tools to support the design and construction of energy-efficient buildings. Throughout its 20-year history, NBI has become a trusted and independent resource helping to drive buildings that are better for people and the environment.

NBI completed a new construction target-setting analysis that enables the City to determine the necessary changes to building codes for new construction decarbonization. Utilizing its FirstView Tool, NBI also analyzed municipal building benchmarking data and strategies from municipal building work across the country for getting to zero over time**.** NBI provided information to Atlanta on measures and strategies that are typically included in decarbonization roadmaps as they relate to buildings. NBI coordinated with City of Atlanta staff and partners to select policies and strategies that can be implemented to meet municipal and new building goals.

Southface Institute (Southface) is a nonprofit organization that promotes a regenerative economy and green building through education, research, policy, advocacy, and technical assistance. The Atlanta-based organization has more than 40 years of experience advancing resource efficiency and a sustainable built environment.

In its role with this project, Southface led the residential and commercial building decarbonization recommendations and survey policy best practices of this roadmap, identifying a comprehensive suite of potential pathways to assess for implementation in Atlanta. Southface's equity consultant, Cicely Garrett, incorporated an assessment of equity considerations into the policy review process. All partners coordinated with City of Atlanta staff and partners to collaboratively develop the final suite of action areas for existing buildings decarbonization policy. Southface also developed a multi-year workplan for the City of Atlanta to move that suite of policy options forward, working with the partner team to provide recommended sequencing and prioritization of policies, along with evaluating near-term opportunities for roadmap implementation.

Greenlink Analytics is an Atlanta-based energy research and consulting organization equipped with sophisticated analytical technologies and deep industry knowledge in the clean energy space, receiving accolades from MIT, Georgia Tech, and the National Science Foundation, among others. It uses these technologies to help create a smarter, cleaner, and more equitable future. Greenlink Analytics has spent years developing the data and methods to produce reliable, localized estimates of the impacts of efficiency and renewable energy options for the City of Atlanta and the energy ecosystem within which the City operates. Greenlink has assisted numerous cities with conducting analyses on the benefits of decarbonization policies, establishing and evaluating decarbonization policies, and producing public communications materials to show the value of clean energy for buildings operations.

Greenlink's role in this project included leading the assessment of six policies across commercial and residential building types, which were identified through collaboration with the City, NBI, Southface, and local partners. Utilizing its proprietary energy forecasting models, Greenlink analyzed the impacts of potential decarbonization policies to help the City determine the most locally appropriate mix of policies and investments. Greenlink also performed opportunity and challenge assessments for potential short and long-term policies, including addressing equity considerations, and produced detailed forecasting of GHG outcomes, cost/cost-savings, and impacts on stakeholders.

Methodology

The solutions included in the decarbonization roadmap are those with the greatest potential to be the most impactful and viable solutions given decarbonization goals as well the current racial, political, and economic climate. The project team vetted 25 solutions for inclusion in the roadmap before selecting six priority "areas for action" for the City of Atlanta to pursue using an equity lens to achieve decarbonization of Atlanta's existing and future building stock. Detailed information on the vetting, scoring, and ranking parameters and analysis of each of the 25 solutions can be found in Appendix A.

Equity Assessment

Energy burdens, or the percent of household income spent on electricity and gas bills, are not shared evenly across Atlanta: low-income communities in the southern neighborhoods of Atlanta face electric and gas burdens that far exceed the national average (3%), reaching up to 24% in some communities. Figure 2 shows energy utility burden (electricity and gas) by neighborhood.[9]

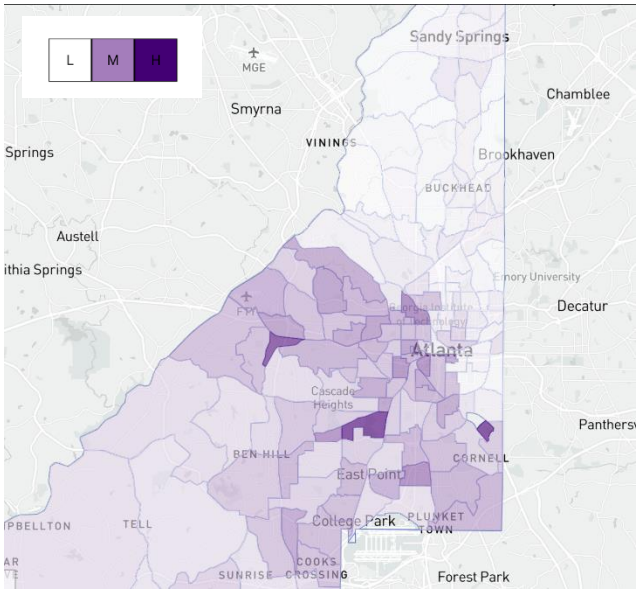


Figure 2 Equity Assessment of Energy Burdens in Atlanta

The importance of addressing utility burden has become increasingly clear, as research indicates that paying utility bills is the most common expense for which people use short-term loan products[10,11] and as many as 31% of Americans have gone without a meal or prescription to pay an energy bill.[12] As a result, reducing energy burdens may have spillover

[9] Greenlink Equity Map, Greenlink, www.equitymap.org/

[10] Levy, R., and J. Sledge. 2012. A Complex Portrait: An Examination of Small-Dollar Credit Consumers. Chicago: Center for Financial Services Innovation.

[11] *Utilities and Payday Lenders: Convenient Payments, Killer Loans*, National Consumer Law Center, June 2007, https://www.nclc.org/images/pdf/pr-reports/report_payday_utility_2007.pdf

[12] Ingber, Sasha. *31 Percent of U.S. Households Have Trouble Paying Energy Bills*. NPR, 20 Sept. 2018, www.npr.org/2018/09/19/649633468/31-percent-of-u-s-households-have-trouble-paying-energy-bills.

benefits related to economic well-being and overall quality of life that far exceed the sole benefit of lowered utility bills.

Values

Cicely Garrett led the project team through a process to ensure racial, social, and economic equity was an overarching priority in the development of *Decarbonize Atlanta*. For *Decarbonize Atlanta*, the partners chose to define equity as:

> All Atlantans having access to opportunities that are necessary to satisfy essential needs, advance their well-being, and achieve their full potential.

The team adopted a shared set of values and executed an equity assessment of all proposed policies and interventions. Throughout the planning process and creation of the roadmap, the partners sought to establish an equitable and inclusive guide for Atlanta to achieve a decarbonized building stock by 2050.

PEST Analysis with an Equity Lens

Using an equity lens, the partners evaluated potential solutions within a PEST (Political, Economic, Social, Technological) Analysis framework. PEST is a strategic management tool through which an organization can assess major external factors that influence its programs, policies, and operations within a particular time period for strategic analysis and risk assessment. The four areas that make up the acronym are critical to the model. When utilized with an equity lens, it provides a framework for critical yet strength-based inquiry and examination of proposed policies and solutions.

Policy Landscape Review

NBI and Southface conducted an overview of the national decarbonization policy landscape. NBI assessed new construction, municipal buildings, and embodied carbon policies, while Southface assessed the existing buildings' energy landscape. Through this process, a robust selection of policies targeting on-site building energy use and generation, along with energy storage options, were identified and discussed among the partner teams. The teams undertook a rigorous policy evaluation to narrow that broad field of options down to a set of six priority areas for action. This process entailed conducting an initial equity review to assess the suitability of each option within the local Atlanta context, weighing considerations such as climate impact, implementation logistics, and requirements for affected City departments as well as for community members, economic development potential, available resources, and distribution of associated costs and benefits, among others. After this round of analysis, findings were shared with City personnel, who ultimately selected the final six actions for a deeper-level analysis in this roadmap.

Decarbonization Solution Modeling

Greenlink led the in-depth analytical assessment of the final six decarbonization solutions identified for Atlanta. The team built upon Greenlink's clean energy models from the *Clean Energy Atlanta* planning process to analyze the impacts of potential decarbonization solutions specifically in Atlanta's energy system. Impact areas studied for each solution included the number of local

jobs created, change in local incomes and GDP, public health savings, carbon dioxide (CO_2) emission mitigation, and the benefits and costs of each policy. The results of the solutions impact analyses enable stakeholders to weigh and incorporate differences between solution options and identify pathways toward more desirable outcomes.

The impacts of each solution were modeled using a machine-learning tool designed to simulate the electricity system that provides power to Atlanta. To understand how the electricity system functions in Atlanta, the ATHENIA Tool constructs hourly electricity demand and supply profiles.

Electricity demand was constructed using 65 different hourly building-demand profiles for Atlanta, accounting for differences in building type, age, occupancy patterns, and size. Electricity supply is constructed using each power resource used to generate electricity for Atlanta, including operational characteristics and information about emissions, water usage, and waste. Total building footprints are collected from Google 3D imaging and building assessments, helping to produce the most accurate read of buildings presently within city limits.[13]

The ATHENIA Tool analyzes the price of different energy sources as well as how much of that source could eventually be on the grid. This analysis is then used to determine how much investment in different clean energy policies and programs would be required to decarbonize Atlanta's buildings. Greenlink also quantified the value of energy savings; macroeconomic impacts such as net job creation, increased local GDP growth, and labor income impacts for 10 sectors of the economy; and health impacts resulting from reductions in seven common pollutants (NOx, CO_2, SO_2, PM2.5, PM10, VOCs, and NH_3) for each of the six solutions.

The Path Ahead

To achieve a decarbonized building stock Atlanta will need to prioritize policies that drive efficiency, electrification, and on-site renewable energy generation, and ensure that energy supplied to buildings comes from carbon-neutral, clean energy sources.

Aggressive action is required in the next 10 years to set the wheels in motion for decarbonization to be achieved across Atlanta by 2050. Passing ambitious policies is a key element of this effort, but for these policies to be successful a strong local clean energy infrastructure needs to be built to ensure the decarbonization goal can be achieved. This includes foundational elements such as access to financing for energy efficiency improvements and workforce development to ensure the availability of trained professionals to perform building decarbonization work.

This roadmap details six priority areas for action for the City to pursue to advance progress on building decarbonization and identifies the timeline required for these actions to yield benefits by a 2050 target.

1. Equity-centered green bank
2. Lead-by-example municipal building policy
3. New construction codes

[13] Values modified from Google Environmental Insights Explorer. December 2020.

4. Energy performance requirements for existing buildings
5. Time-of-lease and time-of-sale performance disclosure
6. Embodied carbon regulation

These actions were chosen not only for their individual impact but also for the synergies produced as a collective. For example, by providing enhanced access to clean energy financing through the creation of an equity-centered green bank, residents and industry can more quickly adopt efficient electric building technologies and practices. By generating early momentum, the City will more easily be able to adopt new construction codes and achieve energy performance requirements for existing buildings.

AREAS FOR ACTION

Equity-centered Green Bank

Access to resources for clean energy investments is essential for building owners and developers to make the investments required to adopt energy efficiency and renewable energy measures, as well as to comply with increasingly rigorous local ordinances governing building energy performance. Many cities and states across the U.S. are establishing green banks, which are financial instruments that can facilitate the deployment of clean energy using limited public dollars, attracting private capital investment in clean energy projects, usually with an established target for total dollars to invest or climate benefits to achieve. This innovative program design makes clean energy more affordable and accessible to consumers.[14] Green banks are unique in that they prioritize positive climate outcomes and environmental benefits, while measuring success through metrics such as greenhouse gases averted, energy consumption reduced, jobs created, public health dollars saved, etc. The local nature of a green bank creates opportunities for program design that addresses local priorities such as prioritizing clean energy financing for Black, Indigenous, and People ofColor (BIPOC)and low-income communities.

Definitions and benefits

Establishing an equity-centered green bank for Atlanta will prime the pump for clean energy investment across all six action areas identified in this roadmap, from new construction to existing buildings improvements, from energy efficiency to renewable energy investments, and from the commercial sector to residential sector improvements. It is a foundational step the City must take to enable accelerated investment in voluntary building decarbonization measures, which will create momentum towards a smooth implementation of the building performance improvement mandates that are recommended in the 2020s. An equity-centered green bank will include debt products with relationship-based underwriting standards as well as flexible repayment and re-borrowing terms. Additionally, community financial institutions, including community development financial institutions (CDFIs), community development commissions (CDCs), credit unions, and minority depository institutions, offering micro- and mid-sized loans in the market will be engaged as active partners providing services in under-resourced, energy burdened neighborhoods. An equity-centered green bank in Atlanta will create multiple benefits (shown in Table 1).

Establishing an equity-centered green bank for Atlanta is expected to drive significant new investments in energy efficiency and renewable energy. The policy would cut energy waste from homes and significantly increase energy productivity in businesses with a focus on serving communities that might otherwise struggle to access funds. The bank could establish financing opportunities that are missed by the status quo, with resulting impacts on economic development and public health outcomes. Overall investments compared to the costs to Atlanta are shown in Table 2. Cumulative benefits include the impact to both the City of Atlanta and the region, as jobs and societal benefits do not stop at the city limits. Cumulative costs represent the spending spurred by the green bank; while the majority of this amount is spending by the bank, not everyone is expected to use a loan to pay for the full cost of a project. These figures represent $12 to $15 million per year in loans being administered under a successful program. These estimates were

[14] Connecticut Green Bank, https://www.ctgreenbank.com/about-us-2019/

developed through a review of other green banks in the U.S. and their spending levels, adjusting that amount upwards proportional to the higher cost of serving low-income households and businesses to reflect the equity-centered focus of an Atlanta green bank.

Table 1: Benefits of Establishing a Green Bank

Benefit Categories	**Full Impact**	**Equal To**
Local jobs created	9,225	1.1 Coca-Cola headquarters
Local incomes increased by	$532,500,000	$62.50 per Atlanta citizen per year
Local GDP growth	$451,500,000	7% of Delta Airlines global revenues
Public health savings	$255,750,000	$2.51 monthly health insurance savings
Metric tons CO_2	4,544,250	6 months without cars

Table 2: Cumulative and Atlanta Specific Benefits and Costs of Establishing a Green Bank

Cumulative Benefits	**Cumulative Costs**	**Net Benefits**	**Benefit/Cost Ratio**
$8,486,250,000	$168,750,000	$8,317,500,000	50.3
Atlanta Specific Benefits	**Atlanta Specific Costs**	**Net Benefits**	**Benefit/Cost Ratio**
$847,500,000	$168,750,000	$678,750,000	5.02

Economic Development

The economic development implications for an equity-centered green bank are very positive, with the projection showing the creation or sustaining of 9,225 job-years (a full-time position held by one person for one year) through 2035. Assuming the average person keeps a job for four years, this would roughly equate to 2,300 new employment opportunities that would not have otherwise existed in Atlanta. Looking across more than 500 industries, direct employment of 100 or more positions would be created in seven industries including construction, HVAC, program

administration, lighting, energy management, building materials, and architecture and engineering services.

An equity-centered green bank is likely to generate similar job creation figures for the residential and commercial sectors because of the greater emphasis on the residential sector than other policy options. Successful implementation of an equity-centered green bank will result in indirect and induced job effects as well. Indirect job losses are concentrated in the power sector and supporting industries as less money is spent on energy bills. Induced jobs see strong growth, for essentially similar reasons: as less money is used towards energy bills, residents and businesses in Atlanta spend more in other parts of the economy, spurring growth and the creation of more jobs. In total, more jobs are created through induced pathways than through direct or indirect effects, showing that the benefits of reduced energy spending are significant and shared across the entire consumption-driven economic landscape.

Incomes and GDP will grow as well, reflecting much the same story as employment. Stated plainly, spending less on energy allows the residents and businesses of Atlanta to put more resources into efforts that employ more people, increasing incomes, and growing the economy. The equity-centered green bank policy shows great promise in achieving these outcomes.

Public Health

The consumption of energy from resources that cause pollution creates public health damages that generally are not considered relevant by Atlanta's electric utility service provider because the costs are borne by others. As a result, people lose workdays and the income that comes with it, more children become asthmatic, and many health conditions, such as stroke, heart attacks, and even death, are increased. In addition, these energy resources are also the source of carbon emissions, the primary driver of climate change which threatens to cause multi-trillion-dollar losses in the global economy and disrupt many aspects of modern society.

An equity-centered green bank in Atlanta presents an opportunity to reduce the public health and welfare cost of emissions by nearly $255 million through 2035, with benefits occurring within Atlanta and across the country. It would also reduce carbon emissions by 4.5 million metric tons conservatively; equivalent to 6 months of the total emissions from personal vehicle use in Atlanta.

Cost-Benefit Analysis

Many of the positive benefits of establishing an equity-centered green bank reach beyond the City of Atlanta boundary. As an example, the majority of the public health benefit is likely to accrue to other communities across Georgia. On the other hand, the costs of these actions will be borne by those within city limits.

The predominant source of economic benefit from the equity-centered green bank will be energy savings. Public health benefits also contribute a sizable dollar value to the total economic benefit. Most of the costs associated with this solution are related to hiring contractors and service providers to implement the necessary energy upgrades to hit the green bank target. Through 2035, projected Atlanta-specific benefits are $847 million, at a cost of $168 million. As a result, this policy option is projected to deliver net benefits of $678 million at a benefit-cost ratio of 5.0, or $5 of benefit for every $1 spent.

A well-executed equity-centered green bank for Atlanta would have widespread equity implications by reducing energy use from residential single-family and multi-family homes (in comparison to the building performance standard (BPS) that would focus on multifamily and commercial buildings) and significantly increase energy productivity in commercial businesses with a focus on serving communities that might otherwise struggle to access funds.

What does this mean for Atlanta?

The creation of a green bank will create new options for financing building performance improvements **community-wide** and will bolster a local clean energy economy and create local jobs.

The **City of Atlanta government**—those who serve the Mayor and uphold and enforce the laws created by City Council—would first support City Council in enacting legislation to establish the equity-centered green bank and then develop and administer a green bank program. They could draw from national best practices demonstrated through successful existing programs including the DC Green Bank and the Connecticut Green Bank to ensure the prioritization of equity-driven programs that benefit low-income residents, small business owners, and BIPOC populations. The City's economic development arm, Invest Atlanta, will play a critical role in the financial administration of the green bank. The City will need to conduct a robust community engagement campaign on the benefits of clean energy, availability of programs, and resources to determine program eligibility for financing provided by the green bank. City Council members should also support community engagement efforts to inform residents and stakeholders of the benefits of clean energy and the availability of programs and program eligibility through the equity-centered green bank. Over time, the data the City collects through administering the green bank's programs will provide deeper insights into the equity impacts of the green bank on alleviating energy burden and supporting small business owners.

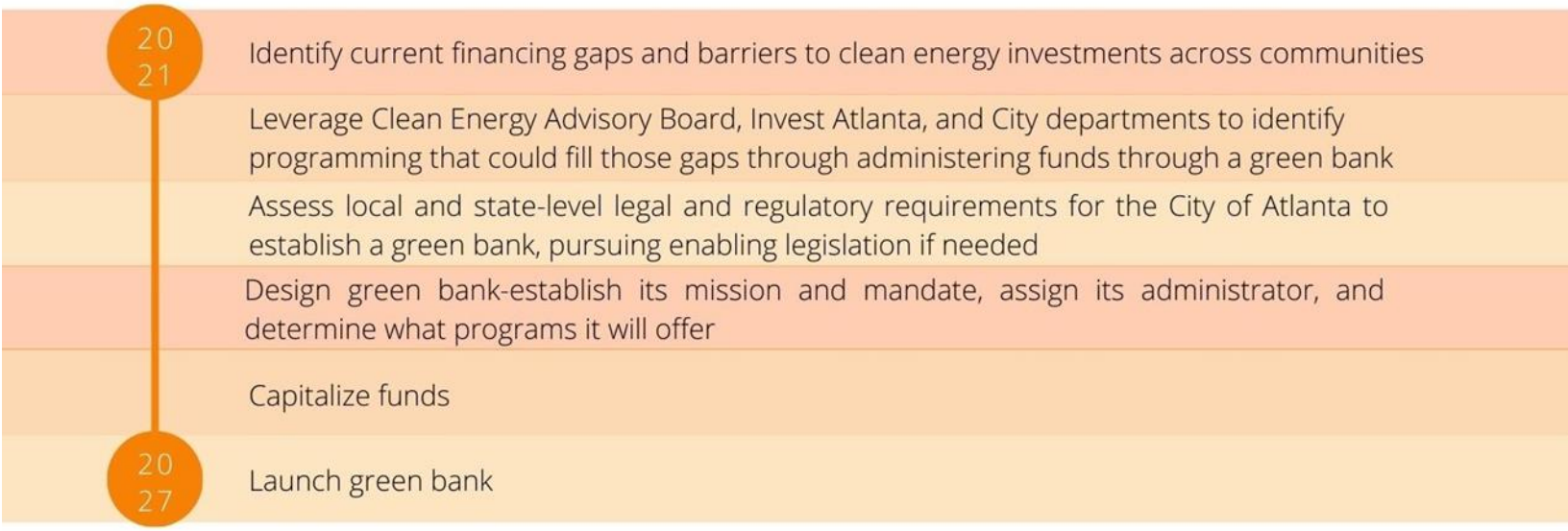
Homeowners, renters, landlords, and developers will maximize the benefits of a green bank by visiting clean energy resource centers (virtual and physical locations co-located with other high-traffic services and info centers) to learn of the benefits of clean energy, the availability of programs, and program eligibility. After understanding benefits and programs, building owners and landlords may apply to access green bank financing programs as funding and eligibility permits. Once approved owners, and renters can implement upgrades to realize energy savings.

Real estate professionals would benefit from training courses and briefings offered on green bank financing and they would, in turn, share information with colleagues, peers, and clients. Real estate professionals would play an important role in supporting the City's community engagement efforts in partnership with City of Atlanta staff to inform residents and stakeholders of the benefits, eligibility requirements, and program details associated with the green bank.

Finally, **service providers and local trades** will play a critical role in implementing the clean energy improvements for homes, businesses, and other improvement projects financed by the green bank.

How to get there

Establishing a green bank is a complex task that will take time, expertise, interdepartmental cooperation, and successful public-private partnerships. The intentionality of design is critical to ensure the resources a green bank affords for clean energy improvements are accessible to all members of the community.



Laying the Foundation

Since significant up-front investment may be required to make energy improvements in buildings, it is in the City's best interest to provide clean energy investment resources before enacting rigorous building performance mandates. Creating the infrastructure ahead of time and creating momentum by facilitating investments for interested "early adopter" building owners will help pave the way for the successful implementation of future solutions, including building performance policies.

PACE Financing

The City is already poised to create a green bank. In 2017, the Atlanta City Council adopted Ordinance No. 16-O-1430,[15] authorizing Invest Atlanta to launch a property assessed clean energy (PACE) program. The largest program approved in the U.S. at that time, the Atlanta PACE program is designed to provide $500 million in financing opportunities for renewable energy, energy efficiency, and water efficiency improvements in commercial and residential properties. While the program has not yet formally launched, once it does, the Atlanta PACE program will create access to capital for residents and business owners to direct to building improvements. The program is expected to create a market for clean energy investments, expand the region's clean energy workforce, and attract new green building technologies and resources to the Atlanta market at a larger scale. The Atlanta PACE program serving as a precursor to a green bank will

[15] https://library.municode.com/ga/atlanta/ordinances/code_of_ordinances?nodeId=846068

accelerate a citywide culture towards transitioning to a decarbonized building stock and increase awareness of green financing options.

Clean Energy Resource Center

An effective decarbonization strategy is as much about engagement, awareness, and information sharing as it is about policies and interventions. All the recommendations contained within this roadmap and forthcoming clean energy initiatives must dedicate significant strategy and adequate resources that allow the free exchange of information and promotion to all stakeholders with no barriers. Establishing “clean energy resource centers” across the city is critical for reaching as many stakeholders as possible. These centers should provide virtual and physical access to information and resources and be co-located with other established gathering places that are accessible to the public via multi-modal forms of public transportation. Good locations include public libraries, community centers, centers of commerce, etc. The centers will facilitate education, information sharing, and access to resources for residential and commercial energy consumers. It will be a one-stop-shop clearinghouse to provide information on existing resources and new policies and programs as well as energy audits, weatherization programs, financing options, utility rebate programs, efficiency, and renewable energy options offered by the city, county, state, and/or utilities. A forum for information sessions, a clean energy resource center is best operated as a public-private partnership between government and suitable local partners such as local business, chambers of commerce, and utilities, economic development authorities, and local nonprofits working in the clean energy space, daylighting opportunities to improve equity in clean energy, community-building, energy efficiency best practices, and beyond.

Implementation

Program Design

To ensure equity is centered throughout all aspects of policy creation and implementation there are several critical aspects to take into consideration in the design of an equity-centered green bank. Lived experience, social capital, and networks are key to evaluating who should not only design but administer the green bank. Since green banks leverage public dollars to drive private sector investment in clean energy, the City of Atlanta needs to play a role in program design and implementation. Typically, green banks are administered by a city’s economic development authority, which in Atlanta’s case would be Invest Atlanta. Some jurisdictions have created and staffed their own green bank programs. Others employ the services of an outside provider to serve as the program administrator.

Additionally, identifying who are the major benefactors of the green bank and designing the program to ensure it can serve the least resourced beneficiaries to the savviest stakeholders is critical to evaluate throughout the program design an equity-centered- green bank should build programs that benefit multiple stakeholders of all income levels, such as a small business and entrepreneurs, especially women- and BIPOC-owned businesses, as well as deploy funds to low-income homeowners, residential customers, large commercial customers, and small commercial customers alike. A green bank will offer financial products with relationship-based underwriting standards as well as flexible repayment and re-borrowing terms. A green bank designed and distributing funds and resources with an equity lens to benefit all Atlantans, prioritizing under-resourced communities, will play an important role in community-wide adoption of decarbonization goals and the benefits of clean energy. The availability of resources provided through the green bank and program eligibility will greatly affect the intended impact of a green bank. Cultural

competency training for private and public service providers and businesses and alliances with community experts as equally weighted implementation partners will prove invaluable to efforts to expand the reach of green banks and maintain a commitment to equity. Additionally, community financial institutions (including CDFIs, CDCs, credit unions, and minority depository institutions) already providing services in under-resourced, energy-burdened neighborhoods will be engaged as partners.

During the design phase of the green bank, program designers should survey lessons learned and unintended consequences from other publicly funded incentive programs. Atlanta can glean information from evaluating programs such as Opportunity Zones (OZ). Created by the Tax Cuts and Jobs of Act of 2017 to spur equitable development in underserved communities via tax incentives, Opportunity Zones have largely been a tax shelter benefitting large real estate projects and developers rather than small businesses and community developments. Furthermore, a recent study by the Urban Institute[16] shows only a small percentage of the more than $10 billion invested as part of the OZ program has benefited mission-oriented projects that align with community needs. The City of Atlanta has 26 Opportunity Zones that overlay Atlanta's most energy-burdened ZIP codes. This program and other cautionary tales will prove invaluable in Atlanta's quest to develop an equity-centered green bank and avoid unintended outcomes that do not benefit under-resourced communities.

Launch Green Bank, Adopt and Enforce Building Energy Performance Requirements

A green bank should either be launched prior to the adoption of building energy performance standards or in tandem with the adoption of those standards. When the City provides financial incentives and in-kind resources to make it easier for building owners to access capital, they need to fund the clean energy improvements that may be required by building performance laws, it becomes easier for building owners to comply with those laws, thereby accelerating building decarbonization in Atlanta. The green bank has the benefit of making it easier for building owners to comply with building performance requirements. In turn, the requirements create a demand for the financing the green bank provides, ensuring that the green bank is successful at accelerating investments in building decarbonization. Building performance policies such as a time-of-lease and time-of-sale energy performance disclosures, building performance standards, building energy stretch codes, expansion of renewables, retro-commissioning, lighting retrofits, building energy benchmarking, and building energy labeling laws will drive market demand for investments in clean energy.

[16] https://www.urban.org/urban-wire/opportunity-zone-incentive-isnt-living-its-equitable-development-goals-here-are-four-ways-improve-it

Zero Carbon Municipal Building Policy

Cities all over the country have adopted energy and carbon reduction goals that have targeted significant improvements to the energy performance of their municipal building stock. Los Angeles is requiring all new municipally owned buildings and major renovations to reach carbon neutrality by 2030.[17] Seattle is banning equipment that burns fossil fuels on-site from all new or renovated municipal buildings and developing a strategy to eliminate fossil fuel use in all existing municipal buildings.[18] Pittsburgh[19] and Park City[20] have passed ordinances requiring all new municipal buildings and all major renovations of existing municipal buildings to achieve net-zero energy ready building performance.[21] These leading municipalities are adopting these policies to demonstrate to their communities successful approaches to reducing carbon emissions from their buildings. Before passing additional regulation on private buildings, Atlanta should take the opportunity to lead by example by passing a zero carbon municipal building policy.

In 2017, City of Atlanta passed an updated Sustainable Building Ordinance[22] which requires new municipal buildings and major renovations over 5,000 square feet to achieve the U.S. Green Building Council's LEED Silver certification and all municipal buildings over 25,000 square feet to be certified under the LEED for Existing Building Operation & Maintenance (O&M) rating system over the next 10 years. This ordinance is a first step in reducing carbon emissions from Atlanta's municipal buildings. However, if Atlanta wants to join others as a leader in fully decarbonizing the building stock, an update to the municipal building policy is required. Fortunately, the work to develop, adopt, and begin the implementation of an updated municipal building policy can often be accomplished in a relatively short time period because fewer buildings and fewer stakeholders are involved in the process. Compared to other policy options outlined in this roadmap, an updated municipal building policy is therefore both an important and relatively easy first step for a city seeking to accomplish its decarbonization goals.

Definition and benefits

The City of Atlanta should update its current municipal building policy using "a zero carbon over time approach" with the goal of achieving net zero carbon emissions from municipal buildings by 2035. This approach helps new construction and existing municipal buildings leverage every opportunity to reduce energy and carbon emissions. The approach rests on the following three pillars:

> **Energy Efficiency:** A municipal building policy should prioritize energy efficiency, the most cost-effective strategy to reduce carbon emissions, by establishing energy efficiency

[17] *Executive Directive No. 25: LA's Green New Deal: Leading by Example*, City of Los Angeles, 10 Feb. 2020, www.lamayor.org/sites/g/files/wph446/f/page/file/20200210ExecutiveDirective25.pdf.
[18] *Executive Order 2020-01: Advancing a Green New Deal for Seattle*, City of Seattle, Jan. 2020, durkan.seattle.gov/wp-content/uploads/sites/9/2020/01/Final-Executive-Order-2020-01-Advancing-a-Green-New-Deal-for-Seattle_.pdf.
[19] *Pittsburgh Paves the Way for a Zero-Energy City*, Rocky Mountain Institute, 15 Oct. 2019, rmi.org/pittsburgh-paves-the-way-for-a-zero-energy-city/.
[20] *Park City Passes Resolution to Adopt Net-Zero Energy Performance Requirements for Municipal Buildings and Facilities*, Park City, 16 Oct. 2017, bit.ly/36kAH4y
[21] A net zero-energy ready building is a building that is efficient enough that it could be net-zero energy if renewables were installed on site.
[22] Ordinance No. 2017-42 (17-O-1218), City of Atlanta, 17 July 2017, library.municode.com/ga/atlanta/ordinances/code_of_ordinances?nodeId=841543.

targets for each building type owned by the City in both new construction and renovations. While the current policy's use of the LEEDv4 rating system encourages energy efficiency, not only can new municipal building projects meet LEED prerequisites, but they can also obtain 2 points (one quarter of the average number of points obtained by LEED Silver projects[23]) under the rating system by simply complying with Georgia's current commercial energy code which is required by state law. Therefore, an update to the municipal building policy is necessary to require the implementation of all cost-effective efficiency measures in both new construction and renovations.

Electrification: By establishing a plan to remove existing equipment that burns fossil fuels and requiring the electrification of new buildings, city owned buildings can lead the way in removing all on-site carbon generating sources of energy from buildings. Because LEED does not incentivize electrification, an update to the municipal building policy is also needed to begin a conversion from combustion equipment which burns fossil fuels to electric sources of energy for space conditioning, water heating, and cooking in buildings owned by the City by 2035. If the City meets its 2035 clean energy goals, removing fossil fuel equipment from buildings would reduce carbon emissions from municipal buildings by 100%.

Renewables: The policy should also establish a goal of providing all electricity used by city-owned buildings with renewable energy, ideally produced on-site or at least locally. Because 70 percent of electricity provided by Georgia Power comes from the burning of fossil fuels,[24] an update to the municipal building policy is required to fully eliminate carbon emissions caused by the generation of electricity for city-owned buildings. This goal should align with and strengthen the City's *Solar Atlanta* Program to procure on-site renewable energy for its municipal buildings.[25] On-site renewables, although incentivized, are not required to achieve LEED Silver certification. In addition, LEED gives projects almost equal credit for purchasing RECs. Because of the success of the renewable energy market, RECs are oversupplied which has resulted in low prices and little financial impact to the facilities generating and selling credit for their renewable electricity. Therefore, purchasing RECs does not result in the addition of new renewable energy to the electric grid.

A net zero carbon emissions policy should also clearly define action points such as major renovations and equipment replacements for when energy efficiency, electrification, and renewable energy upgrades will be required in existing buildings. A policy should include clear guidance on the appropriate action to take when buildings do not or cannot meet the energy efficiency or carbon targets outlined in the policy.

Other aspects of an updated municipal building policy could include guidance on reducing embodied carbon in building materials, promoting refrigerants that have low global warming

[23] Pelin Gurgon, Asli, and David Arditi. *Assessment of Energy Credits in LEED-Certified Buildings Based on Certification Levels and Project Ownership*, MDPI, 9 Feb. 2018, www.mdpi.com/2075-5309/8/2/29/pdf.
[24] *Facts & Figures*, Georgia Power, 10 Feb. 2021, www.georgiapower.com/company/about-us/facts-and-financials.html.
[25] *Walking on Sunshine: Atlanta Launches First Community Based Solar Program*, Atlanta Intown Paper, 17 May 2018, atlantaintownpaper.com/2018/05/walking-on-sunshine-atlanta-launches-first-community-based-solar-program/.

potential, and installing electric vehicle charging stations to aid in the transition to an electric city-owned fleet.

Finally, the municipal building policy should include a requirement that all new construction and renovation projects report annual greenhouse gas emissions of the building to the Office of Resilience in addition to current benchmarking requirements and a plan from each city Department for the removal of combustion equipment from city-owned buildings. An example "zero carbon over time" municipal building policy is located in Appendix C.

What does this mean for Atlanta?

Although a handful of cities have developed a net zero carbon over time municipal building policy, none have yet adopted the goal of completely decarbonizing public buildings. If Atlanta were to update its Sustainable Building Ordinance with this goal, the City would become a clear leader in not only the Southeast but the country in advancing towards a more sustainable future. This leadership by example policy could also help pave the way for future policies like updates to new construction codes which would mandate more energy efficient construction, electrification and renewables. An updated municipal building policy would also result in cleaner, more efficient, healthier, and more comfortable public buildings, averted greenhouse gas emissions, improved local air quality, and overall cost savings for our **community**. Finally, a net zero carbon municipal building policy would demonstrate to Atlanta's private sector that decarbonization is possible, realistic, and ultimately affordable and would begin to expose the public and especially communities of color to technologies that would benefit their community.

The **City of Atlanta government** will need to draft and introduce legislation to update the City's Sustainable Building Ordinance to completely decarbonize all public buildings. Internal stakeholders and department decision makers will have to work together to develop and execute a strategy to achieve deep and on-going carbon reductions in public buildings. Successful enactment of an updated municipal building policy will also require the evaluation of department budgets. Certain actions required by a zero carbon over time municipal building policy would not need additional funding such as reviewing performance contracts to mandate that all new HVAC systems installed are electric. Other actions may require additional funding in department budgets such as the addition of on-site renewables to new construction and major renovation projects. Internal procedures to track progress on achieving policy goals will have to be updated to support new ordinance requirements. Members of the Atlanta **City Council** will need to review and adopt legislation to update the Sustainable Building Ordinance. City Councilmembers should also support community engagement efforts to inform residents and stakeholders of the benefits realized through this policy.

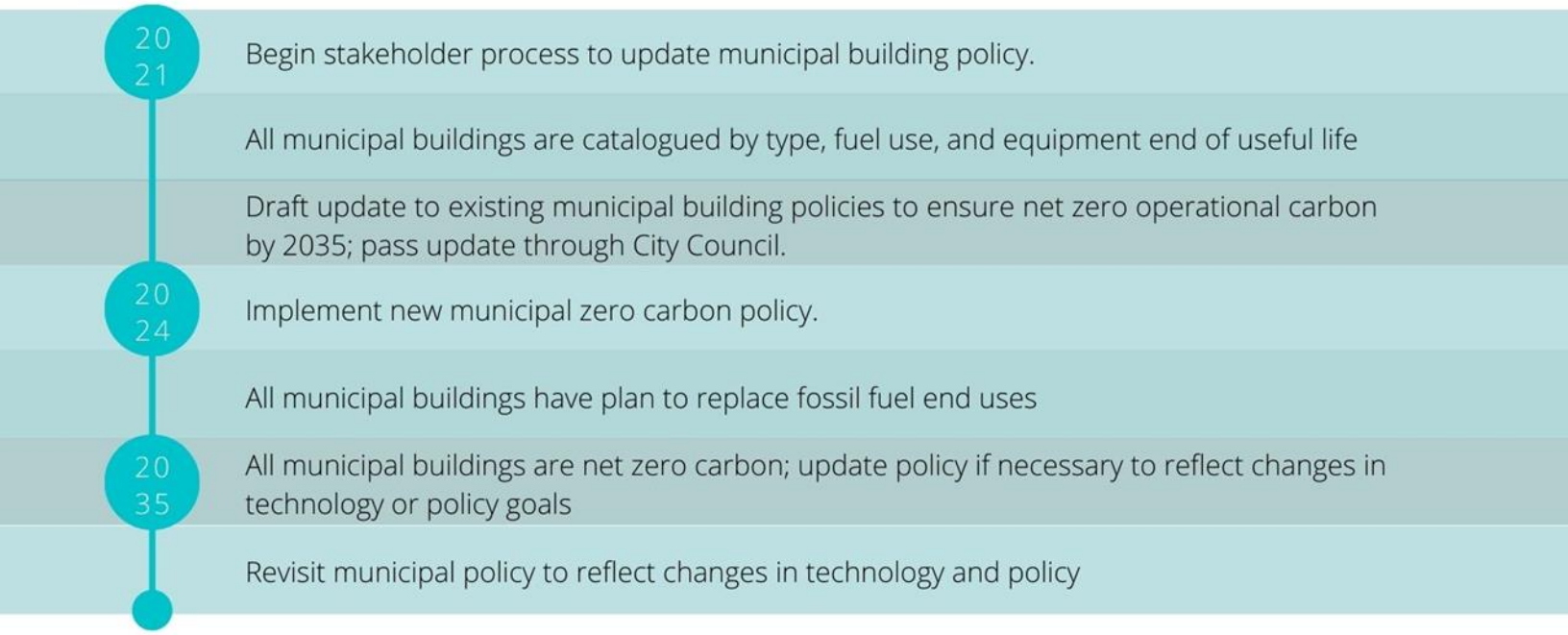
Finally, **service providers and local trades** will be needed to implement the improvements required to meet the ordinance. There are currently 63,000 individuals in the energy efficiency sector in Georgia.[26] An updated municipal building policy will help lead the growth of this sector and give the City an opportunity to target under-resourced communities and job seekers. By leading in this space, the City would be creating an early demand for workforce development

[26] National Association of State Energy Officials and Energy Futures Initiative, 2021, *2020 U.S. Energy & Employment Report*, bit.ly/39suCVG.

programs that would additionally benefit the job growth and potential of the other policies recommended in this roadmap.

How to get there

Leading by example, public building owners should take a strategic approach to energy management in public building portfolios. This approach should begin with a consensus-building process led by Office of Resilience staff to engage stakeholders, set tangible goals, target opportunities, and develop a plan to achieve deep and ongoing energy reductions in public building portfolios.



This will require coordination of regular facilitated meetings during which staff gain sufficient alignment and buy-in from relevant stakeholders on an actionable municipal building policy for Atlanta. An integrated team of stakeholders should include representatives from the individuals in charge of approving or implementing this policy such as:

- Department-specific decision makers (e.g., Police/Fire, Parks and Recreation, etc.)
- Public Works department and/or facilities managers (including building managers and maintenance staff)
- Information Technology department
- Finance representative or budget expert/decision maker.

Because energy efficiency is one of the most cost-effective strategies in a zero-carbon municipal building policy, one of the most important tasks of this group of stakeholders is to catalog all municipal buildings and set energy use intensity (EUI) targets by building type for both new construction projects and major renovations. To establish reasonable targets, the group should

use existing project data (as available), *ASHRAE 100*, NBI Zero Energy Targets, data from the Greenlink analysis in *Decarbonize Atlanta*, and targets from other advanced codes and standards. One can then align this information with site EUI performance of existing city buildings as reported in ENERGY STAR® Portfolio Manager and analyzed using FirstView® and energy savings promised in current energy performance contracts to determine the gap between current and expected building performance. Once energy efficiency targets are established, the City could update its existing ordinance to require new construction and major renovation projects achieve a certain number of points under LEED. In addition to establishing efficiency targets in an updated municipal building policy, the Office of Resilience's group of internal stakeholders should establish goals and policies to encourage the electrification of new and existing municipal buildings as well as goals and policies to encourage the addition of on-site or off-site renewables.

Once goals and policies are established, the City should start developing a plan to accomplish its goals, taking into account future plans for new construction and major renovations, known energy efficiency, electrification, and renewable energy opportunities in existing buildings, and a building's timeline for achieving certification under the LEED Existing Buildings O&M rating. A plan to meet the efficiency targets for existing buildings should also consider the recent benchmarking analysis, located in Appendix B of this roadmap, that was conducted using FirstView. The low-performing buildings highlighted in the FirstView portfolio report should be targeted for additional analysis, audits, or upgrades as recommended, especially if the building is about to undergo a major renovation.

The plan should also include a timeline for removing combustion equipment from municipal buildings and a timeline for adding on-site or off-site renewables. The policy could require the City to develop a plan to replace combustion equipment in buildings a year or two after the ordinance is adopted. New municipal buildings and existing buildings whose combustion equipment is at its natural end of life should be the first targeted for electrification. The policy could also include a plan for adding renewables. The first targets for on-site renewable energy should be new municipal buildings, existing-high performing municipal buildings that, according to the recent benchmarking analysis, could most easily achieve net zero energy (NZE), and buildings already identified in a potential solar contract with Cherry Street Energy as new sites for on-site renewable energy generation.

To gain support for initiatives outlined in the plan, economic arguments for all efficiency, electrification and renewable projects should be included. Finally, any plan should require continuing current energy tracking and benchmarking efforts already underway within the City of Atlanta. This ongoing information is critical to both empowering continuous improvement of building performance across the building portfolio and helping the Office of Resilience report the city's climate leadership to stakeholders. These tracking efforts will also help the City consider future updates to its municipal policy to reflect changes in technology and policy.

New Construction Codes

Energy codes are a subset of building codes, which establish baseline requirements and govern building construction. Energy codes represent a significant, long-term cost savings opportunity for consumers in the City of Atlanta because they set minimum energy efficiency requirements for specific characteristics of new and renovated buildings, including the building envelope, mechanical, hot water, and lighting systems.

Energy codes are an important tool for the City of Atlanta to guide improvements in the building stock and deliver both energy and carbon emission savings. When efficiency is built into the design and construction of new buildings and major renovations, reductions in energy use and emissions over the life of the building can be assured. Strong codes result in buildings that cost less to own, reduce long-term energy burden, are more comfortable to occupy, and are more resilient during power outages. A strong, forward-looking code roadmap can also be helpful in providing clarity to the market regarding future expectations in the building design and construction industry. This creates consistency, which supports code usability and can improve compliance once the new local code is adopted.

Definition and benefits

In Georgia, the state sets minimum energy code requirements, although cities can participate and influence this process. In addition, the City of Atlanta has the authority to adopt more aggressive codes locally. The City of Atlanta has already established its own code by requiring electric vehicle infrastructure in new buildings. In this case, the code sends a strong assurance to car manufacturers and dealers about the likely expansion of the electric vehicle market, as well as to designers and installers who are now required to include this infrastructure in buildings. These requirements also prevent more expensive retrofits in the future when electric vehicles (EVs) are more widely adopted.

Where efficiency remains a least-cost resource, reduced energy consumption makes it simpler and less expensive to meet building's energy needs with renewable sources of energy. Reducing energy use results in lower utility bills, which is especially important for low-income households and communities of color who disproportionately experience energy burden. Research shows that efficient buildings with good indoor environmental quality have significant health and productivity benefits. Efficiency also reduces the stress on the grid as distributed energy resources and central (i.e., utility-scale) renewables are added. Electric-only buildings running on renewables emit no carbon and are safer and healthier than buildings with combustion equipment due to improved air quality and reduced risk of carbon monoxide poisoning. Because the most efficient heating and water heating technologies are electric, electrification can also help lower utility bills.

Construction in the City of Atlanta is robust, with total new residential and new commercial starts increasing over the last five years, as shown in Table 3.

Table 3: New Residential, Multifamily, and Commercial Starts in City of Atlanta[27]

Year	New Residential Starts	New Residential Square Footage	New Multifamily Starts	New Multifamily Square Footage	New Commercial Starts	New Commercial Square Footage
2015	605	2,748,167	398	1,944,133,900	82	221,026,444
2016	703	2,065,275	413	1,050,088,854	62	418,732,222
2017	666	2,296,906	548	825,886,456	86	663,107,541
2018	837	3,059,090	878	1,081,521,166	91	756,563,077
2019	744	2,752,464	1004	804,021,310	147	1,301,438,617

Assuming a similar rate of construction is maintained moving forward, the benefits of enacting a new construction code policy are outlined in Table 4 below.

Table 4: Benefits of a New Construction Code Policy

Benefit Categories	**Full Impact**	**Equal To**
Local jobs created	6,975	0.8 Coca-Cola headquarters
Local incomes increased by	$404,250,000	$47.50 per Atlanta citizen per year
Local GDP growth	$345,000,000	6% of Delta Airlines global revenues
Public health savings	$297,000,000	$2.91 monthly health insurance savings
Metric tons CO_2	5,212,500	7 months without cars

New, more stringent construction codes will grow Atlanta's local GDP by $345 million and create close to seven thousand local jobs, which in turn will raise income levels in Atlanta by $404 million, an average of $47 per Atlanta citizen per year. Assuming the average person keeps a job for four years, this would roughly equate to 1,740 new employment opportunities than would have otherwise existed in Atlanta. Direct employment would be created in not only the clean energy sector but in the general economy as well. Assuming compliance with new, more stringent energy codes is high, Atlanta will see both indirect and induced job effects. Minor job losses will occur in the power sector as consumers pay less for their utility bills, while larger job gains are seen in the economy overall as consumers spend money they would have spent on higher utility bills elsewhere.

Overall investments compared to the costs to Atlanta are shown in Table 5. Cumulative benefits include the impact to both the City of Atlanta as well as the region, knowing that jobs and societal benefits do not stop at the city limits.

[27] Taber, Kate. Received by Matt Cox, Building Permit Data, City of Atlanta, Office of Buildings.

Table 5: Cumulative and Atlanta Specific Benefits and Costs of New Construction Codes

Cumulative Benefits	Cumulative Costs	Net Benefits	Benefit/Cost Ratio
$6,342,000,000	$193,5000,000	$6,148,500,000	32.8
Atlanta Specific Benefits	**Atlanta Specific Costs**	**Net Benefits**	**Benefit/Cost Ratio**
634,200,000	$193,5000,000	$440,700,000	3.28

The benefits of adopting new, more stringent energy codes are similar to the benefits seen by establishing a green bank. New construction codes would spur growth in the clean energy sector growing Atlanta's GDP and reducing both greenhouse gas emissions and pollution from Georgia's coal and natural gas plants, resulting in significant public health benefits.

Because the majority of Georgia's electricity is generated from fossil fuels, which emit pollutants that cause adverse health effects, adopting energy codes that reduce demand on the electric grid will have a positive and significant impact on Atlanta's public health, saving $297 million through 2035, with benefits occurring locally within Atlanta and more broadly across the country. New codes will also reduce Atlanta's carbon emissions by 5.2 million metric tons, equivalent to seven months of the total emissions from all personal vehicle use in the City of Atlanta. Adopting new, more stringent energy codes, is also a very cost-effective action, resulting in $3.28 in benefits for every dollar spent to enact and comply with a new energy code.

What does this mean for Atlanta?

Adopting new construction codes will bolster a local clean energy economy and create local jobs. New construction codes will result in cleaner, more efficient, healthier, and more comfortable buildings, averted greenhouse gas emissions, improved local air quality, and overall cost savings for our community.

The **City of Atlanta government** will first need to draft and introduce legislation to adopt the *2021 International Energy Conservation Code* (*IECC*) and NZE appendices leveraging the City's authority to adopt stretch codes locally. The City will also need to develop goals and a timeline for updating energy codes so that newly constructed buildings emit zero carbon by 2035. To undertake this task, the City will need to engage with local stakeholders such as clean energy advocates, equity advocates, and representatives of the design and construction community. The City should also engage with the state of Georgia to influence the state code development and adoption process and participate in the national model code development process.

Members of the Atlanta **City Council** will need to review and approve legislation to adopt the *2021 IECC* and NZE appendices. City Council members should also support community

engagement efforts to inform residents and stakeholders of the benefits of these new construction codes and to understand whether safety nets should be put in place so that updated energy codes do not exacerbate the housing affordability crisis or affect business costs in historically black neighborhoods.

Homeowners, renters, landlords, and developers will need to be educated on the benefits of City's new construction codes and ways they can comply with these codes through resource centers. **Real estate professionals** would benefit from training courses and briefings so that they can share information in their industry and advise clients. Finally, **service providers and local trades** will be needed to implement the clean energy improvements required by new codes. Across the state of Georgia, 63,000 individuals are employed in the energy efficiency sector.[28] New construction codes will help grow this sector and give the City of Atlanta an opportunity to target under-resourced communities and job seekers.

How to get there

On January 1, 2020, the *2020 Georgia State Minimum Standard Energy Code* went into effect.[29] The residential and commercial versions of the Georgia energy code are based on the 2015 version of the *IECC*, with state-specific amendments. The *IECC* is a national model energy code that is updated every three years. Since the *2015 IECC* was developed in 2013, two subsequent *IECC* versions have been published, the *2018 IECC*[30] and *2021 IECC*.[31] Both of these are more stringent than the *2015 IECC* version currently required in the state of Georgia. Thanks in part to the participation of the City of Atlanta in the development process of the *2021 IECC*, the *2021 IECC* is also significantly more stringent than the *2018 IECC*.

Compared to peer cities across the country, current energy codes in Georgia are not delivering adequate levels of cost-effective energy performance in buildings. While the City of Atlanta is bound by state minimum codes, the City has the authority to exceed the state code locally. In fact, Atlanta has already used this authority when electric vehicle charging requirements were added to the code.

The City of Atlanta should engage in code development at the local, state, and national levels to help the City ensure that they meet local carbon reduction goals while protecting consumers and providing the additional benefits of health, jobs, and affordability in new construction and major renovations. Specifically, City staff should:

- **Immediately start the process to adopt the *2021 IECC*** and renewable building appendices by leveraging their authority to adopt codes locally using the provisions outlined in *O.C.G.A. Section 8-2-25(c).*

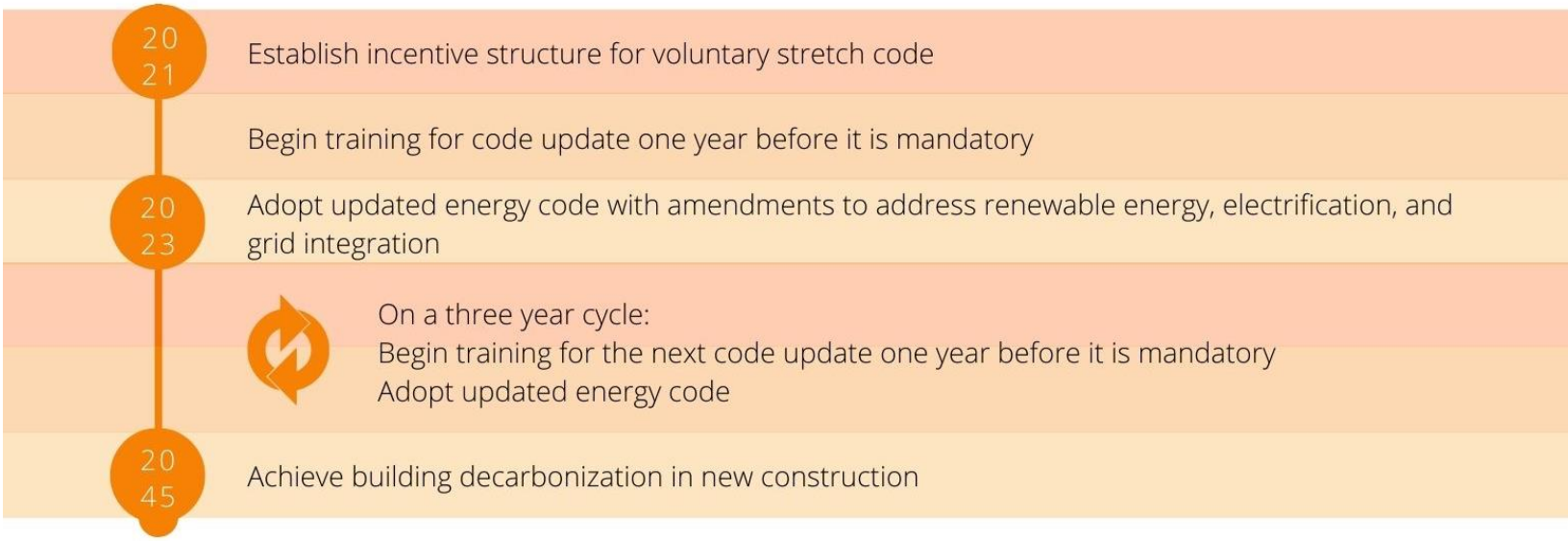
[28] National Association of State Energy Officials and Energy Futures Initiative, 2021, *2020 U.S. Energy & Employment Report*, bit.ly/39suCVG.
[29] *Georgia State Minimum Standard Codes*, Georgia Department of Community Affairs, 1 Jan. 2020, www.dca.ga.gov/sites/default/files/2020_ib_codes_info_sheet_grey_1-6-2020.pdf.
[30] *2018 International Energy Conservation Code,* International Codes Council, Aug. 2017, codes.iccsafe.org/content/iecc2018.
[31] *2021 International Energy Conservation Code,* International Codes Council, Dec. 2020, https://codes.iccsafe.org/content/IECC2021P1.

- **Work within the context of the code update and adoption process managed by the state of Georgia** as a vocal stakeholder to influence the state code development and adoption processes when it begins.
- **Participate in the national model code development process.** The City of Atlanta was actively engaged in voting for the development of the *2021 IECC*. The next *IECC* code development process will likely begin in mid-2021 through a newly defined standards process. To continue to push the state code forward, Atlanta should continue to engage in the new development process as that process becomes more clearly defined.

For new construction and major renovations, achieving climate policy goals in the built environment requires the City of Atlanta to adopt updated energy codes every three years. Generally, the updates to the energy code for Atlanta will align around the following important foundations:

- **Energy efficiency** – Make incremental increases in stringency to require more efficiency each code cycle until the target year and target energy performance.
- **Renewable energy resources** – Increase deployment of renewable resources to offset building energy use.
- **Electrification** – Address the transition away from on-site fossil fuel combustion as the electricity grid becomes cleaner.
- **Building-grid integration** – Align electricity demand load and generation curves to limit extra burdens on the grid.

These four foundations are critical to reducing operational carbon and are considered separately below. Often considered after operational carbon, embodied carbon is explored separately in this document.



Commercial Construction

While the foundations are similar across commercial and residential construction, the methods and steps required to achieve carbon neutral buildings vary slightly between these two building types. For commercial buildings, a high-level overview of this approach is summarized in Table 6. A more detailed explanation of each of the four foundations and their implementation over the next five code cycles is explained below.

Table 6: Atlanta Building Energy Code Roadmap for New Commercial Construction

	2020	2023	2026	2029	2032	2035
Energy efficiency	*2015 IECC* (baseline)	*2021 IECC*	*2024 IECC* + amendments to meet 11% step	*2027 IECC* + amendments to meet 11% step	*2030 IECC* + amendments to meet 11% step	Max tech efficiency
Renewable energy resources	Not required (baseline)	0.25 W/sq. ft. of 3 largest floors	0.5 W/sq. ft. of conditioned floor area	10% site energy use	20% site energy use	50% site energy use
Electrification	Not required (baseline)	Electric ready	All-electric unitized / electric ready central	All-electric	All-electric	All-electric
Building-grid integration	Not required (baseline)	ADR and sub-metering	Storage and water heating	All residential appliances	Full building-grid integration	Full building-grid integration

Energy Efficiency

Analysis of each version of the *IECC*, combined with energy use intensity (EUI) target analysis for commercial building types (See Appendix D: Energy Use Intensity Target Analysis for more information on the commercial building analysis) shows that Atlanta needs to reduce the energy use intensity of new construction and renovations by 11% every three years (each code cycle) to achieve carbon neutrality in new construction by 2035. Based on an analysis conducted by the U.S. Department of Energy (DOE) on historical energy code improvements of both *ASHRAE 90.1* and *IECC*,[32] it is unlikely that the model energy codes will achieve an 11% reduction in energy use in each future code cycle. It will therefore be imperative for Atlanta to push beyond model codes by reviewing the base increase to the model code each cycle and creating additional amendments or leveraging the additional efficiency options in code to make up the gap to 11%. While establishing energy efficiency targets, the City should ensure policies are put in place so that updated energy codes do not affect the affordability of new commercial buildings in

[32] US Department of Energy Commercial Energy Code Determinations https://www.energycodes.gov/development/determinations

historically black neighborhoods and therefore risk driving out businesses owned by people of color who have reduced access to capital.

Figure 3 illustrates the approximate energy efficiency performance targets of new commercial buildings over time if the City of Atlanta were to establish a goal of requiring all new commercial construction to be net zero carbon by 2035.

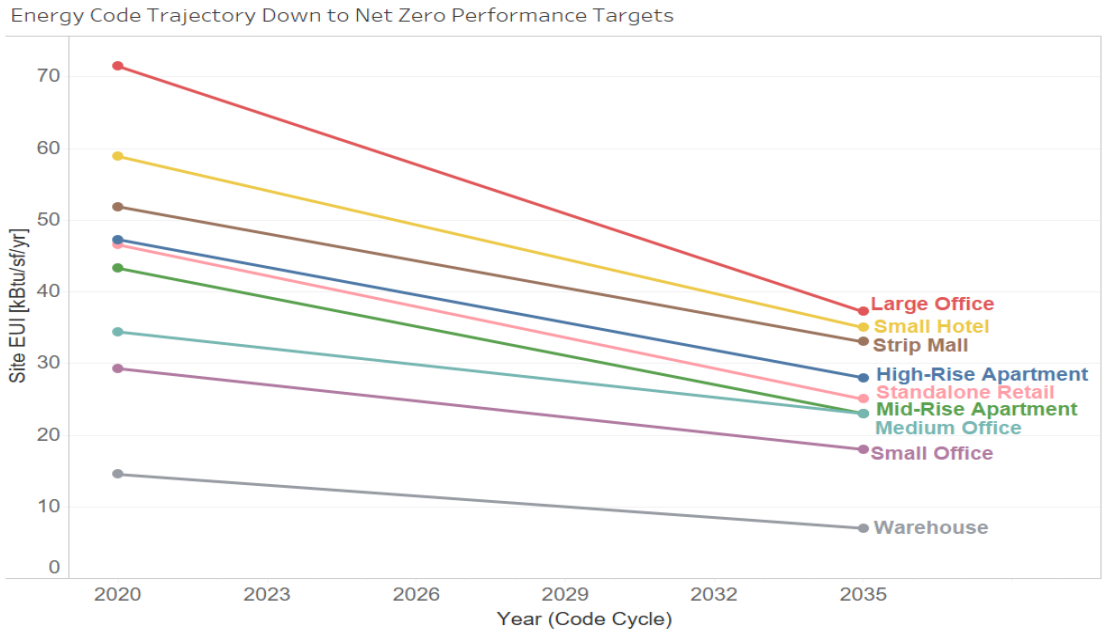


Figure 3: Energy Code Performance Trajectory to Net Zero Energy by Commercial Building Type

To get started, Atlanta should either adopt locally or encourage the state to adopt the *2021 IECC* with a start date of 2023. Adopting the *2021 IECC* leverages base efficiency changes across building envelope, mechanical, electrical, and plumbing systems. The commercial and residential efficiency increase of the *2021 IECC* over Georgia's current energy code, the *2015 IECC*, is widely estimated to be at 11%-12% nationally. Therefore, adopting the *2021 IECC* by 2023 should meet the initial 11% efficiency target.

To move to the *2021 IECC*, City staff should:

- **Engage and convene a set of local stakeholders** to review and advocate for the 2021 code updates.
- **Immediately start the process to adopt the *2021 IECC*** and renewable building appendices by leveraging their authority to adopt codes locally using the provisions outlined in *O.C.G.A. Section 8-2-25(c)*.

Beyond the efficiency target, the City should advocate for bypassing the *2018 IECC* and advancing directly to the *2021 IECC* so that important structural changes and renewable energy appendices that the city can leverage are included going forward. For example, the update to Section C406 in the *2021 IECC* commercial energy code chapter changes the section from a "pick

one" option to a points-based system that reflects the different savings potential (based on an analysis of the options by the Pacific Northwest National Labs). Design teams and owners can choose to comply with the energy code by selecting one option with many points or several options with fewer points, as long as at least 10 points are achieved to meet the *2021 IECC* (as required by this section). Each point is worth approximately 0.25% energy savings, with 10 points amounting to a total of 2.5% energy cost savings.

This structure is critical to achieving energy efficiency targets during the cycles moving to 2035, where the base *IECC* model code may not make an 11% efficiency jump, and large modifications to the code at the city level would require a detailed stakeholder engagement process. Instead, Atlanta can easily increase the number of points required to achieve compliance under Section C406 and therefore the level of efficiency required in new construction to meet code. It is recommended that the City still engage in a stakeholder process to make this update, during which the City should explore new measure options to add to the table that may directly address local developer and industry professionals' practices and needs.

Moving forward, the City should make code updates every three years through 2035 so that the code requires the latest and most up-to-date technologies and construction approaches, staying on track to meet the efficiency goals targeted. With the long-term efficiency targets established, the City of Atlanta will be most successful when making continuous improvement toward those goals on a predictable and transparent cycle.

To continue in efficiency development, City staff should:

- **Brief City Council members on the importance of code adoption updates** and consider if a legislative amendment requiring action is needed to make necessary gains. The City could use state-specific energy and economic analyses published by the DOE one year after the code is released to help make the case for adopting the newest version of the energy code.[33]
- **Determine a process to engage a set of local stakeholders** to review and advocate for the code updates. This process will be most successful when the Department of Buildings is at least engaged, if not leading the overall workstream. Local stakeholders should include design and construction professionals as well as clean energy and equity advocates.

Renewable Energy Resources

Renewable energy is a critical part of achieving the goals of *Clean Energy Atlanta*, and the energy code has an important role to play in achieving this aspirational goal. To transition the building industry from the current baseline of no requirements for renewable energy to a building stock that contributes significant renewable resources of the grid, small steps should be made in the mandatory code, along with the adoption of a renewable energy appendix that encourages net zero energy new construction.

[33] *Building Energy Codes Program: Development*, Department of Energy, www.energycodes.gov/development.

The initial transition step should be based on the *ASHRAE 90.1 Addendum by*,[34] which requires a small amount of on-site solar based on floor area. This incremental step allows for early solar penetration and goes beyond solar readiness, which has issues in commercial construction around the sizing of panel space and conduit and ensuring access to needed infrastructure is maintained. In addition, the use of prescriptive measures in early implementation will not require modeling that will be considered in later updates to determine overall site energy use.

Additionally, the *2021 IECC* includes an optional appendix for commercial buildings, *Appendix CC Zero Energy Commercial Building Provisions*, which serves as a mechanism to adopt renewable energy as a requirement for all buildings. *Appendix CC* requires that new commercial buildings install or procure enough renewable energy to achieve NZE annually. The appendix aims to encourage on-site renewable energy systems through a weighting factor, but also supports offsite procurement of renewable energy through a variety of contractual mechanisms. Many of the provisions of *Appendix CC* should be modified by those more recently published in the *International Green Construction Code (IgCC): ASHRAE 189.1 Addendum J*,[35] which will be included in the *2021 IgCC*.[36] This approach clarifies important definitions and requirement language, and contains precise language to address the concerns of additionality, permanence, and survival through a property sale of renewable energy transactions, which are not addressed in *Appendix CC*.

Addendum J offers a mechanism to modify requirements to respond to changes in the market for renewable energy. The basic prescriptive requirement is that the sum of the renewable energy produced on-site or procured off-site be greater than or equal to about half of the expected energy use. A mandatory, on-site PV system is required based on the portion of the building roof area that is unshaded and is not being used for public access or by a vegetated roofing system. The mandatory requirement is expressed in terms of the system capacity, as opposed to annual production. It also allows on-site renewable energy systems other than PV to meet the mandatory requirement if they produce an equivalent amount of annual energy to the required PV system.

With the adoption of the *2021 IECC*, City staff should:

- **Adopt the minimum requirement for on-site commercial renewable energy.**
- **Adopt *ASHRAE 189.1 Addendum J*** as a voluntary path and explore the potential for incentivizing NZE new construction.
- **Track case study NZE buildings as local examples** for renewable energy market penetration and cost/benefit analysis.

Including a NZE appendix in the model energy codes will smooth the transition for builders to include renewable energy systems in their projects. Relying on the model code appendix provides

[34] *ANSI/ASHRAE/IES Addendum by, ck, and cp to ANSI/ASHRAE/IES Standards 90.1-2019*, ASHRAE Standards Committee, 31 July 2020, https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_by_ck_cp_20200731.pdf

[35] *ANSI/ASHRAE/ICC/USGBC/IES Addendum j to ANSI/ASHRAE/ICC/USGBC/IES Standards 189.1-2017*, ASHRAE Standards Committee, 2 March 2020, https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/189_1_2017_j_20200302.pdf%22

[36] The IgCC is a construction code that can be adopted by local jurisdictions to mandate green building. The igCC, often referred to as the high-performance building standard, includes energy provisions that are more stringent than required in the energy code.

consistent national language across the industry for manufacturers, builders, and trades. Builders can standardize their construction practices across jurisdictions and states to meet these requirements. This makes education, incentive programs, and implementation significantly more straightforward and cost-effective.

It is critical to note that the introduction of renewable energy resources into the base code will require greater regulation of the sale of RECs from those buildings. Where a building is required to have on-site renewable energy, the RECs must be continually held by the owner and the benefit of that renewable energy generation must remain with that building and its residents or tenants. This may be seen as a higher cost to developers familiar with building and selling the RECs as an income stream but will have the benefit of maintaining the overall reduction in utility bills for lower-income tenants or residents of affordable and market-rate housing.

Electrification

Electrification refers to replacing direct fossil fuel use in buildings (e.g., propane, heating oil, natural gas for heating, hot water heating, cooking, and other uses) with electric sources, or preventing fossil fuel uses from being installed in the first place. It can also include provisions that cover the electrification of transportation by incorporating electric vehicle charging requirements.

In new construction, heating and water heating systems that would have been powered by natural gas, propane, or oil (e.g. combustion equipment) can easily be swapped with electric heat pumps during the design phases. All-electric new construction has the added benefit of increasing the overall efficiency of buildings compared to mixed-fuel new construction. There are also known health benefits of all-electric buildings.

With the adoption of the *2021 IECC*, City staff should:

- **Adopt language requiring electric ready and electric capable end uses for all regulated loads.** Regulated loads include space and water heating, cooking, and lighting appliances. Unregulated loads include emergency back-up generation and specialized end uses like those used in labs and hospitals.[37]
- **Review the potential for incentive programs for all-electric buildings.**
- **Engage in state processes where local authority preventing electrification may be limited.** *Georgia HB 150* which has been passed by the House and Senate prohibits governmental entities from adopting any policy that prohibits the connection or reconnection of any utility service based upon the type or source of energy or fuel. City of Atlanta testified in opposition of this bill. To meet the goals in this roadmap, City of Atlanta will have to find ways to incentivize electrification and/or disincentivize combustion equipment in buildings without explicitly banning natural gas use in buildings.

Beyond the *2021 IECC* adoption, the next step toward electrification, if the City receives too much resistance from the construction industry to make the full leap in two cycles of energy code adoption in commercial construction, would be to require all-electric end-uses for unitized

[37] *Building Decarbonization Code*, New Buildings Institute, 11 Feb. 2021, newbuildings.org/resource/building-decarbonization-code/.

systems, or systems that are similar in scale to residential systems as recommended in Table 6. Technology around central heating and water heating is making rapid strides, but the building industry market in Atlanta may need an additional cycle to make a full switch to all-electric commercial construction. To help aid in this transition, City staff should:

- **Track local all-electric construction.** Develop case studies that showcase all-electric solutions and provide a cost analysis. Use them as educational tools.
- **Focus on training for all-electric design, construction, and operations.**

Building-Grid Integration

Addressing building-grid integration will become increasingly important over the next five code cycles for Atlanta (2023, 2026, 2029, 2032, and 2035). Building-grid integration includes integrating distributed energy resources (DER) such as solar, storage, energy efficiency, and demand management with the electric grid to allow flexibility to respond to grid signals as buildings and homes are increasingly all-electric. Building-grid integration depends on regional grid sources, where there is a specific value in managing time-of-use characteristics of a building's energy demand. Over time, the framework for grid integration in building energy codes will increasingly consider efficiency as a function of time of day. An energy code requirement that aims to save more energy in total may be less desirable than an alternative energy code requirement that saves less energy but at a certain time of the day. Energy storage, dispatchable loads, and time-specific efficiency may provide greater value since they provide efficiency during those times of grid congestion.

To electrify all building systems and then power all those end-uses with 100% renewable electricity, buildings must be equipped with systems that both add flexibility to electricity consumption and store electricity.

Achieving grid flexibility and storage capabilities requires both the building as well as third-party demand response (DR) aggregators, the grid, and the utility to work together. Buildings must have infrastructure such as water heaters, air conditioning, and HVAC and lighting controls capable of implementing load adjustments and either receiving DR requests or responding to price signals from the utility. Utilities must either offer DR programs or structure their pricing to compensate customers during times when they provide services to the grid. Georgia Power currently offers DR programs to industrial customers, direct load control of water heaters in the residential and commercial sector and rate plans to encourage customers to shift demand off times of peak use. Georgia Power plans to offer two new residential DR programs and one new "behavioral" commercial program by 2022, both of which will enable building-grid integration and increased energy and carbon savings in Atlanta.[38]

[38] *Electricity Solution Sector,* Drawdown Georgia, 24 Feb. 2021, https://www.drawdownga.org/wp-content/uploads/2020/10/101620_Electricity_TechnicalReport.pdf

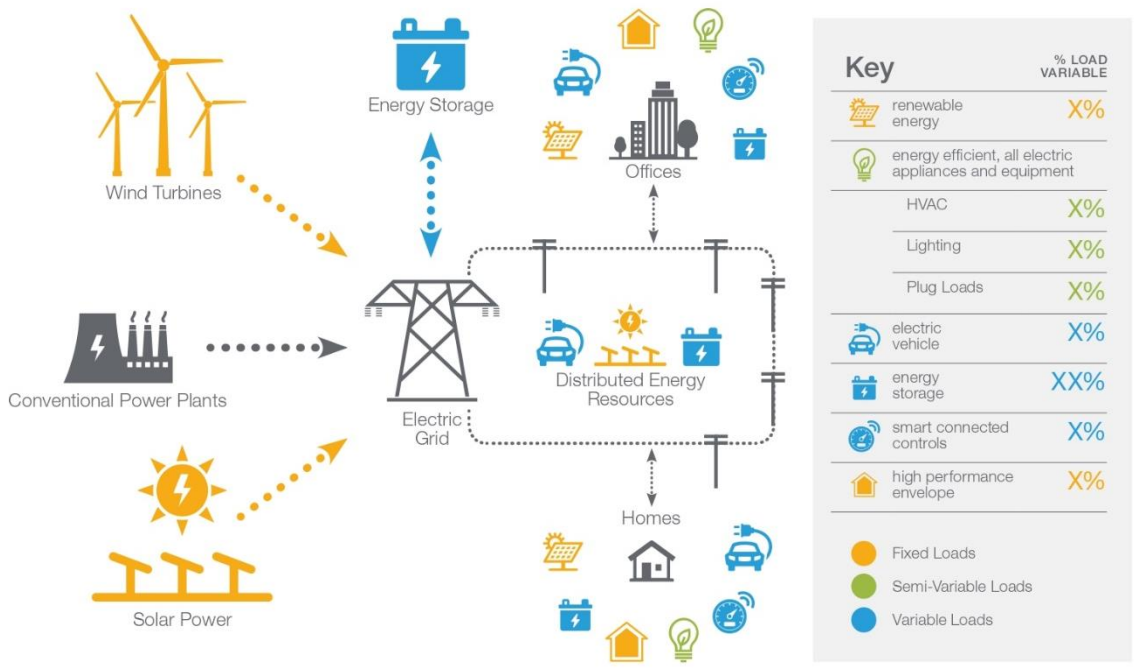


Figure 4: Building-Grid Integration

Figure 4 shows ways a building might provide grid flexibility and storage for the grid. Recommendations to transition toward grid integration in Atlanta include taking small steps to bring the industry along. Atlanta already has requirements for EVs that should be monitored over time as market demand in the area increases, as EVs will play a role in providing grid flexibility in the future. As a first step, the code should require automated DR infrastructure for HVAC system setpoints and variable speed equipment adjustments, and requirements to sub-meter all loads by end-use. Next, establishing minimum requirements for energy storage and water heaters to comply with *CTA/ANSI 2045-B* communication technology. In the final two steps toward grid integration, Atlanta should require all residential-scale appliances to be capable of receiving a grid signal by 2029, and finally, all building end uses by 2032. This staged delay will allow for progress in grid-integration technology where issues around privacy (control of appliances) and technology (demand lighting controls) have not been resolved to the satisfaction of the customer base, while beginning to integrate off the shelf ready and consumer accepted grid-integration measures.

With the adoption of the *2021 IECC*, City staff should:

- **Establish a process to review and update EV requirements.** This will help ensure the market need continues to be met beyond the current requirements over time.
- **Begin training on distributed energy resources and code.** Because most grid-integration measures will impact multiple codes (energy, fire, mechanical, electrical, and plumbing) beyond permitting to operations, it is important to ensure the local industry is ready to make adjustments in the next few cycles.

Beyond the code language and the building side controls, additional coordination may need to occur with Georgia Power to allow for Atlanta to make a transition to grid integration across its building stock.

Residential Construction

For residential buildings, a high-level overview of this approach is summarized in Table 7. Below are explanations for how to implement each of the foundations during the next five code cycles.

Table 7: Atlanta Building Energy Code Roadmap for New Residential Construction

	2020	2023	2026	2029	2032	2035
Energy efficiency (ERI)	51 (baseline)	48	44	41	38	34.5
Renewable energy resources	Not required (baseline)	Solar ready	10% site energy use	25% site energy use	50% site energy use	100% site energy use
ERI with renewables	51 (baseline)	48	40	31	18.5	0
Electrification	Not required (baseline)	Electric ready	All-electric	All-electric	All-electric	All-electric
Building-grid integration	Not required (baseline)	ADR and sub-metering	Storage and water heating	All residential appliances	Full building-grid integration	Full building-grid integration

Energy Efficiency

Residential construction targets for 2035 are set at Passive House[39] levels of efficiency before the addition of renewables. This energy efficiency target would allow a home constructed in 2035 to be NZE if renewables are added. These efficiency levels use the Energy Rating Index (ERI)—scores, where 100 is equivalent to a home built to the 2006 IECC and 0 is a NZE home. Currently with the 2015 IECC, new residential construction in Atlanta in Climate Zone 3 would achieve a score of 51. Tracking in equal steps downward to 34.5, or approximately the level of the expected performance of Passive House residential construction, each code update moves closer to the performance target. Based on research conducted by the DOE on past improvements in the residential energy code, it is unlikely that the model energy codes will meet these residential

[39] *Passive House Principles*, PHIUS, 11 Feb. 2020, www.phius.org/what-is-passive-building/passive-house-principles

efficiency targets. It will therefore be imperative for Atlanta to push beyond model codes by reviewing the base increase to the model code each cycle and creating additional amendments or leveraging the additional efficiency options in code to make up the gap each cycle.

To get started, Atlanta should either adopt locally or encourage the state to adopt the 2021 IECC with a start date of 2023, but with revised ERI scores to begin the target reductions. This update leverages base efficiency changes across building envelope, mechanical, electrical, and plumbing systems. The ERI compliance scores in the IECC have been widely debated and remain at 51 for the 2021 cycle even though the code itself has adjustments making it by all estimates more than 10% more efficient than the 2018 IECC (which is estimated to be on par with the 2015 IECC currently in use by Atlanta).

To move to the 2021 IECC, City staff should:

- **Update residential energy code to 2021 IECC** with an adjustment in the ERI table from 51 to 48 for Atlanta's Climate Zone 3.

In addition to the transition towards the ERI approach to gauge overall efficiency, the 2021 IECC provides Section R408, Additional Efficiency Package Options. The purpose of Section R408 is to increase efficiency by roughly 5%, and to provide code users with the flexibility to select the measures that make the most sense for each project. This section provides full option packages, instead of a points-based structure like the commercial equivalent. The range of options will provide multiple paths for projects to achieve the intended improvement in the code, the technologies included are currently available in the relevant markets, and the improved practices have been proven feasible in residential buildings.

Going forward, the City of Atlanta may be able to similarly leverage this section to require more than one option in cycles where the base IECC model code may not make the necessary jump in stringency, and large modifications to the code at the City level are undesirable. The City of Atlanta may also look to transition this section to a points-based model that is more easily increased in smaller increments. It is recommended that the City of Atlanta still engage in a stakeholder process to make these updates, during which the city should entertain new measure options to add to the section that may directly address local developer and industry professionals' practices and needs. Stakeholders that should be consulted in the code adoption process include code officials, design and construction professionals, and energy efficiency and equity advocates. Equity advocates in the stakeholder process should help the City consider additional policies so that more stringent energy codes do not exacerbate the housing affordability crisis or disproportionately impact small and local businesses.

Renewable Energy Resources

The energy code will play a critical role in helping Atlanta meet its goal to achieve 100% renewable energy by 2035. To transition the building industry from the current baseline of no requirements for renewable energy to a building stock that assists in the transition to a renewable-based grid, the City should take small steps in the mandatory code and adopt a renewable energy appendix that encourages NZE new construction.

To phase in renewable energy requirements, it is recommended that the City start with solar-ready provisions for single- and two-family residential buildings and require all low-rise multifamily buildings and commercial buildings to meet renewable energy requirements. This can be done

by adopting the 2021 IECC Appendix RB Solar Ready Provisions as mandatory for residential construction. Appendix RB is ready for implementation and enforcement with language on the sizing of solar-ready zones and requirements for electric infrastructure.

Additionally, Appendix RC Zero Energy Residential Buildings Provisions provides jurisdictions a standard to define a zero-energy home. This appendix uses the ERI compliance path and sets values that produce a more efficient home than base code before adding on-site generation. The appendix is based on the use of RESNET/ICC Standard 301, which allows for consistency in enforcement and compliance and includes mandatory thermal envelope backstops to ensure the homes built under this compliance path do not trade off the envelope stringency for shorter life measures.

The values included in Appendix RC were calculated based on a thorough analysis of Home Energy Rating Score (HERS) data nationwide, a survey of HERS scores for model high-performance homes, modeling done for ASHRAE 90.2, and the DOE Zero Energy Ready Home program. The ERI scores are set for an efficient level of energy consumption, which importantly is still cost-effective for the homeowner. All renewable energy is required to be on-site. Homes may use any fuel under RESNET 301 to comply with the appendix.

As a first step, compliance with the residential Appendix RC requires that the rated design be shown to have an efficiency score without accounting for renewable energy. After the rated design is shown to have met that score, the next step is to calculate the ERI value including on-site renewable energy production to result in an ERI of zero. Software used to generate HERS scores can easily generate an ERI score of the home before and after the inclusion of renewable energy (known as on-site power production in HERS), making the documentation of compliance with both steps simple.

With the adoption of the 2021 IECC, City staff should:

- **Adopt Appendix RB for solar-ready requirements** on all single- and two-family residential construction.
- **Adopt Appendix RC as a voluntary path** and explore the potential for incentivizing NZE new construction
- **Track case study NZE buildings as local examples** for renewable energy market penetration and cost/benefit analysis

Beyond the update to the 2021 IECC, the City should continue to increase the amount of renewable energy as a percentage of onsite energy use in step with the increases in efficiency. Together these two paths will result in NZE new construction for Atlanta by 2035. When renewable energy becomes a code requirement, the City should take efforts to ensure equitable access to renewable energy opportunities, including jobs in the solar industry and incentives for solar power, RECs, community solar projects, and more.

Electrification

The residential market requires just two steps to mandate all-electric construction. First, the City would need to adopt electric-ready provisions, as the costs for electric-readiness will be greater than the cost of an all-electric building. Second, the City would need to adopt the 2021 IECC. This

transition period will also allow for continued market penetration of technologies such as induction cooking, which are seen as major barriers for all-electric construction in the residential segment.

By 2026, Atlanta should prohibit mixed-fuel residential new construction. If HB150 is signed by the governor, which would prohibit Atlanta from adopting a policy to prohibit the connection of any utility service based upon its fuel type, Atlanta should consider preemption workarounds such robust incentives for all-electric construction and/or heavily disincentivizing mixed-fuel construction financially or through provisions in the energy code. This, combined with taking steps to increase energy efficiency and renewable energy generation, will establish a new residential building stock that is net zero carbon by 2035.

Other Policy Mechanisms to Reduce Operational Carbon

Where Atlanta would not have the ability to go beyond Georgia's energy code, it could pursue alternate policy mechanisms. Alternative policies such as those described below could have the effect of increasing familiarity with advanced measures, which can pave the way for future code advancement and improve code compliance once passed. Below are examples of other policy mechanisms that have been tied to required energy advancements.

Local Development Commission Funded Projects

The local development commission can set the minimum condition that projects must meet stretch code requirements to qualify for funding. The Portland Housing Bureau (PHB) has adopted the Affordable Housing Green Building Policy with the goal of achieving NZE for PHB-funded buildings by or before the year 2050. The policy requires projects receiving at least 10% of the total project funding from PHB or are owned by PHB receive third-party certification from either LEED or Earth Advantage. The policy also requires the project owner to conduct a solar study and, if feasible, the project must either be solar ready or include a solar system in the design.

Affordable Housing Programs Using Public Funding

Housing projects receiving public funding can be required to comply with stretch codes. For example, state agencies providing matching funds to projects receiving U.S. Department of Housing and Urban Development (HUD) funds can set criteria. The state of Washington used a portion of HUD funds from the Housing Trust Fund, a HUD-sponsored program, to fund its $1.9 million Ultra-High Energy Efficiency Demonstration Program, which focuses on NZE projects for affordable housing. Other cities and states have provided points in their qualified allocation plans (QAP) for achieving certifications like Passive House to achieve beyond-code energy efficiency. Currently, Georgia requires housing projects receiving public funding to achieve certification under one of four green building standards: EarthCraft House, Enterprise Green Communities, LEED for Homes, or Home Innovation Research Lab's National Green Building Standard.[40] The City of Atlanta could encourage the state QAP to require more stringent certifications such as Passive House, a requirement in the state QAP in at least 12 U.S. states, including Minnesota, Idaho, Illinois, Pennsylvania, and Delaware. In Pennsylvania, achieving the Passive House standard was found to cost the same as affordable housing built conventionally.[41] By encouraging

[40] *2019 State of Georgia Qualified Allocation Plan*, The Georgia Housing and Finance Authority, www.dca.ga.gov/sites/default/files/2019_qualified_allocation_plan.pdf.

[41] Legere, Laura. *How a Pa. Affordable Housing Agency Is Making Ultra-Efficient Buildings Mainstream,* Pittsburgh Post-Gazette, 31 Dec. 2018, www.post-gazette.com/business/development/2018/12/31/pa-affordable-housing-tax-credits-pennsylvania-housing-finance-agency-passive-house-design/stories/201812190012.

renewable energy through the state QAP, Atlanta could also could also help ensure disadvantaged communities experience the benefits of high-performance buildings and clean energy generation..

Utility Incentive Programs

Just as the local code and policy context varies from state to state, utility regulations also vary from state to state. In most states, when a measure is required by code, whether it is from an advanced local code or mandatory stretch code, utilities may be precluded from providing financial incentives by state regulators. However, there are examples where regulators consider the local community as being "voluntary", which allows energy efficiency programs to continue incentivizing advanced measures, even when they are required. This is true in British Columbia's "step" code and was true in the Green Communities program in Massachusetts. In the case of voluntary stretch codes, residential and commercial buildings can leverage utility incentive programs to offset the initial cost of construction. For example, when stretch code requirements are consistent with rebate programs from Georgia Power for heat pump water heaters, Georgia Power may provide a rebate for the heat pump water heater, offsetting initial and ongoing costs.[42]

Zoning Bonuses and Incentives

Zoning and Floor Area Ratio (FAR) bonuses are regulatory options that allow for higher value zoning or additional density for projects that comply with additional requirements. FAR limits the gross floor area of the building for a given building lot size. Municipalities can increase the FAR for buildings that build to a stretch code. Savannah, Georgia, provides bonus density increases for commercial building projects if buildings achieve LEED Gold certification. The same could be true for achieving certain levels of energy performance.

Eligibility requirements for achieving the incentive are generally considered during the long-term public process facilitated by the land use-planning group within a city. Some cities have engaged in comprehensive community planning processes for particular neighborhoods, which have resulted in suggestions on how development incentives can be used. In those cases, after the planning process, the requirements must be vetted through normal zoning code processes.

An increasing number of jurisdictions are using zoning policy as a way to prevent the displacement of low- and moderate-income residents and to achieve climate goals and objectives. A summary of approaches is presented in Appendix E. Municipalities can also use bonuses for buildings that design and construct to a stretch code and comply with energy outcomes. These incentives can precede code mandates and serve to increase familiarity with advanced measures. Case studies that highlight a track record of success can help inspire future code enhancements. This can also serve to improve code compliance once new codes with these requirements are adopted.

[42] *Rebates & Incentives*, Georgia Power, 11 Feb. 2021, www.georgiapower.com/residential/save-money-and-energy/rebates-and-discounts.html.

Building Performance Standard

Building performance policies represent pathways through which to improve the overall energy efficiency of a building. In recent decades, cities across the United States have enacted myriad types of building performance policies, including benchmarking and transparency laws like Atlanta's Commercial Buildings Energy Efficiency Ordinance, lighting retrofit requirements, and retro-commissioning standards. Leveraging upon the momentum of those performance policies, building performance standards (BPS) represent the most rigorous building performance policy type employed by local governments to date and represent by far the greatest opportunity to reduce carbon emissions associated with energy use in existing buildings. So far, three cities have enacted a BPS—New York, Washington, DC, and St. Louis—and this is a pathway being explored by several of municipalities nationwide. The power of a BPS derives from its ability to impact all buildings, not just new construction. Since new construction represents only 1%-3% of the building stock in any given year, it's clear that any policy addressing carbon reduction in buildings must focus strongly on existing buildings. For most cities, however, this is new territory as they have historically only thought in terms of influencing the design and construction of new buildings through energy codes.

Definition and benefits

A BPS sets minimum requirements for efficiency (through a prescribed EUI or ENERGY STAR score) or carbon emissions (through a prescribed carbon emissions cap) for existing buildings. Multiple standards can target different building sizes and types, as well as different aspects of building performance (energy, gas, water use, emissions, and peak energy demand). A BPS requires buildings to achieve a performance threshold by specific dates, with buildings benchmarking their performance to meet that threshold. BPSs may become more stringent over time, and enforcement mechanisms can differ.

An effective BPS is centered on equity and prioritizes community needs. The rigors of bringing a building up to a higher energy or carbon performance threshold have the potential for unintended consequences, including increasing the costs of housing, which could further exacerbate gentrification and racial inequality in the city. A well-designed, well-implemented, equity-centered BPS that applies to commercial and residential properties has the potential to ensure all who live and work in Atlanta have access to high-performing, decarbonized buildings (and the benefits that come with them) while improving public health outcomes, enhancing incomes, and creating new local jobs. The local benefits identified here demonstrate what can be expected through a BPS that is set to achieve a highly ambitious, but achievable, 33% reduction in emissions by 2035.

A BPS for Atlanta could be a transformational policy that would dramatically cut energy waste from homes and significantly increase energy productivity in businesses. The policy is expected to drive major investments in energy efficiency and renewable energy and successful implementation would help cement Atlanta's position as a national leader in climate action.

Table 8: Benefits of BPSs[43]

Benefit Categories	Full Impact	Equal To
Local jobs created	17,900	2.0 Coca-Cola Headquarters
Local incomes increased by	$1,043,000,000	$122.50 per Atlanta citizen per year
Local GDP growth	$889,500,000	15% of Delta Airlines global revenues
Public health savings	$881,000,000	$8.63 monthly health insurance savings
Metric tons CO_2	15,400,000	20 months without cars

Overall benefits compared to the costs of implementing to the City are shown in Table 9. Cumulative benefits include the impact to both the City of Atlanta as well as the region, knowing that jobs and societal benefits do not end at the city limits.

Table 9: Cumulative and Atlanta Specific Benefits and Costs of a BPS

Cumulative Benefits	**Cumulative Costs**	**Net Benefits**	**Benefit/Cost Ratio**
$16,864,500,000	$701,250,000	$16,163,250,000	24.0
Atlanta Specific Benefits	**Atlanta Specific Costs**	**Net Benefits**	**Benefit/Cost Ratio**
$847,500,000	$701,250,000	$146,250,000	1.21

Economic Development

The economic development implications of a BPS are very positive, with the projection showing the creation or sustaining of nearly 18,000 job-years (a full-time position held by one person for

[43] Modeling by Greenlink Analytics

one year) through 2035. Assuming the average person keeps a job for four years, this would roughly equate to 4,500 new employment opportunities than would have otherwise existed in Atlanta. Looking across more than 500 industries, direct employment of 100 or more positions would be created across nine industries including construction, HVAC, program administration, lighting, energy management, building materials, architecture and engineering services, insurance and finance, and water heating services.

Job growth related to electrical services industries and servicing and installing motors, drives, and generators see improvements as well, especially in the commercial building sector. A BPS is likely to create slightly more demand for services in the commercial sector, with 54% of the employment growth focused on servicing commercial buildings (46% would be focused on the residential sector). For the nine industries highlighted above, demand would be created in both sectors, but the commercial sector drives higher proportional employment in energy and environment management and motors, drives, and generators.

Successful implementation of a BPS will also result in indirect and induced job effects. It is expected that the power sector and supporting industries will see some indirect job losses as less money is spent on energy bills. However, any job losses are estimated to be greatly dwarfed by the creation of new, induced jobs for essentially similar reasons (as less money is used towards energy bills, residents and businesses in Atlanta will be able to spend more in other parts of the economy, spurring growth and the creation of more jobs). In total, more jobs are created through these induced pathways than through direct or indirect effects, showing that the benefits of reduced energy spending are large and shared across the entire economic landscape.

Incomes and GDP grow as well, reflecting much the same story as employment: Spending less on energy allows the residents and businesses of Atlanta to put more resources into efforts that employ more people, increasing incomes and growing the economy. The BPS policy shows great promise in achieving these outcomes.

Public Health

The consumption of energy from resources that cause pollution creates public health damages that are generally not factored into costs and benefit analyses by Atlanta's electric utility service provider because the costs are borne by others. As a result, those costs are borne by the community: people lose workdays and the income that comes with it, more children become asthmatic, and the likelihood of many health conditions, such as stroke, heart attacks, and even death, is increased. These energy resources are also the source of the pollution that is the primary driver of climate change, which threatens to cause trillion-dollar losses in the global economy and disrupt many aspects of modern society. A BPS in Atlanta presents the largest opportunity to reduce these emissions that this plan assesses, reducing the public health and welfare cost of emissions by nearly $900 million through 2035, with benefits occurring within Atlanta and across the country. It would also reduce carbon emissions by 15.4 million metric tons, equivalent to more than a year and a half of the total emissions from personal vehicle use in Atlanta.

Cost-Benefit Analysis

Many of the impacts of a BPS reach beyond the City of Atlanta boundary. As an example, the majority of the public health benefit is likely to accrue to other communities across Georgia. On the other hand, the costs of these actions will be borne by those within city limits.

The predominant source of economic benefit from the BPS is energy savings. Public health benefits also contribute a sizeable dollar value to the total benefits. The source of most of the cost is paying contractors and service providers to implement the necessary energy upgrades to hit the BPS target. Through 2035, projected Atlanta-specific benefits are $847.5 million, and come at a cost of $701.25 million. As a result, this policy option is projected to deliver net benefits of $146.25 million at a benefit-cost ratio of 1.21.[44]

What does this mean for Atlanta?

An Atlanta BPS will improve local air quality and ensure that Atlanta has cleaner and more efficient buildings across the **community,** reducing greenhouse gas emissions and creating cost savings and cost avoidance that exceed cost expenditures. For the **City of Atlanta government**, developing this policy will require submitting legislation to the City Council to authorize a BPS law. To implement the BPS, the City will need to build out sufficient staffing and budgetary resources for a robust policy enforcement infrastructure, deepening resources provided for compliance with current City policies, including the Commercial Buildings Energy Efficiency Ordinance, as well developing a new building performance policy to accommodate the labor-intensity of an intentionally implemented BPS. Through BPS implementation, the City can take advantage of physical and/or virtual clean energy resource centers to connect building owners to new and existing incentive programs for building energy performance improvements. Additionally, the City will need to provide information to the public about policy changes and compliance requirements, as well as ensure that all municipal facilities and equipment adhere to the new BPS.

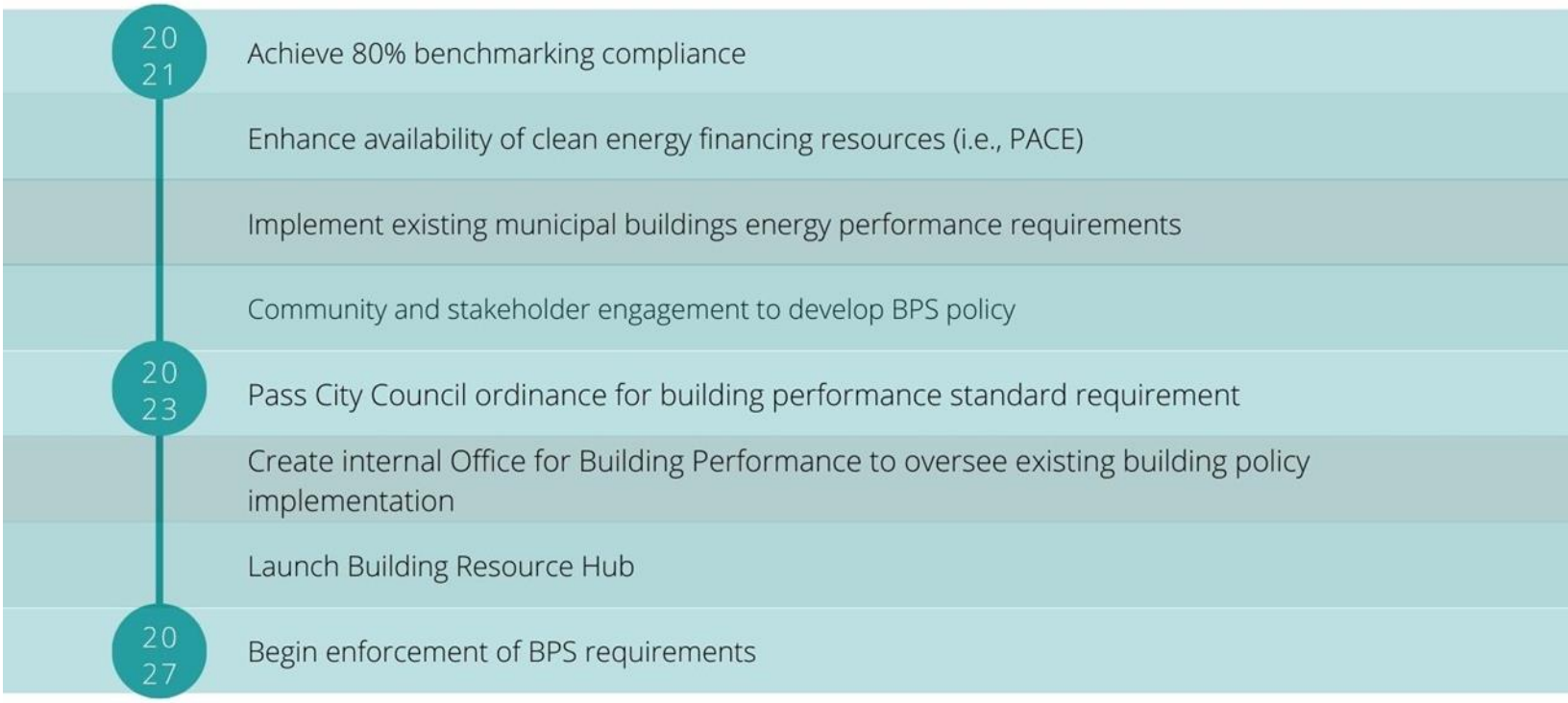
City Council will need to review and vote on the proposed BPS and can play a critical role in promoting their stakeholders' use of clean energy resource centers for building owners, which provide resources on new and existing incentive building energy performance improvements programs. **Building owners**, including **landlords**, as well as interested **renters**, can take advantage of these resources to learn about the BPS and the potential to alleviate energy burden through local investment in higher-performing buildings. Landlords and building owners will be able to access new (and existing) building energy performance improvement programs and incentives and can utilize those programs and incentives to plan and implement the required energy retrofits according to the phases outlined in the BPS policy. **Renters** should be made aware that they may experience disruptions in living spaces as upgrades are made. However, they should expect lower utility bills because of the energy efficiency improvements in their buildings. One potential challenge for renters is the possibility of seeing increased rent to cover the cost of retrofits, so partnerships between tenant groups and the City will be important. Finally, **real estate professionals** should be educated on the policy changes through training and shared resources by City staff. The real estate industry should be encouraged to promote the benefits of upgraded building stock as an amenity. **Service providers** will play a critical role in installing building performance improvements and technologies, driving a clean energy workforce, and working with the City in workforce development policies and programs to ensure that high road job opportunities are accessible and attainable.

[44] Modeling conducted by Greenlink

How to get there

Laying the Foundation

The City of Atlanta has established strong partnerships in the commercial buildings community, starting with the successful Atlanta Better Buildings Challenge program, which achieved a 20% reduction in energy and water consumption in over 100 million square feet of commercial building space in Atlanta, and the Commercial Buildings Energy Efficiency Ordinance (CBEEO), adopted in 2015.



Benchmarking

A successful benchmarking program is a critical first step. The CBEEO has set the stage for the City to pursue and implement a BPS. This benchmarking policy currently applies to all commercial properties (including multifamily) larger than 25,000 square feet, requiring annual energy and water benchmarking, as well as energy and water audits performed every 10 years. To successfully shape and implement a BPS, the City needs to have access to comprehensive and accurate energy benchmarking data, going back several years, for the impacted properties in the city. This would translate to an 80% compliance rate for covered properties under the CBEEO, which will require an increase of approximately 20% over the City's current compliance rate. A logical first step for the city is to redouble and enhance efforts and resources for enforcing this existing policy. Additionally, long-term availability of aggregated, building-level utility data through a platform such as the Georgia Power Automated Benchmarking Tool will be required for both electricity and natural gas, to facilitate accurate collection of energy performance data.

Access to Financing

Taking a poor- or average-performing building up to being a high-performing building, which is a process that a BPS is designed to accelerate, may require capital investment from building owners. It is incumbent on the City to make access to financing options available to building owners to ensure they can comply with a BPS policy. By equipping owners with the tools they need to achieve compliance with the City's BPS, the City accelerates progress towards its building decarbonization target. The City's property assessed clean energy (PACE) financing program, once launched, will be an excellent tool in that toolbox. The equity-centered green bank proposed in this roadmap is an additional, even more impactful tool for the City to put to use for building owners. Launching an equity-centered green bank in tandem with, or in advance of, enacting a BPS will make it much easier for the development community to achieve compliance with the BPS policy.

Clean Energy Resource Centers

The upfront costs for building performance improvement requirements can be a barrier for building owners to be able to comply with the City's building performance laws. The City needs to alleviate the potential cost burden for residents and building owners by ensuring the availability of robust resources for building-performance improvements. Described in greater detail in the equity-centered green bank section of this roadmap, clean energy resource centers and financing programs such as PACE and a green bank can all help equip building owners in Atlanta with the resources they'll need in order to invest in the clean energy improvements that may be required through a BPS policy.

Consider Interim Requirements for Performance Improvements

Before adopting a BPS, the City may want to consider enacting comparatively lighter-touch energy efficiency policies such as building labeling laws, building retro-commissioning or retuning mandates, or LED lighting retrofit requirements. These policies are by no means necessary for a City to enact a BPS; however, some jurisdictions have found them to be effective early and interim policy milestones that help build local momentum towards ultimately adopting a BPS policy. It is preferable to go directly to a BPS, but these lighter-touch policies may be satisfactory options in the short term as the City works towards adopting a broader BPS requirement.

Leadership by Example

If the City plans to place a requirement on building owners in Atlanta to adhere to a BPS, it is important for the City to walk the talk and demonstrate its commitment to decarbonization through investing in robust clean energy actions on City-owned properties. This goal is outlined in greater detail in the Municipal Buildings Policy section.

Adopt and Implement a BPS Ordinance

In developing the appropriate BPS for Atlanta, the City needs to follow the following steps.

Preparation

Developing a BPS policy is a time- and labor-intensive undertaking, with a need for great intentionality of stakeholder participation and policy development processes. Other cities that have passed, or are in the policy of passing, BPS policies have dedicated a year or more in developing and socializing their BPS policy approaches. Before contemplating writing a BPS policy, the City needs to establish clear policy goals that reflect the local context, factoring in local

priorities such as equity, affordability, public health, climate impacts, and job creation, to name a few examples. These goals need to be derived through a comprehensive internal and external stakeholder engagement process executed by the City. Given that a BPS is an advanced policy that will require significant political will and intentionality of execution, it's vital that the City engage the following people:

- City leadership. Foster long-term buy-in to bringing a BPS to fruition by building consensus and trust with those who will be impacted by this policy.
- Internal and external partners, including:
    - Internal – In addition to elected officials, City departments with the potential to be impacted by the policy and/or its implementation need to be engaged. These include, but are not limited to, the City Planning Department, Office of Buildings, Invest Atlanta, Department of Finance, and WorkSource Atlanta.
    - External – Community-based organizations, building owners, renters, labor, and community members, among others, are key to any City prioritization exercise and should be included throughout the BPS policy development process.

While the "usual suspects" for stakeholder engagement in energy policy development, including energy service providers, environmental nonprofits, and local thought leaders are valuable partners in many aspects policy formulation, it's community leaders and members with lived experience who possess knowledge of equity interventions that can be identified through dialogue with the City. Partnerships across City departments and with community-based organizations will help ensure that a comprehensive set of stakeholder perspectives are at the table during the goal-setting and policy development processes. The Urban Sustainability Directors Network; the Zero Cities Project; and numerous cities; including Seattle, WA; San Francisco, CA; and Cleveland, OH have produced resources on centering equity in stakeholder engagement processes around policy formulation.

In weighing how a BPS aligns with the City's policy goals, the City needs to assess what its building stock will look like in the future, evaluating current development pressures and trends, along with projections around population growth and density in the coming decades, and determining what they want Atlanta's building stock to look like in the years to come to achieve equity and climate goals. The next level of that assessment should include information on what regulations are already in place that advances those goals, as well as a gap analysis with regard to current regulations to identify where the regulatory gap is in Atlanta that a BPS policy needs to fill.

Draft the Policy

To draft the policy, the City needs to identify the buildings that will be covered by the policy. In making this decision, the City should weigh whether to have buildings that may not currently be required to comply with the CBEEO covered under the BPS, such as buildings smaller than 25,000 square feet, non-commercial property types, and/or a broader assortment of municipal assets. Considerations for making this covered buildings list include building type, with options including commercial, multifamily, and residential buildings, as well as building size, selecting a minimum square footage threshold for buildings that will be required to comply with the BPS. Finally, the City needs to identify a compliance cycle to determine when and how will it phase in this compliance requirement, and how often will it require buildings to invest in building

performance improvements. The City may want to consider leveraging its Clean Energy Advisory Board or an outside partnership with local organizations to help shape engagement with the community and resulting policy parameters.

The City will also need to identify compliance pathways for building owners to take to achieve the requirements set by the BPS. Pathways can include:

- **Performance**: Achieving a target level of energy or carbon performance, as demonstrated through a metric of the City's choosing (i.e., ENERGY STAR score or carbon intensity).
- **Prescriptive**: Adhering to a prescribed list of building energy and/or carbon performance improvements, provided by the City.

One option for BPS development is requirements for deep energy retrofits. A deep energy retrofit is a powerful way to reduce energy waste and achieve significant energy savings, potentially achieving a 50% reduction or higher. Deep energy retrofits require intensive whole-building analysis and construction processes sometimes implemented over several years. Deep energy retrofits could be treated as a prescriptive, standalone policy mandate or as a compliance pathway within a BPS.

As a BPS is a long-term policy that requires decades of continuous improvement and oversight, the City needs to identify a long-term process by which it will continue to monitor progress towards its decarbonization goals. This process should outline how the City will handle reassessing minimum performance requirements as buildings become increasingly efficient, establish a frequency for revisiting the policy, and, from policy conception through to policy adoption, leverage an advisory committee, perhaps the current Atlanta Clean Energy Advisory Board, for long-term BPS implementation oversight.

Stakeholder and community engagement remains key throughout the policy development and implementation process. The City should actively seek out critical perspectives that can shed light on unforeseen unintended consequences of the policy, including the potential for disproportionate impacts with regard to racial and social inequities. Engaging traditionally marginalized communities to identify how a BPS policy might intersect with their own priorities can help correct historic and systemic inequities. A comprehensive stakeholder and community engagement process results in more effective policy design and paves the way for long-term productive relationships between the City and historically marginalized communities. Community-based organizations, youth groups, racial and social justice groups, tenant organizations, and housing advocates are some examples of community partners that can provide insights on an equity-centered policy. The City's Clean Energy Advisory Board can be an effective guide to the City in developing its stakeholder engagement strategy and well as identify stakeholders and community members with whom to engage.

BPS policies represent a new policy horizon for cities with regard to regulating building performance while ensuring such policies center around equity. The City should look to the most recent guidance from peer cities and leading organizations on stakeholder engagement processes when it embarks on its policy development.

Prepare the Community for the Policy

An effectively executed BPS should instill a culture of advanced building performance across a city's building industry. Achieving this level of culture shift will require effective communication with the community about the City's clean energy goals and the benefits of a clean energy transition, advanced through building decarbonization, for all Atlantans.

Additionally, all stakeholders impacted by the BPS requirement should be engaged early and often. This will provide building owners with ample time, ideally years, to undertake the budgeting and planning that may be necessary for them to make clean energy improvements to their buildings. Potential service providers who would perform building energy improvements should also be engaged early on, along with other key implementation partners such as tenant groups, affordable housing groups, neighborhood associations, community-based organizations, and beyond to ensure a successful policy implementation process.

Clear communication about the BPS policy, its requirements, and its compliance deadlines will ensure the building sector is informed of the policy and prepared to comply with it when it comes into effect.

Implement the Policy

To successfully implement the BPS, dedicated resources need to be provided for both the City, to ensure staffing and budgetary capacity exists for implementing and enforcing the BPS requirement, as well as for building owners and property managers, to ensure they have the resources they need to improve the performance of their buildings. These resources are in the form of offered trainings, materials, technical assistance, etc.

Ensure Enforcement Capacity

Enforcing a BPS will require robust staffing and budget resources for the City of Atlanta team created or put in charge of enforcing this policy. Every U.S. city that has enacted a BPS has created dedicated building performance offices within the City government, employing multiple staff working exclusively on advancing building performance through BPS enforcement, with an enforcement budget allocation to augment their efforts. Funds for a BPS enforcement team could be sourced through numerous pathways, including a general fund departmental allocation, permit and filing fees, or fines and penalties for noncompliance. This type of enforcement role is well suited to be housed within a City department or office with experience playing an enforcement role in the buildings sector, such as a building permitting office or planning/development office. The team that provides this enforcement function could potentially be the same team that enforces the time of lease/time of sale policy detailed in this roadmap.

Create Building Resource Hub

Several cities have created organizations to help provide the buildings sector with the resources they need to comply with a BPS policy. Going beyond a typical clean energy resource center structure, a resource hub can provide services such as building owner and property manager information sessions on the BPS, trainings for energy service providers, resources for building owners to find the service providers they need, identification of funding options such as the City's PACE program or equity-centered green bank for building improvements, and more. A resource hub can serve the function of public outreach around the BPS, sharing information on policy compliance requirements, building owner and community benefits, and partnering with the City to

share information on building performance and data management, including support to building owners in data management needs for BPS compliance and support to the community through broadcasting shareable building performance data to the broader public through online data visualization platforms, building energy report cards, and beyond.

Time of Lease/Sale Performance Disclosure

Time of lease and time of sale energy performance disclosure requirements require owners of commercial and/or residential buildings to disclose their building's energy performance at the time of lease and time of sale, respectively. Disclosures may come in the form of an ENERGY STAR score, HERS rating, or other metric that informs potential future renters and owners of the building's energy performance. Such a policy can require either the simple disclosure of building performance or require disclosure plus compliance with a certain level of improvement before the next lease or sale. A leading example of a successful time of transaction energy disclosure policy is the City of Austin's Energy Conservation Audit and Disclosure Ordinance[45], which sets requirements for home energy audits prior to the time of sale for all residential properties, as well as energy benchmarking requirements for commercial buildings. To maximize impact and access to information, the disclosure policy recommended here for the City of Atlanta applies not only to single-family and multifamily residential properties, but to commercial properties as well, and that combination is reflected in the policy impact analysis provided here.

Definition and benefits

A time of lease and/or time of sale policy can advance tenant and consumer equity rights by providing access to information on the total affordability of a property. By identifying anticipated monthly energy costs alongside the typically property cost information (i.e. rent, HOA fees, property taxes, etc.), owners and tenants are made aware of overall housing costs during the purchase or lease process. This type of disclosure policy has the added benefit of driving owners to invest in building performance improvements to entice buyers and renters, enhancing the quality of the City's building stock over time while driving the City closer to its buildings decarbonization goal and achieving the economic and health co-benefits identified here.

A disclosure policy for Atlanta could create market incentives to cut energy waste from homes and businesses. The policy is primarily expected to drive investments in residential energy efficiency. If successful, there would be positive impacts on economic development and public health outcomes.

Furthermore, to ensure the policy is most effective, it requires the input and expertise of all impacted stakeholders. This is a tremendous opportunity for the City to engage a diverse group of partners a collaborative process to develop the policy, technology, implementation and outreach strategy. Having the general public, City of Atlanta, City Council, homeowners, purchasers, renters, leasees, landlords, landowners, developers, real estate professionals, building trades, and service providers working together on policy is not only a major win for participatory democracy but also a great foundation and model for the development of other clean energy and decarbonization policies.

[45] *Energy Conservation Audit and Disclosure Ordinance*, City of Austin, 27 May 2020, austinenergy.com/ae/energy-efficiency/ecad-ordinance/energy-conservation-audit-and-disclosure-ordinance.

Table 10: Benefits of Time of Lease/Time of Sale Performance Disclosure

Benefit Categories	Full Impact	Equal To
Local jobs created	10,050	1.1 Coca-Cola headquarters
Local incomes increased by	$579,000,000	$67.92 per Atlanta citizen per year
Local GDP growth	$486,750,000	8% of Delta Airlines global revenues
Public health savings	$260,250,000	$2.55 monthly health insurance savings
Metric tons CO_2	4,645,500	6 months without cars

This time of lease/time of sale disclosure policy complements the City's Commercial Buildings Energy Efficiency Ordinance through providing homeowners, renters, and commercial tenants and property owners with access to a deep level of energy performance and energy cost data associated with the buildings and/or tenant spaces which they are contemplating renting or purchasing. While the CBEEO provides data on aggregated whole building energy consumption in the City's larger commercial building stock on an annual basis for buildings with ENERGY STAR scores above 55, a time of disclosure policy can make more granular information such as energy costs and other energy performance information that may be reflected in building systems inventories or other energy and building systems data that the City requires be disclosed through this policy. Making deeper-level information of this kind available to those contemplating major investments in properties ranging from single-family homes to multifamily condo units to small businesses within larger buildings with complex ownership structures to behemoth skyscrapers, and further enhance transparency and the ability of Atlantans to make informed decisions around total affordability of the buildings in which they live and work.

Table 11: Cumulative and Atlanta Specific Benefits and Costs of Time of Lease/Time of Sale Performance Disclosure

Cumulative Benefits	Cumulative Costs	Net Benefits	Benefit/Cost Ratio
$9,322,500,000	$52,500,000	$9,270,000,000	177.6
Atlanta Specific Benefits	**Atlanta Specific Costs**	**Net Benefits**	**Benefit/Cost Ratio**

$621,500,000	$52,500,000	$569,000,000	11.84

Economic Development

The economic development implications for a disclosure policy are very positive, with the projection showing the creation or sustaining of about 10,000 job-years (a full-time position held by one person for one year) through 2035. Assuming the average person keeps a job for four years, this would roughly equate to 2,500 new employment opportunities than would have otherwise existed in Atlanta. Looking across more than 500 industries, direct employment of 100 or more positions would be created in the construction industry. In total, about 550 jobs would be directly created or sustained through a disclosure policy[46].

As with the BPS, successful implementation of a disclosure policy will result in indirect and induced job effects as well. Indirect job losses are concentrated in the power sector and supporting industries as less money is spent on energy bills. Induced jobs see strong growth, for essentially similar reasons—as less money is used towards energy bills, residents and businesses in Atlanta spend more in other parts of the economy, spurring growth and the creation of more jobs. In total, nearly all job creation from a disclosure policy is through these induced pathways rather than through direct or indirect effects, showing that the benefits of reduced energy spending are large and shared across the entire consumption-driven economic landscape.

Incomes and GDP grow as well, reflecting much the same story as employment. Said plainly, spending less on energy allows the residents and businesses of Atlanta to put more resources into efforts that employ more people, increasing incomes and growing the economy. The disclosure policy shows promise in achieving these outcomes. A baseline energy audit should be provided to homeowners and renters at least 12 months prior to policy implementation. Additionally, special consideration and incentives for energy upgrades should be provided to homeowners in areas of rapid gentrification to mitigate potential under-valuation and displacement in under-resourced communities.

Public Health

The consumption of energy from resources that cause pollution creates public health damages that are generally not considered relevant by Atlanta's electric utility service provider because the costs are borne by others. As a result, people lose workdays and the income that comes with it, more children become asthmatic, and the likelihood of many health conditions, such as stroke, heart attacks, and even death, are increased. In addition, these energy resources are the source of the pollution that is the primary driver of climate change, which threatens to cause multi-trillion-dollar losses in the global economy and disrupt modern society. A disclosure policy in Atlanta could reduce the public health and welfare cost of emissions by nearly $260 million through 2035, with benefits occurring within Atlanta and across the country. It would also reduce carbon emissions by 4.6 million metric tons, equivalent to six months of the total emissions from personal vehicle use in Atlanta.

[46] Modeling by Greenlink Analytics

Cost-Benefit Analysis

Many of the impacts of a disclosure policy reach beyond the City of Atlanta boundaries. As an example, the majority of the public health benefit is likely to accrue to other communities across Georgia. On the other hand, the costs of these actions will be borne by those within city limits, although these costs are relatively low compared to other options because the primary purpose of this policy is to promote information exchanges on energy performance.

The predominant source of economic benefits from the disclosure policy is energy savings. Public health benefits also contribute a sizable dollar value to the total benefits. The source of most of the cost is hiring contractors and service providers to implement the expected energy upgrades homeowners and landlords will implement to improve market positioning. Through 2035, projected Atlanta-specific benefits are $621.5 million, and come at a cost of $52.5 million. As a result, this policy option is projected to deliver net benefits of $569 million at a benefit-cost ratio of 11.84.

What does this mean for Atlanta?

Adopting a time of lease/time of sale building performance disclosure law will generate the **community-wide** benefits of ensuring a cleaner and more efficient building stock throughout the city, reducing greenhouse gas emissions, improving local air quality, and yielding cost savings and cost avoidance for residents.

To bring a time of lease/time of sale disclosure requirement into force, the **City of Atlanta government** will need to research and design a program based on national best practices, planning for implementation and dedicating staff and resources to execute and regulate the disclosure requirements. The City will need engage stakeholders and community-based organizations to inform draft legislation to be introduced to authorize this policy and, upon policy adoption, continue to collaborate with external partners to develop a system to produce required and accurate disclosures. Additionally, the City will need to conduct a robust community engagement campaign to inform residents and stakeholders of this disclosure requirement and how they can take advantage of the building energy performance information that will now be accessible to them. The Atlanta **City Council** will review and vote on legislation to authorize a time of lease/time of sale disclosure law. City councilmembers can support the City's community engagement campaign, working to inform residents and stakeholders in their districts of the requirement.

Residents, homeowners, home purchasers, renters, lessees, landlords, landowners, and **developers** can learn about the requirements and benefits of a time of lease/time of sale disclosure law through visiting clean energy resource centers (virtual and/or physical). **Homeowners and home purchasers** will receive information on the energy use of the building as part of multiple listing service (MLS) and for sale listings, providing them the ability to compare properties based on energy efficiency, which could influence their decision-making process. This

same information on building energy performance will be made available to **renters and lessees** as part of the rental/leasing process and may influence what property they decide to rent.[47]

Figure 5 shows the percentage of renters and owners by neighborhood in Atlanta that would benefit from these policies.

Landlords, landowners, and developers will have to disclose this information to potential purchasers or renters at the time of listing a property for sale or rent. This disclosure requirement may motivate landlords, landowners, and developers to make energy performance improvements to their properties and/or building plans to produce more favorable disclosure statements.

This new incentive for investment in building performance improvements will create new job opportunities for **local service providers and trades,** and local **real estate professionals** can further accelerate the clean energy benefits of this policy through offering training courses and briefings to educate professionals on time of lease/time of sale disclosure statements to share information and advise clients.

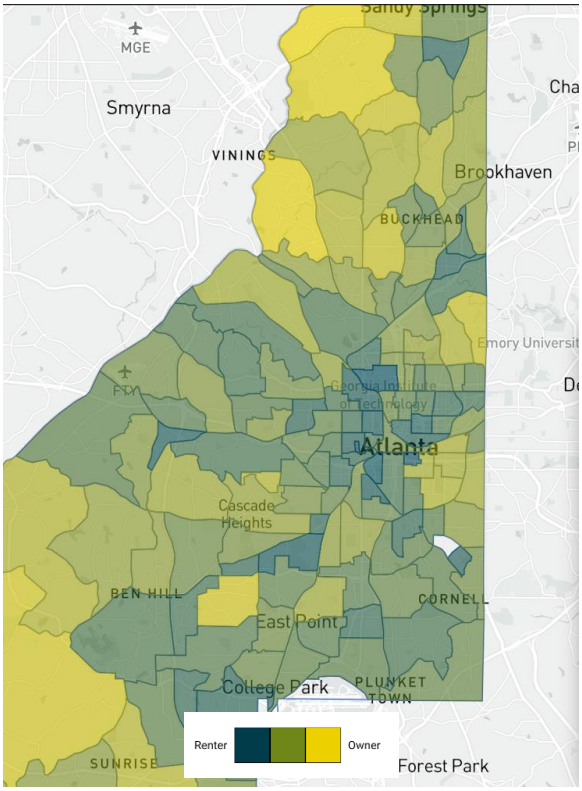


Figure 5 Renter or Owner in Atlanta

How to get there

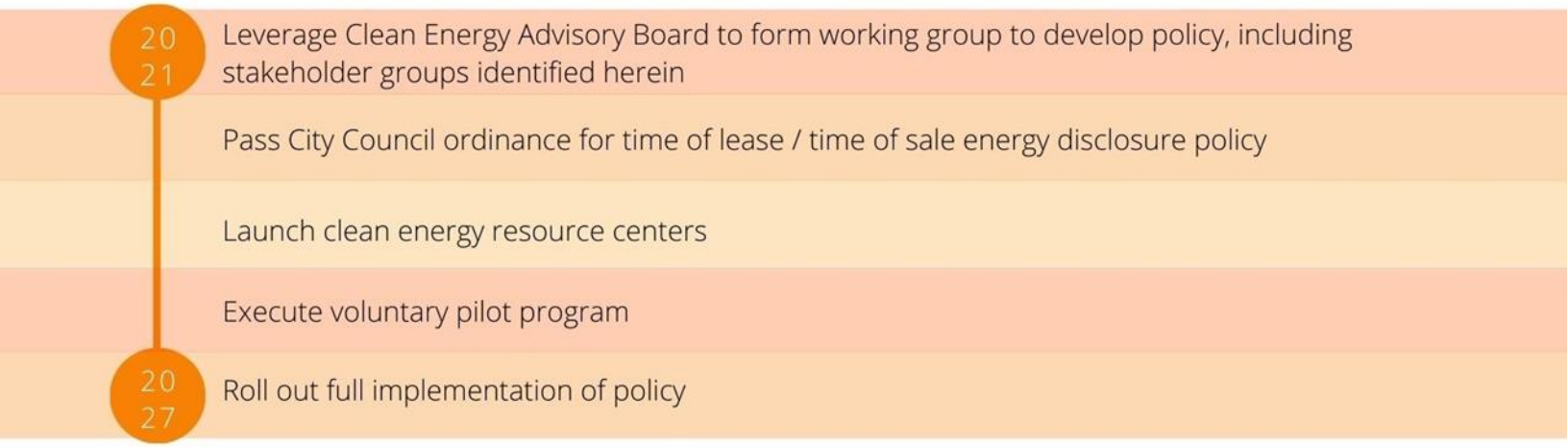
Laying the Foundation

To set an effective time of lease and time of sale requirement, there are some key criteria that need to be in place for a policy and its implementation process to be successful.

Access to Financing

A time of lease/time of sale energy disclosure policy is designed to encourage building energy performance improvements. These improvements may require capital investment from building owners. It is in the City's best interests to increase access to financing options available to building owners. The City's PACE financing program, once launched, will be an excellent resource for building improvement costs. The equity-centered green bank proposed in this roadmap is another such resource, one that can have greater levels of flexibility in the types of financing and programs it offers

[47] Greenlink Equity Map, Greenlink, www.equitymap.org/



Clean Energy Resource Centers

Limited access to resources for building performance improvements creates barriers to improving building energy performance. For motivated building sellers or landlords, lack of resources may make it challenging to achieve a higher, more desirable level of energy performance to advertise on mandated time of lease/time of sale energy disclosure reports. The City can alleviate that potential burden through ensuring the availability of robust resources for building energy performance improvements. Described in greater detail in the green bank section of this roadmap, clean energy resource centers and financing programs such as property assessed clean energy and a green bank equip building owners in Atlanta with the resources, they'll need in order to invest in the clean energy improvements that may be required through a BPS policy.

Adopt and implement a time of lease/time of sale energy disclosure policy

Draft the Policy

The first step in policy development is identifying the buildings that would be covered by the policy. Time of lease and time of sale disclosure policies can be applied to single-family residential, multifamily residential, and commercial properties, and the policy impact analysis provided in the section contemplates a requirement that covers all three of those types of buildings. Additionally, the City needs to identify a timeline for phasing in the compliance requirement, ideally mapping out a gradual process to facilitate successful implementation across building types. And finally, the City needs to determine the appropriate method and forum for these energy performance disclosures.

Prepare the Community for the Policy

A time of lease/time of sale energy performance disclosure requirement will affect anyone who is buying, selling, leasing, or renting property in Atlanta, covering a very large and diverse set of stakeholders. To ensure the community is familiar with this policy and understands how to act on the energy data that is being disclosed through this policy, extensive community outreach and education will be required. This education should provide information on what this policy is, what its objectives are, and what enforcement will entail, and the educational content presented should

be customized for multiple stakeholder groups, including real estate professionals, building owners, purchasers, leasers, and lessees, and service providers.

Implement the Policy

To successfully implement a time of lease/time of sale energy performance disclosure law, dedicated resources need to be provided for both the City, to ensure staffing and budgetary capacity exists for enforcing the disclosure requirement, as well as for building owners and property managers, to ensure they have the resources they need to improve the performance of their buildings. In addition to offering training and education to ensure compliance, real estate professional organizations and certifiers will be a critical collaborative partner to develop a system to produce required and accurate disclosures. Building trades and service providers will need to adapt or develop new technologies that assist parties that play a role (i.e. buyers, renters, landlords, landowners, developers, and real estate professionals) in sale and leases in the production and explanation of disclosure statements. A standardized reporting and disclosure platform will be a valuable tool for ensuring consistency in reporting and disclosures across the commercial and residential building sectors.

Ensure Enforcement Capacity

Designate a team for enforcement of this policy and provide them with the staffing and budgetary requirements needed to enforce this policy. This type of role is well suited to be housed within a City department or office with experience playing an enforcement role in the buildings sector, such as a building permitting office or planning/development office. The team that provides this enforcement function could potentially be the same team that enforces the BPS detailed in this roadmap.

Create Building Resource Hub

Several cities have created organizations to help provide the buildings sector with the resources they need to comply with a BPS policy, and this roadmap recommends that Atlanta do the same for implementing its BPS policy. This resource hub can serve an added function of providing similar resources and education for the time of lease/time of sale energy performance disclosure requirement, providing focused services such as real estate professionals trainings in addition to the building owner and property manager information sessions on the BPS, trainings for energy service providers, resources for building owners to find the service providers they need, identification of funding options such as the City's PACE program or equity-centered green bank for building improvements, and more.

Embodied Carbon

Construction materials alone are responsible for about 11%[48] of all global carbon emissions as shown in Figure 6. As discussed above, emissions from building operations can be addressed primarily through energy efficiency and electrification. Carbon emissions from construction materials can be measured and addressed by calculating a material or a building's embodied carbon. While embodied carbon is not specifically addressed within the boundary of the CEA plan, it is a critical step to decarbonization in Atlanta's building stock.

Definition and benefits

Embodied carbon refers to the total impact of all human-induced GHG emitted from material extraction through the end of its useful life. Embodied carbon is calculated by summing all carbon emitted from non-renewable energy sources resulting from sourcing raw materials, manufacturing, transporting, construction and installation activities, ongoing material/product energy use, maintenance, repair, and finally, disposal.

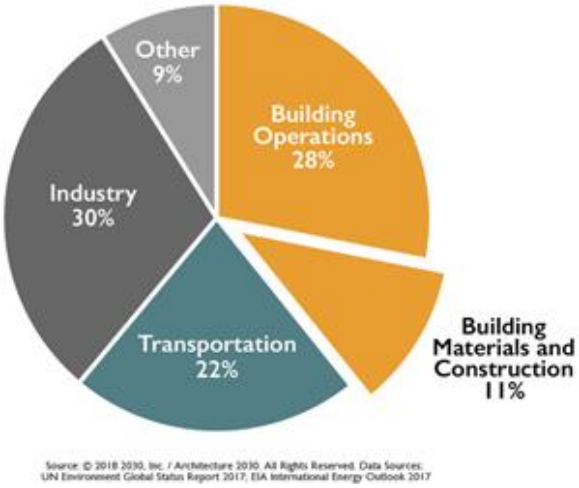


Figure 6 : Global CO_2 Emissions by Sector

Sustainable materials experts have studied embodied carbon for decades. The concept has received increased attention due to its intersection with net zero carbon buildings. As building energy efficiency increases and more buildings eliminate fossil fuels in building operations, the impact of embodied carbon emissions in buildings is becoming increasingly significant. Solutions to reduce embodied carbon will need to be prioritized while addressing carbon in the built environment.

What does this mean for Atlanta?

Addressing embodied carbon in the built environment will not only reduce GHG emissions but will also bring innovation, new projects, and profits to a community. Policies to reduce embodied carbon will result in building reuse. A diversity of building vintage, use, and scale brings character to a community. Reusing whole buildings and repurposing building components keeps history and the stories associated with them alive. Encouraging building reuse will also benefit communities of color who have historically been preservationists out of necessity and survival. Reducing embodied carbon will incentivize the selection of local products, which will support the economy. The majority of money spent at locally owned businesses stays within the communities they hire within and serve. Local businesses often have smaller carbon footprints and are invested in the

[48] *Why the Building Sector?*, Architecture 2030, architecture2030.org/buildings_problem_why/

well-being of the community. Reducing embodied carbon from local cement manufacturers will improve local air quality and GHG emissions.

The **City of Atlanta government** will need to engage stakeholders like organizations in the green building industry and local organizations focused on equity to draft an actionable policy that addresses embodied carbon. Legislation must then be introduced to the City Council to require the creation, adoption, and implementation of strategies to reduce embodied carbon, possibly starting with government-owned buildings first, and then expanding to include the private sector. Budgets and internal procedures will need to adjust to support any new embodied carbon policies such as incentives that will prime the market for future requirements. Additionally, the City will need to support the education of the design and construction community on how they can reduce embodied carbon in the built environment and citizens and local businesses on the benefits of this policy.

City Council will need to review and vote on the proposed embodied carbon policy. **Building owners**, including **landlords**, as well as interested **renters**, can take advantage of educational resources to learn about the embodied carbon policy. Finally, **real estate professionals** should be educated on the policy changes through training and shared resources by City staff. The real estate industry should be encouraged to promote the benefits of upgraded building stock as an amenity. **Service providers** such as material reuse retailers like the Life Cycle Building Center and the Habitat for Humanity ReStore and local craftspeople will play a critical role in reducing embodied carbon in our buildings, driving the growth of a clean energy workforce.

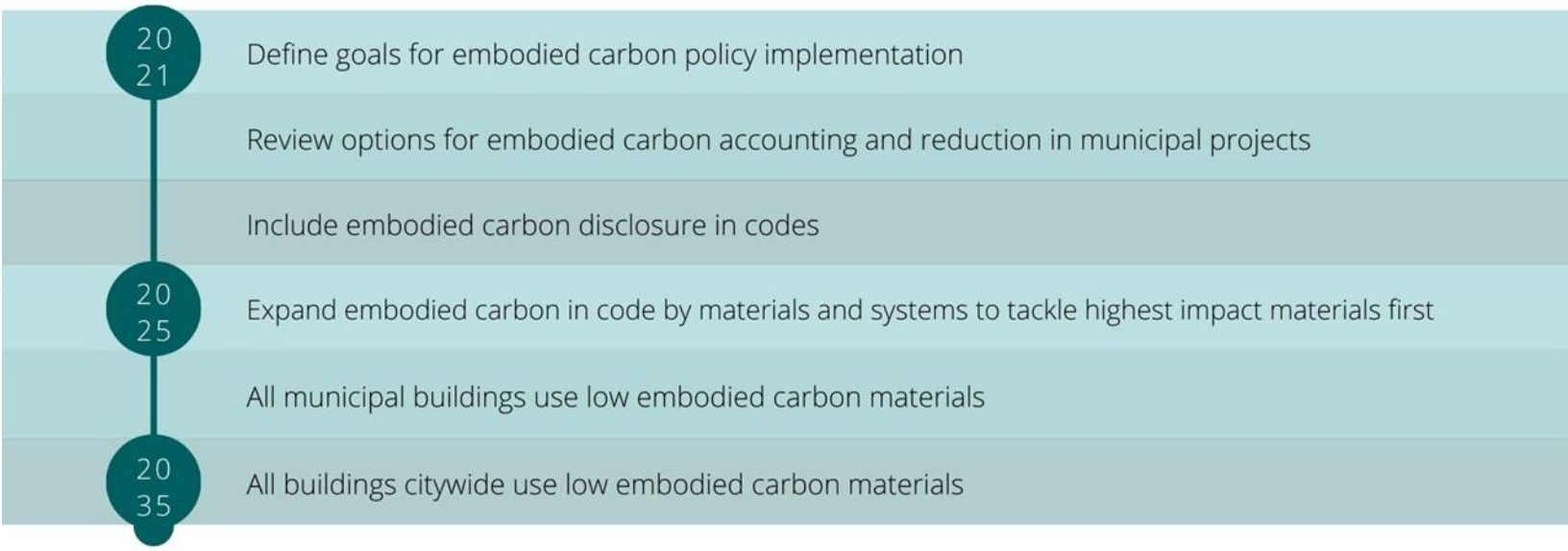
How to get there

Timeline for Implementing Embodied Carbon Policies

The World Green Building Council's report, *Bringing Embodied Carbon Upfront*[49] suggests a timeline for cities to create, adopt, and implement embodied carbon strategies to achieve net zero embodied carbon by 2030. The report suggests that, starting in 2020, cities should create strategies for 2024 adoption. Minimum strategies include setting embodied carbon reduction targets, mandatory targets for building life cycle analysis (LCA), and timelines for implementing low carbon public procurement policies.

By 2025, cities should have already set net zero carbon targets and be enforcing them. Embodied carbon targets should have a clear trajectory towards zero for new public buildings and large public renovations. Embodied carbon disclosure requirements should be enforced for all new municipal buildings. City-procured buildings and infrastructure projects should comply with embodied carbon emission budgets. By 2030, cities should have implemented policies that set progressive embodied carbon reduction targets and specify when net zero embodied carbon will become mandatory for all new buildings, renovations, and retrofits, and where possible, all infrastructure projects. Policies should include embodied carbon emissions reduction targets, maximize the reuse of existing buildings and materials, and give private developers incentives to meet embodied carbon reduction requirements.

[49] *Bringing Embodied Carbon Upfront*, World Green Building Council, www.worldgbc.org/news-media/bringing-embodied-carbon-upfront.



Embodied Carbon Policy Categories:

The Carbon Neutral Cities Alliance's *City Policy Framework*[50] lists 52 policies in seven categories to reduce embodied carbon. Different jurisdictional departments can enact the policies to affect their own municipal projects, private construction, or both. The phases below recommend an approach for rolling out embodied carbon policies. Policies may overlap during these phases, so more information has been provided in the following section about recommended embodied carbon policies.

Phase 1:

1. Infrastructure policies impact publicly owned projects.
2. Municipal building policies impact public-owned buildings.

Phase 2:

3. Procurement policies direct what and how materials, projects, and services are purchased.
4. Waste and circularity policies impact materials life cycle and end-of-life use.
5. Regulation policies affect public and private sector construction.

Phase 3:

6. Zoning and land use policies cover what can be built where and land sales/leases.
7. Financial policies include taxation, fees, incentives, and commercial (dis)advantages.

[50] *City Policy Framework for Dramatically Reducing Embodied Carbon*, Carbon Neutral Cities Alliance, One Click LCA, Architecture 2030. https://www.embodiedcarbonpolicies.com/

Recommended Embodied Carbon Policies

Recommended embodied carbon policies provide general best practice principles for introducing the topic, educating the community, and implementing Atlanta's municipal projects before encouraging private development to adopt embodied carbon policies.

- **Setting goals** for embodied carbon policies is an essential first step.
- **Lead by example** with Atlanta enacting embodied carbon requirements on public projects.
- **Prime the market** by offering embodied carbon education to the design and construction industry and set up incentives for private construction projects.
- **Incentives** can bolster low embodied carbon businesses that offer low embodied carbon products and practices.

Embodied Carbon Goal Setting:

Set citywide embodied carbon goals to inform the Atlanta market of the long-term vision. The goals will help Atlanta set a series of policies to meet the target over time. Prepare the building industry for coming policy changes to offer faster policy adoption and more successful implementation. Start by studying the best strategies to prime the market. Early adopters and innovators in the private sector can set themselves apart from others in the building industry through their experience and teach others to expand the market's embodied carbon know-how.

Goal-setting policies may include:

- Incorporating embodied carbon goals into City plans and department plans
- Using carbon as an optional criterion for public design competitions

Develop a strategy for embodied carbon policies by identifying a GHG emissions target, list how the goals fit into existing community needs and City of Atlanta goals and set a timeline for public policy implementation. The strategy should include researching what peer cities and private organizations plan to implement, their successes, and lessons learned. To determine the specific materials to address in policies, the City should research common building materials where the embodied carbon can be reduced. Take an inventory of regional materials (wood, high recycled content steel, prefabricated concrete, etc.). Retroactively study recently built projects' embodied carbon content, which will help the City learn what is possible and set a baseline for GHG emissions targets. Use this information to study carbon's social cost and how low embodied carbon materials can create a more livable Atlanta.

Existing Atlanta and state-level policies and programs can support the strategy. Georgia *HB 355,* which passed both the house and senate, would expand the state's existing carbon sequestration registry to include building products and materials that can demonstrate carbon sequestration such as mass timber, CO_2-infused concrete, and carbon neutral flooring.[51] By encouraging the use of products with low embodied carbon into construction, Atlanta would support Georgia businesses and institutions that participate in carbon markets. Atlanta should update plans, policies, and programs to reflect GHG emissions goals or targets, market advancement goals, and other aspects related to embodied carbon. For example, the City of Austin, Texas's

[51] *HB355: Georgia Carbon Sequestration Registry; Inclusion of Building Products in Construction; Provisions*, Georgia General Assembly, Mar. 2021, www.legis.ga.gov/legislation/59427.

September 2020 *Austin Climate Equity Plan* states a goal to reduce the embodied carbon footprint of building materials by 40% by 2030.

Include requirements for embodied carbon into the existing policy strategies such as:

- Climate Action Plan
- *Clean Energy Atlanta*
- Sustainable Building Ordinance
- Zoning plan
- Transportation plan
- Local industry development plans
- Job creation plans
- Purchasing policies (vehicle procurement, etc.)

Collaborate with other city departments and citizens interested in addressing embodied carbon. Create a dialog with others to gain insight into their priorities and understand the positive and negative impacts of the policies on the private sector and low-income owners and renters. Have discussions with local real estate developers, which may uncover unnecessary financial burdens that can be minimized by extending the timeline for material procurement. Developers may indicate incentives or services that Atlanta can provide to encourage low embodied carbon projects. Successful policies will be aligned with both market capabilities and City targets.

Departments to be included in embodied carbon strategy include:

- Aviation
- City Planning
- Invest Atlanta
- Grants & Community Development
- Watershed
- Parks and Recreation
- Procurement
- Public Works
- Transportation

Develop a timeline for implementing prioritized policies. Incorporate embodied carbon goals into the climate action plan and other City documents. Identify how the City can mimic what a model embodied carbon project looks like through Atlanta's procurement process. Atlanta's success can prepare the market for coming changes through modeling best practices. When the city leads by example, the market will follow.

An embodied carbon policy strategy should include clear goals and objectives for various audiences: city departments, designers, contractors, local manufacturers, and other stakeholders. Review embodied carbon-reporting documents on a set schedule to study if the policy is meeting its goals and objectives. If the targets are not on track, adjustments will be necessary. Depending on the weakest point of measurement, adjustments may include developing new or making existing incentives more enticing, reducing embodied carbon GHG targets, increasing awareness and offering education, adjusting the policy implementation schedule, etc.

Offer a clear policy pathway to support successful implementation. Policy implementation will require research, internal cross-City department collaboration, community engagement, policy language development, awareness and education campaigns, policy implementation, and evaluation. By creating joint commitments with other departments, the embodied carbon policy strategy has the potential to maximize GHG emissions reduction potential.

Lead by Example in Embodied Carbon

Atlanta can lead by example and prime the market for future changes by adopting and implementing embodied carbon policies before private mandates. Embodied carbon tracking and reporting requirements can provide data to create benchmarking policies for embodied carbon. Reuse buildings and materials and specify low embodied carbon construction materials in public buildings and infrastructure projects as a way to illustrate that policy implementation is achievable. Regional material manufacturers can prepare for coming market needs by calculating and documenting their products' embodied carbon and offering products that support or meet new policy requirements. Leading-by-example policies may include:

- Municipal embodied carbon benchmarking and disclosure for high profile projects
- Municipal embodied carbon limits for key building and infrastructure materials and supporting reuse
- Municipal building and infrastructure low carbon cement and concrete policy
- Municipal Life Cycle Analysis targets for buildings and infrastructure projects
- Municipal waste diversion through reuse and up-cycling

Introductory embodied carbon policies should focus on tracking and setting carbon performance on specific materials or primary building and infrastructure components. Create requirements for low embodied carbon aluminum, cement and concrete, glass, gypsum, chemicals (i.e., plastics, insulation), steel, and asphalt. Or focus on life cycle analysis of structural systems, enclosures, or finished materials. Allow project teams the flexibility in selecting low embodied carbon products that fit the project. Low embodied carbon materials may include reused materials, regionally sourced materials, products with high recycled content, alternative products (wood rather than steel), economic structural framing strategies, and material elimination. Embodied carbon reduction can occur at many different points within a product's life cycle: material extraction, harvesting, processing, manufacturing, transportation, installation of building materials, and end of life.

Cement and concrete policies have been adopted by a few U.S. cities as their first embodied carbon actions. Addressing concrete's carbon content is often an easy design change but offers significant GHG reductions for both buildings and infrastructure. Adjusting the concrete mix is often cost neutral and offers high-embodied carbon savings because of the volume of concrete used in most projects. Setting a carbon budget for concrete offers flexibility in selecting which concrete ingredients support the goal. Aggregate harvest location (or recycled aggregate) and cement ratios can be adjusted without compromising the structural integrity of the final mix. Policies may prioritize prefabricated concrete products since they are often lower in cement content and produce less waste than on-site fabrication.

Buy Clean is a burgeoning embodied carbon policy that uses the power of procurement to address embodied carbon. The policy targets specific construction materials used in infrastructure projects, such as structural steel, rebar, concrete, glass, and mineral wool board insulation. The *Buy Clean California Act* was the first such policy to be signed into law. Atlanta can design a similar policy to address low embodied carbon materials, and support the local economy and workforce, by encouraging local products such as gypsum, carpet, wood, and other locally extracted/harvested and manufactured products. Local products require less transportation, lowering their embodied carbon and reducing regional emissions. The Portland Cement

Association estimates that roughly 1.8 metric tons of CO_{2e} was emitted by Georgia's cement industry in 2015. According to Drawdown Georgia, alternative cement is a market-ready solution with sufficient local expertise to implement.

Before implementing a *Buy Clean* policy, coordinate with the Department of Economic Development and work with regional manufacturers of identified materials to ensure they create the desired products. Alert manufacturers to future demand and specific reporting requirements, as well as the benefits for a cleaner Atlanta.

The *Atlanta Sustainable Building Ordinance (17-O-1218)* requires city-owned new construction and major renovation projects over 25,000 square feet to achieve LEED certification. It should be updated to prioritize LEED embodied carbon credits. Credits include Materials and Resources credits for Building Life-Cycle Impact Reduction, Building Product Disclosure and Optimization, or the pilot credit, Procurement of Low Carbon Construction Materials. If Atlanta requires product-specific low embodied carbon, the policy should be aligned with the LEED requirements. Projects seeking LEED certification should be allowed to meet LEED credits and forego other City-required documentation, whichever is more stringent.

Building foundations, structures, and envelopes account for the majority of a building's embodied carbon. Additionally, building demolition can be a carbon-intensive process with potentially negative air quality effects as hazardous materials become airborne. A policy can require the owner to explore building reuse prior to demolition permitting. City-owned buildings may require a financial assessment prior to the decision of demolition. Reusing and adapting existing buildings has additional benefits. Existing structures can help retain the historic nature of a community. Neighborhoods that offer a diversity of building vintage, use, and scale offer a visually appealing urban landscape. Reusing whole buildings and repurposing building components provides a tangible connection to history and the associated stories. Ponce City Market, Atlanta's largest adaptive reuse project, is a successful example of building reuse that resulted in the transformation of the historic Sears, Roebuck & Co. building into a vibrant mixed-use space with a central food hall, shops and apartments adjacent to the Beltline.

Leading by example impacts more than the City, and partnerships can help advance carbon goals. For example, architecture and construction firms learn about the life cycle of a material and how to reduce embodied carbon. Manufacturers also learn from reporting requirements and can plan for future product requests. An architecture firm in Portland, Oregon, stated that the City of Portland's policy for low embodied carbon concrete gave their staff the reason and resources to research the topic. Firms that learn by working on a project can more easily expand their service offerings and set their firms apart. Once a firm's knowledge is established, the learning curve on the next project is less steep, and the firm's embodied carbon knowledge is expanded. Firms can change their base specifications to reduce embodied carbon on all future projects, whether it was requested or not, changing the market. Organizations such as the Carbon Leadership Forum offer tools and resources to support the City and implementers alike.

Prime the Market for Embodied Carbon Policies

For decades, stretch codes, rating systems, and incentives have brought attention to and taught designers about the importance of reducing operational energy and carbon. Topic awareness can increase demand and create healthy competition in the private sector. Atlanta can offer tools to support the free market and provide a clear path for implementation, expanding the market's capabilities. Atlanta can partner with professional organizations to offer and promote embodied carbon awareness. The permitting department can offer information on building and material reuse, construction waste recycling, how to select low embodied materials, and life cycle analysis calculators and other tools. Policies and actions that prime the market may include:

- Provide information on adaptability and construction waste reduction
- Publicize best practices and case study projects
- Educational trainings focused on material life cycle

Raise awareness on building reuse, low embodied carbon, and material life cycle thinking. Develop case studies on Atlanta buildings that have successfully reduced embodied carbon, like Interface Headquarters or the Kendeda Building at Georgia Tech. Create short videos on the process and the organizations that made the projects successful. Highlight embodied carbon reduction strategies such as minimizing the number of materials in a project or adaptive reuse like Ponce City Market. Specifying a polished concrete floor over tile reduces materials and first costs. Educate the industry on materials used by low embodied carbon projects, the metrics hit or missed, and measurement tools used to calculate emissions avoided, like the E3 calculator. Encourage and financially support similar case studies of private development projects.

Atlanta is home to world-renowned architecture firms that are well versed in sustainability, including embodied carbon. During the goal setting phase, Atlanta should team with local professional organizations on their embodied carbon ideas. Partner with the same organizations to host workshops, lunch and learns, webinars, and other training and networking opportunities to educate the design and construction community on the topic of embodied carbon. Education is a low-cost option, with the potential to reach a large population with the right partnership. Organizations such as local chapters of American Institute of Architects, ASHRAE, International Interior Design Association (IIDA), Commercial Real Estate Development Association (NAIOP), Urban Land Institute (ULI), Green Building Council (GBC), International Living Future Institute (ILFI), and Carbon Leadership Forum (CLF). Outreach should also be conducted to Atlanta-based community groups focused on equity like the Partnership for Southern Equity, Proctor Creek Stewardship Council, Groundwork Atlanta, Teach for America, the library system and historically black colleges and universities, material transparency groups, etc. Educating traditionally marginalized communities would ensure embodied carbon policies benefit entrepreneurs and small businesses and help build community wealth in these communities. All of these groups are essential partners to highlight the importance, value, and process for reducing project embodied carbon.

Promote low embodied carbon products through the above-mentioned education opportunities or sponsor a materials fair or a low embodied carbon design contest. Encourage local manufacturers and distributors to highlight their low embodied carbon products when they have environmental product declarations (EPDs). Encourage designers to visit the Lifecycle Building Center (LBC) or

other retail showrooms to learn more about local products and suppliers that can support their projects. The LBC is a retail store that diverts construction materials from the waste stream. Encourage those renovating existing buildings to donate salvageable materials. Or promote using reused, repurposed, or upcycled materials from the LBC. Such strategies support local businesses, create awareness about embodied carbon, and can lead to job creation. New technologies and business models can spring from such promotion and collaboration.

Recognizing quality projects and products encourages healthy competition. Host information on a website and promote to local developers, designers, and manufacturers. Create or bolster a common set of calculators and tools to track embodied carbon. Host tools within the building permitting department and their website.

Embodied Carbon Incentives

Atlanta can leverage its regulatory authority by offering developers voluntary incentives to build low carbon buildings or infrastructure projects. Incentives encourage a specific behavior in exchange for a benefit. For developers, incentives reduce the pain of the learning curve and offer an opportunity to incorporate a new approach. For policymakers, incentive uptake signifies market readiness for an idea.

Embodied carbon incentives include:

- Tax rebates for low carbon development
- Density bonuses for low carbon buildings
- Disincentives for building in low-density areas

Incentives may include a cash payment, tax credits, free or reduced-cost materials. Incentives do not need to require new city programs or budgets. Non-financial benefits may include offering faster permit review, reduced or waived permitting fee or development charges, density bonuses, etc.

Expedited permitting is beneficial only when long processing times put a financial burden on projects. Real estate developers lose money every day a project is delayed due to the high cost of construction loans. While delayed permitting costs developers money and increases the cost of the final building (potentially raising rents), expedited permitting can save developers money and lower the project's cost.

Land use incentives allow for an exemption from the code, such as maximum building height, floor area ratio, or density adjustment from the typical zone. Density bonuses allow developers to increase the maximum allowable development, often beneficial in urban environments where land is limited. The additional rentable area means a higher profit than a development with the bonus. However, in cities where buildable land is plentiful, like Atlanta, land use incentives may not be a popular option.

Financial incentives, such as tax rebates, can encourage low carbon options in private development. Property taxes, direct grants, and other financial incentives directly benefit building owners for a set number of years. The financial value can be based on a tiered quantity of

embodied carbon reduction. Funding financial incentives to attract developers requires coordination with other city departments to ensure the consequences do not outweigh the benefits. However, sufficiently priced incentives can have a high uptake and be considered successful.

Offering incentives for tracking and reporting low carbon developments allow authorities to test policies before setting metrics. Policymakers should monitor the adoption and carbon impacts of the incentive policy, before expanding as a mandate for all developments. For instance, if a developer is incapable of identifying local low carbon products, policymakers may need to incentivize manufacturers and suppliers or promote low carbon manufacturers. Pilots also offer the flexibility for adjusting for innovative actions that can inform future permanent incentives or policies. Lessons learned can be studied to adjust tools, strategies, and policies.

Manufacturers or suppliers that can create or sell low embodied carbon products could be eligible for a tax credit or additional benefit. Business can track and report product embodied carbon through environmental declaration products, or achieve third-party certifications, such as Declare, to illustrate compliance. Inviting sustainable material conferences to the City, such as ILFI's Human Health and Materials Summit, is another way to raise awareness for low embodied carbon products.

Incentive programs should clearly indicate what project types are eligible, what actions must be taken, the allowed time period to achieve the incentive and the incentive beneficiary. Specify the required building size, location, occupant type, etc., if necessary. Note the necessary tools to be used and if any training or certification is required for the applicant. Common free life cycle analysis tools are available today including Athena, EC3, BEES, BIRDS NEST, etc. Tally, a low-cost add-on to Auto-Desk Revit, commonly used by architects, is another important tool that can both import a bill of materials directly into EC3 and create an LCA based on that bill of materials.

Actions being incentivized may include building or material reuse, local materials selection, or embodied carbon calculation for new materials, construction waste diverted from the landfill, etc. Metrics for measuring embodied carbon avoided may include CO_2e avoided, demolition permits, material reuse sales, landfill volume, etc.

Disincentives are financial disadvantages for not meeting low embodied carbon options. Developers may be charged additional fees for developing low-density buildings, including parking lots, or selecting sites away from mass transit. Manufacturers that do not use renewable energy can be penalized. Fees for projects that don't hit reduction thresholds show the City's priorities.

Incentives can be powerful tools for private developers to overcome learning curves. To be successful, the price must be right, and a straightforward implementation pathway established. Products must be available, tools must work properly, and the industry must have the skills to meet the policy requirements. If policies are developed thoughtfully, the City will help lead other cities toward a low carbon future.

Conclusion

Achieving a decarbonized building stock benefits all Atlantans. An equitable decarbonization transition, designed and executed with great intentionality, can create benefits that extend well beyond mitigating the threats posed by climate change. *Decarbonize Atlanta* demonstrates that pursuing the six areas of action included in this roadmap by the end of this decade will improve public health, reduce incidences of asthma and heart disease, create healthier, more comfortable buildings, reduce energy costs, create jobs, increase incomes, and grow the local economy.

Decarbonization Actions Create Community Benefits

Earlier sections of this roadmap identify the benefits of each of the six areas of action taken individually. Each area of action will yield significant climate and community benefits if implemented on its own as shown in Table 12 below. Actions taken together will support and strengthen other actions. For example, an equity-centered green bank creates resources that ensure a BPS will be more successful by making more funding available to a diverse range of Atlantans for building performance improvements. Aggressive new construction codes result in more efficient, lower carbon new buildings today. These new buildings will be able to more easily comply with a future BPS and will see more benefits from a disclosure policy.

Table 12: Combined Benefits of *Decarbonize Atlanta* Policies

Action	**Local jobs created**	**Local incomes increased**	**Local GDP growth**	**Public health savings**	**Metric tons CO_2**
Equity-centered green bank	11,300	$653M	$554M	$267M	4.75M
New construction codes	7,000	$404M	$345M	$297M	5.21M
BPS	4,300	$260M	$226M	$479M	8.23M
Disclosures	3,300	$191M	$160M	$86M	1.53M
Simple sum of parts	25,900	$1.51B	$1.29B	$1.2B	19.7M
Interactions and synergies	900	$50M	$40M	-$30M	0.3M
Total potential benefits	**26,800**	**$1.56B**	**$1.33B**	**$1.2B**	**20M**

Combined Impact of Policies

Combining these policy options for Atlanta could address multiple important aspects of decarbonizing Atlanta's building sectors more comprehensively. The modeling suggests that there would be synergistic, additive, and duplicative components of successfully implementing these options as a joint effort. For example, disclosures should increase the demand for equity-centered green bank funds for homeowners who learn of cost-effective savings opportunities, find the financing terms favorable, and struggle to access traditional funding resources. To the extent

that the disclosures policy is implemented and enforced in such a way to establish the virtuous cycle of savings (better building performance leading to market incentives for better performance), these demands should increase — incrementally at first, and potentially exponentially in the long run. All items together could leverage market forces and financing options with strong performance backstops like energy codes and BPS to bring Atlanta closer to realizing a fully decarbonized and vibrant built environment. Each policy component plays an important role in overcoming existing barriers to clean energy in Atlanta and is responsible for driving a different aspect of the full benefits of a combined policy approach.

Economic Development

The economic development implications project the creation or sustaining of 20,100 job-years (a full-time position held by one person for one year) through 2035. Assuming the average person keeps a job for four years, this would roughly equate to 5,000 new employment opportunities than would have otherwise existed in Atlanta. Looking across more than 500 industries, direct employment of 100 or more positions would be created in nine industries (Table 13).

Table 13: Local Direct Jobs Created by Industry and Policy

Industry	***Local Direct Jobs Created***				
	Green bank	**BPS**	**Disclosures**	**New construction**	**Combined policies[52]**
Construction	504	1,873	161	294	2,155
HVAC&R	237	879	75	138	1,011
Program administration	171	637	55	100	733
Lighting services	115	425	37	67	489
Energy/env. management[53]	258	956	74	161	1,086
Building envelopes materials	152	564	63	69	674
Architecture/engineering	147	545	47	86	627
Insurance and finance		95			109
Water heating services		332			388
Total Jobs Created	**1,584**	**915**	**6,306**	**512**	**7,272**

As shown in Table 13, the top three job-gaining industries—construction, energy/environmental management, and HVAC and refrigeration—are projected to create more than 1,000 new jobs each, with more than 2,000 construction jobs alone. Interestingly, in combination, 53% of these jobs would service the residential sector, running somewhat counter to the BPS and the equity-centered green bank when modeled as isolated policies.

Successful implementation will also result in indirect and induced job effects, with indirect job losses concentrated in the power sector and supporting industries as less money is spent on energy bills. Induced jobs see strong growth, for essentially similar reasons, as less money is used towards energy bills, residents and businesses in Atlanta spend more in other parts of the economy, spurring growth and the creation of more jobs. In total, more jobs are created through these induced pathways than through direct or indirect effects, showing that the benefits of

[52] The "Combined Policies" includes added synergies of pursuing all actions at the same time. Because of interactive effects between policies, the sum of local jobs created by each policy enacted separately is different than enacting the policies together.
[53] The Energy/Environmental Management category includes smart control technologies.

reduced energy spending are large and shared across the entire consumption-driven economic landscape.

Incomes and GDP grow as well, reflecting much the same story as employment. Spending less on energy allows the residents and businesses of Atlanta to invest more resources into efforts that employ more people, increasing incomes, and growing the economy.

The equity-centered green bank is anticipated to be the single-largest contributor to the economic development impacts, responsible for 42% of the job creation. The actions focused on new construction codes and BPS actions drive 26% and 16% of the roadmap's economic impacts, respectively. The interaction of the two policies is a slight net positive for jobs, contributing an additional 3% to the total.

Workforce Development

To ensure that the jobs created by this roadmap are well paid and that residents in Atlanta, especially those most vulnerable, underserved, and under-resourced, are the ones that benefit from that job growth, the City of Atlanta should concurrently create demand for such jobs and create the pipeline of a prepared workforce.

The City can create demand for decarbonized buildings in several ways through the use of incentives and mandates. Incentives can help increase awareness and training for the local workforce. The City's Department of Procurement can revise the competitive bid processes for relevant municipal services to include preferential scoring for submissions that demonstrate employing appropriately trained graduates of local workforce development programs. Human Resources can also prioritize the applications of appropriately trained graduates of local workforce development programs. The Office of Buildings can expedite permitting reviews and inspections, and in some cases allow for self-certification, where such work is performed by credentialed and appropriately trained graduates of local workforce development programs. The Department of City Planning could allow for density bonuses in projects for which designs are high performance and contractors are employing credentialed, appropriately trained workforces. For a wide variety of project types, Invest Atlanta can prioritize funding opportunities that include employment of credentialed, appropriately trained workforces.

As the market begins to saturate with projects exploiting incentives, mandates can be added to more fully leverage and sustain the locally trained workforce. Procurement can require any construction, facilities maintenance or site related work done on behalf of the City include appropriately trained graduates of local workforce development programs. Human Resources can set minimum credential and training requirements for many positions that reflect the trainings provided through local workforce development programs. The Office of Buildings can require any project to be permitted must include building and site characteristics that mandate the employment of the locally trained workforce. The Department of Parks and Recreation can enhance its policies and procedures to implement landscaping and site best practices creating the demand for well-trained employees.

Atlanta already has a substantial workforce development community that should be leveraged to support an emerging decarbonization-ready workforce. The City of Atlanta can work to establish a clear network of trainers and workforce agencies that create the necessary pipeline of support for underserved residents of Atlanta in establishing stable lives and employment. For example,

the Construction Education Foundation of Georgia and Southface Institute provide general construction skills and green building skills, respectively. They can collaborate with Westside Future Fund and WorkSource Atlanta to identify potential participants and employment opportunities. Other organizations can support participant development in areas such as workplace soft skills and financial literacy. Invest Atlanta can tailor one of its first-time homeowner programs to focus on participants. The key contribution of the City in wrap-around services is establishing the network and defining the necessary focus points for clarity.

Public Health

The consumption of energy from resources that cause pollution creates public health damages that are generally not considered relevant by Atlanta's electric utility service provider because the costs are borne by others. As a result, people lose workdays and the income that comes with it, more children become asthmatic, and many health conditions, such as stroke, heart attacks, and even death, are increased. In addition, these energy resources are also the source of the pollution that is the primary driver of climate change, which threatens to cause multi-trillion-dollar losses in the global economy and disrupt many aspects of modern society. This package of policy options presents an opportunity for the City to improve public health and welfare worth nearly $1.2 billion through 2035, with benefits occurring within Atlanta and across the country. It would also reduce carbon emissions by 20 million metric tons, equivalent to 26 months of the total emissions from personal vehicle use in Atlanta. These results are another area where the impacts are not purely additive, although in this case, the combined impacts are less than the individual policies. This is because fossil power generation is nearly always on the margin in Atlanta's power supply - as more clean energy is used, there is less coal, then less gas to remove so the public health value of new clean energy slowly declines as clean energy activity grows. In total, the combined policies show about $30 million less in public health benefits than if the policies were simply additive.

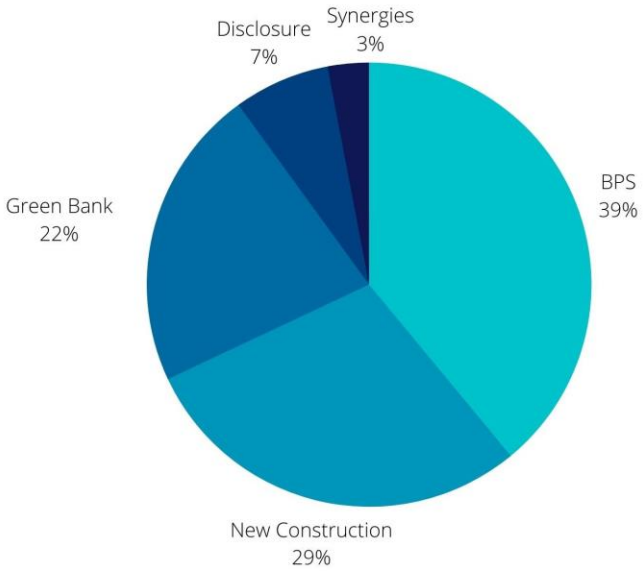


Figure 7: Public Health Benefit Ranking of *Decarbonize Atlanta* Policy Recommendations

As shown in Figure 7, the BPS drives the largest portion of the public health benefits, making up 42% of the total. New construction codes come in second for about 31% and the equity-centered

green bank contributes roughly 24% to the total. Disclosures contribute the final 7% of the public health benefits, with policy interactions taking back about 3%.

Cost-Benefit Analysis

Many elements of this policy package reach beyond the City of Atlanta boundary. For example, the majority of the public health benefit is likely to accrue within other communities across Georgia. On the other hand, the costs of these actions will be borne by those within city limits.

The predominant source of economic benefits is energy savings. Public health benefits also contribute a sizable dollar value to the total benefits. The source of most of the cost is employing contractors and service providers to implement the necessary energy upgrades to hit the combined policy targets. Through 2035, projected Atlanta-specific benefits are $2.5 billion, and come at a cost of $1.05 billion. As a result, this combination policy option is projected to deliver net benefits of $1.46 billion at a benefit-cost ratio of 2.4. As noted in the prior sections, the Disclosures policy has the best benefit-cost ratio, while the equity-centered green bank is the largest provider of net benefits.

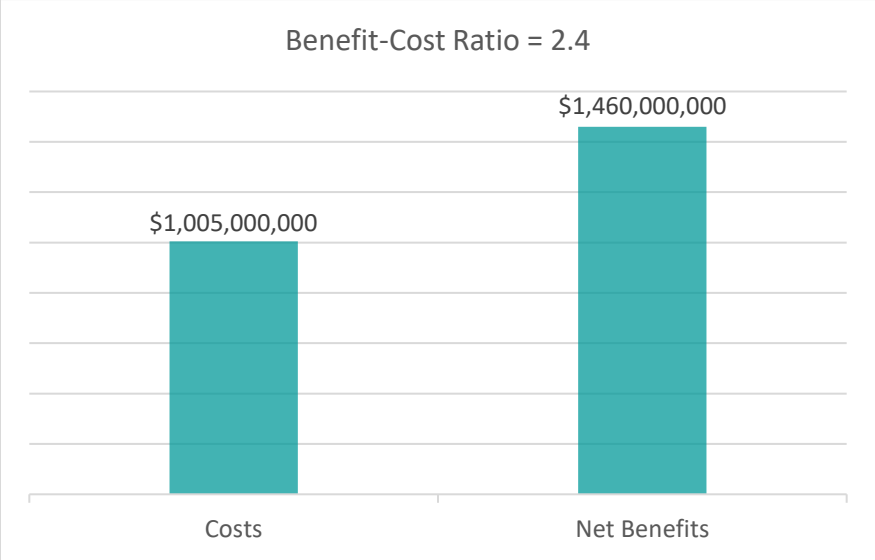


Figure 8: Benefit-Cost Ratio of *Decarbonize Atlanta* Policy Recommendations

Taking Action Now

The benefits of the building decarbonization policies identified in this roadmap rely on early and bold action by City leadership, starting today. These are ambitious, visionary actions will require genuine commitment and strong political will to bring to fruition. What the City does in the next decade will determine the success of *Decarbonize Atlanta*. It is vital to lay a solid foundation now. The following table outlines the actions the City must take within the next decade to fully implement building decarbonization by 2050.

Table 14: First Decade of Recommended Policy Actions

	Green Bank	Municipal Building Policy	New Construction	Building Performance Standard	Time of Lease	Embodied Carbon
2021		Begin stakeholder process	Establish taskforce & stretch code incentives	Benchmark 80% of buildings & Launch PACE	Form working group	Define goals
2022	Identify gaps and legal requirements	Catalog buildings & draft updated policy	Energy code training	Community & stakeholder engagement	Pass ordinance	Incorporated in municipal projects
2023	Design green bank program	Pass ordinance	Adopt updated energy code	Pass BPS ordinance	Launch clean energy resource center	Establish incentive program
2024	Capitalize funds	Implement policy		Create Office of Building Performance	Execute voluntary pilot program	
2025	Launch Green Bank	Establish plan to phase out fossil fuels from municipal buildings	Energy code training	Launch Building Innovation Hub		
2026			Adopt updated energy code			
2027				Enforce BPS	Implement policy	

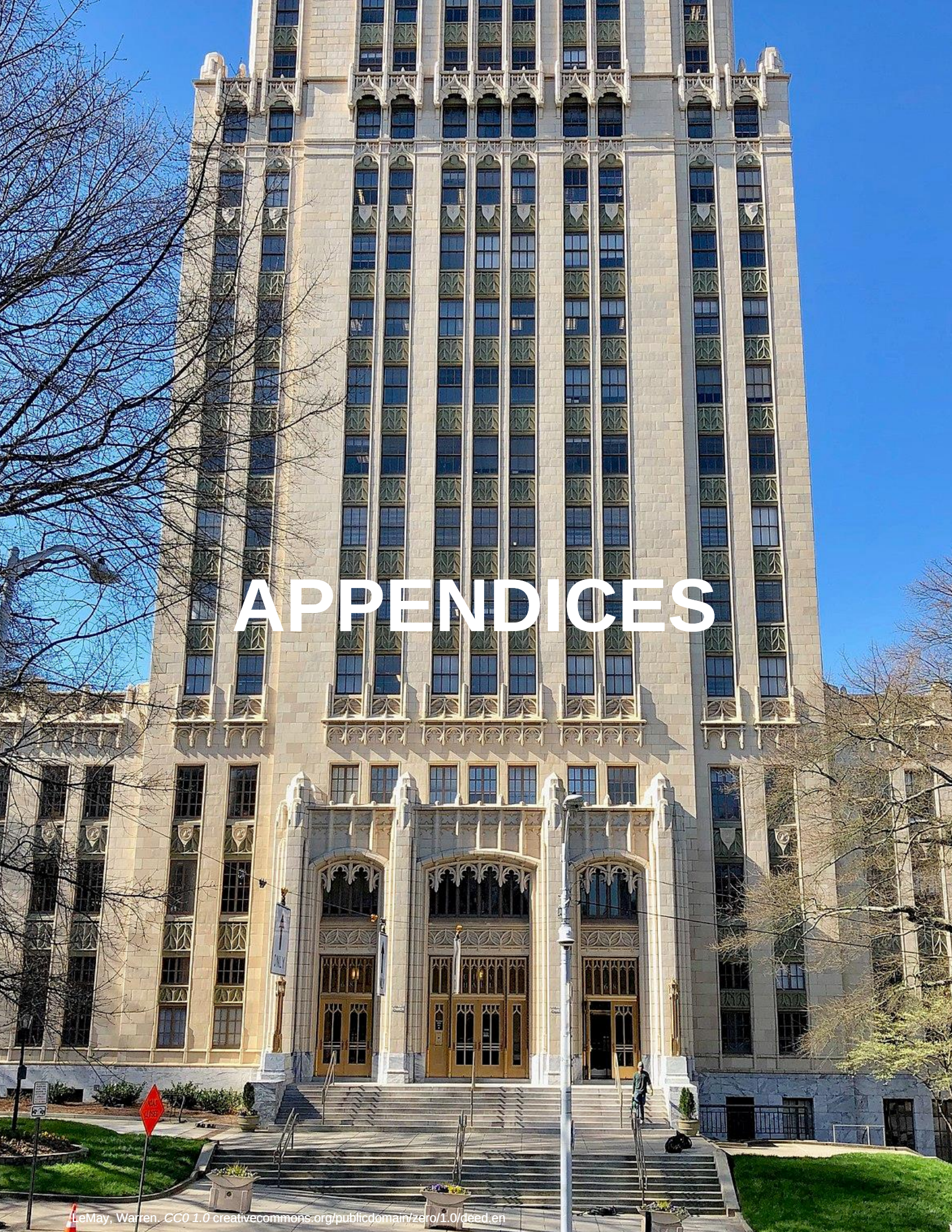
As it implements this roadmap over the next 10 years, the City will ensure racial and social equity remain at the center of all policy solutions to ensure equity is not an incidental by-product, but an intentional outcome. When carefully implemented with an equity lens, the decarbonization policies in this roadmap cultivate affordable housing and strengthen the capacity for growth of small and local businesses. A focus on preserving historically Black neighborhoods, dispelling arguments that it's more cost-effective to build or renovate luxury housing and using a combination of incentives and regulations will be required to achieve full building decarbonization while prioritizing the needs of all Atlantans.

Beyond 2030

If the City lays the foundation in the next decade by taking the actions identified above, the focus beyond 2030 will be on implementation and enforcement of the policies passed in the 2020s. Policy refinements will be critical to keeping up with changes in technologies, building stock, and the City's potential for evolving climate action goals. These policies will be time- and resource-intensive to enforce. From 2030 to 2050, the City will update its energy code and every three years train officials on changes to the code. By 2035, the City will reach the milestones of achieving building decarbonization in new construction, municipal buildings will all be net zero carbon, and buildings citywide will be built using low embodied carbon materials. By 2040, the City will likely need to extend the tranches of funding in its PACE and equity-centered green bank programs. And on an ongoing basis, the City will need to revisit its municipal building and BPS policies to ensure that they reflect changes in technology and policy.

For the duration of this transition, beyond enacting and implementing building decarbonization initiatives, there are opportunities for the City to further accelerate citywide decarbonization. Continuous participation in the Georgia Power Demand Side Management and Integrated Resource Planning processes will position the City to further drive decarbonization through working to decarbonize the local electric grid. The City should also leverage the expertise of its Clean Energy Advisory Board to provide guidance and support in executing the decarbonization policies identified in this roadmap.

The road to a decarbonized Atlanta is not without obstacles. However, this roadmap demonstrates that a decarbonization goal is not only achievable but also necessary to create a more just, healthy, and resilient community.



Appendix A: PEST Analysis of Decarbonization Policy Solutions

The solutions included in the decarbonization roadmap are offered as those with the greatest potential to be the most impactful and viable solutions given decarbonization goals as well the current racial, political, and economic climate. While this roadmap details six priority solutions for the City of Atlanta to adopt to achieve decarbonization of Atlanta's existing and future building stock with an equity lens, 25 solutions were vetted for inclusion in the roadmap and detailed below.

Using an equity lens, the partners evaluated potential solutions within a PEST (Political, Economic, Social, Technological) Analysis framework. PEST is a strategic management tool through which an organization can assess major external factors that influence its programs, policies, and operations within a particular time period for strategic analysis and risk assessment. The four areas that make up the acronym are critical to the model. When utilized with an equity lens, it provides a framework for critical yet strength-based inquiry and examination of proposed policies and solutions.

Policy	Comm.	Res.	Description	P	E	S	T	Overall Impact (Carbon)	PEST Score (Composite 1-15)
Assessing Zoning Code for Additional Opportunities	**X**	**X**	Assessing current Zoning Code to identify opportunities to ease on-site solar development for property owners. Code amendments may address issues such as density, building height, or tree canopy. In an addition to an assessment of current zoning code, this would require stakeholder engagement with solar industry, and zoning code revisions.	1	2	1	3	1	**8**
Building Audits, Retuning, or Retrocommissioning Policy	**X**		Mandates or encourages existing buildings of a designated size to undergo building energy audits, retuning, and/or retrocommissioning in order to make building energy improvements.	2	2	2	2	2	**10**
Building Energy "Stretch" Code	**X**	**X**	Requires the City's buildings energy codes to be more efficient than the current adopted state code. State-level codes are updated every three years.	2	1	2	2	2	**9**
Building labeling policies	**X**	**X (MF Only)**	Affix labels to the exterior of large commercial buildings indicating their energy performance with a "grade" incentivize building owners and managers to increase their buildings' energy performance.	1	1	1	2	2	**7**

Policy	Comm.	Res.	Description	P	E	S	T	Overall Impact (Carbon)	PEST Score (Composite 1-15)
Building Performance Standard (BPS)	**X**	**X (MF Only)**	Sets minimum required energy efficiency (through prescribed EUI or ENERGY STAR requirement) or carbon emissions (through prescribed carbon emissions cap) standard for exiting buildings (and/or new buildings).	2	1	2	2	3	**10**
Education on Programs and Technology Applications (aka "Incentives Education Programming")	**X**	**X**	Promotion of existing energy efficiency programs and opportunities to residential and commercial customers who would benefit most.	3	2	3	2	1	**11**
Efficient Equipment Procurement Policy	**X**		Requires the City of Atlanta to procure only high-efficiency options when replacing or purchasing new equipment for its municipal buildings portfolio.	2	1	2	3	1	**9**
Green Building Permit Incentives	**X**	**X**	Building construction projects provided with incentives such as faster permit processing, additional height, floor area, or density if it achieves a green building rating.	2	2	1	2	2	**9**
Green Lease	**X**		Green leasing or high-performance leasing can align landlord and tenant goals and work to reduce or eliminate the split incentive issue distributing the costs and benefits of energy and water efficiency investments across both parties.	2	2	2	2	1	**9**
Grid-integrated buildings	**X**		Require grid-integrated efficient buildings which use a combination of energy efficiency, renewable energy, energy storage, connectivity into the grid, and smart controls which allow load flexibility technologies. When managed well, grid-integrated buildings can offer financial savings, improve building performance and be a more resilient building and help ensure a more reliable grid.	1	1	1	1	2	**6**
Increased Energy Efficiency - Deep energy retrofits	**X**		Deep energy retrofits require intensive whole-building analysis and construction processes sometimes implemented over several years. A deep energy retrofit is a powerful way to reduce energy waste and achieve significant energy cost savings - sometimes as much as a 50% reduction or even more.	1	2	2	2	3	**10**
Increased installation of renewables	**X**	**X**	Promote and increase installation of renewable energy sources, i.e. solar.	3	2	1	1	2	**9**

Policy	Comm.	Res.	Description	P	E	S	T	Overall Impact (Carbon)	PEST Score (Composite 1-15)
Modify permitting process to encourage electrification	**X**	**X**	Electrification readiness requirements mandate that buildings be set up to electrify in the future, at point of sale or at rental turnover. These requirements may be more suitable for single-family homes and small multifamily and commercial buildings.	2	2	3	2	2	**11**
Net Zero Energy (NZE) Code	**X**		Implements city-specific building and energy codes which would require buildings to provide as much energy as they consume. A NZE Code would go above and beyond stretch energy codes and would offer innovative pathways for compliance, such as renewables installation or carbon offsets.	1	1	1	1	3	**7**
Pay As You Save Program		**X**	An on-bill financing or "Pay As You Save" (PAYS) program would work with the electric utility provider to allow homeowners to finance energy efficiency projects through monthly payments on their electricity bills.	3	3	3	3	2	**14**
Periodic lighting upgrades in large buildings	**X**	**X (MF Only)**	Requires common areas in multifamily residential buildings and all areas in non-residential buildings to upgrade lighting to meet the current city-specific energy conservation code by a designated year.	3	3	2	3	1	**12**
Promote "Green" Loans	**X**		Green loans are loans that are granted specifically to fund "green" projects such as energy efficiency improvements, green building, and renewable energy installations. Cities, specifically offices of sustainability and economic development departments, can play a role in promoting such loans through educational programming.	3	2	2	2	1	**10**
Residential rental units require a rental license that requires a minimum level of efficiency.		**X**	Mandates that a rental license must be approved for a property to be used as a rental or advertised as a rental in any manner. Approval of a rental license would be dependent on the results of required inspections that determine whether a property complies with standards for health/safety, mechanical systems, and energy efficiency.	1	1	1	1	1	**5**
Small & Medium Building Retrofit Policy	**X**		Mandates building performance improvements for existing small and medium buildings and requires building retrofits in order to achieve the target energy savings.	1	1	1	2	2	**7**

Policy	Comm.	Res.	Description	P	E	S	T	Overall Impact (Carbon)	PEST Score (Composite 1-15)
Solar + Storage	**X**	**X**	Battery storage deployed in residential and commercial buildings which have installed solar panels, to capture the energy generated from solar that may otherwise not be used or would be sent back into the grid.	1	1	1	1	3	**7**
Time of lease energy performance disclosure	**X**	**X**	Requires owners of commercial and/or residential buildings to disclose their building's energy performance at the time of lease. This could be an Energy Star score, Home Energy Rating System (HERS) rating, or other metric.	2	2	1	3	2	**10**
Time of sale energy performance disclosure	**X**	**X**	Requires owners of residential and/or commercial buildings to disclose their building's energy performance at the time of sale. This could be an Energy Star score, Home Energy Rating System (HERS) rating, or other metric.	2	3	3	3	2	**13**
Water Conservation Programs and Policies	**X**	**X**	Policies requiring water conservation measures. Examples include installation of high-efficiency toilets, fixture replacements, fixing leaky pipes, and looking at greywater or rainwater systems.	2	3	3	3	1	**12**

Appendix B: Municipal FirstView Analysis

FirstView® is a software tool that enables users to extract targeted and insightful energy performance information from monthly billing data. FirstView works by automatically creating a simplified building energy model that is auto-calibrated to match the building's measured energy use. The auto-calibration matches the weather-normalized model to the measured energy use with an iterative inverse modeling approach which tracks several key operational variables, including set points, equipment efficiencies, and other building characteristics. More information on the FirstView model is available on the New Buildings Institute webpage[54]. The calibrated model is then used to disaggregate energy end uses, provide energy use diagnostics, and develop benchmarks for comparison.

FirstView uses an Energy Signature plot to analyze performance patterns of the building. An Energy Signature is a graph of energy use (vertical axis) in relation to outside temperatures (horizontal axis) for the same period. This reveals key performance indicators as an algebraic function, for example the slope of the heating curve or the height of the electric baseload. The Energy Signature plot enables FirstView to conduct comparisons, such as automated diagnostics and advanced benchmarking.

- **Automated Diagnostics**. FirstView automatically compares mathematic parameters revealed in the Energy Signature to thresholds in eight areas: heating and ventilation efficiency, cooling efficiency, controls, reheat, thermal baseload, light and plug loads, external/process loads, and data consistency. NBI sets diagnostic thresholds based on past experience and comparisons of a particular group of buildings. This enables the tool to quickly and automatically identify poor, average, or high energy performance and directs attention to specific areas that warrant more attention. Each of the automated thresholds is specifically designed based on NBI's past experience drawing from a growing database of previously analyzed buildings.
- **Advanced Benchmarking**. FirstView goes beyond an Energy Use Intensity (EUI) commonly used in benchmarking to graphically illustrate how a building compares to its peers. For this project, NBI developed a custom spectrum based on the building set for this project. This carefully defined spectrum represents the 25th and 75th percentile of building performance and serves as a comparison for all of the buildings to each other. Other spectra for specific building types are also included. These building type specific spectra are generated from a combination of previously analyzed buildings and buildings within this portfolio to compare the portfolio on a national scale. Additional high-performance benchmarks are included in the report to give broader context and aid in target setting.

[54] More information on FirstView is available here: https://newbuildings.org/resource/firstview/

Methodology

Data Received and Pre-Screening

NBI received data for 112 properties in the City of Atlanta. Of those 112 properties, several were either not “buildings” or were missing sufficient data for a successful analysis. 25 properties were not good candidates for analysis, including wastewater facilities, parks, and other “non-buildings”. The energy consumption for these properties is either not weather-dependent or are not strongly correlated to size (e.g., wastewater treatment plants and parks). Of the remaining 87 properties, six had missing or irregular data. NBI analyzed the remaining 81 buildings for this report, though some of those may have inaccuracies in energy data that are undetectable without further knowledge of the individual buildings.

Table 15: Property Summary

Property Name	Analysis Status
Chastain Memorial Park	Missing data
Corrections-Jail and Municipal Court**	Included in report
DOA - Airborne Express - Nrth Cargo	Included in report
DOA - Fire Station 24	Included in report
DOA - Fire Station 32	Included in report
DOA - Fire Station 33	Included in report
DOA - Fire Station35	Included in report
DOA - Fire Station40	Included in report
DOA - Maint Fuel Island Pumps	Not a good candidate
DOP-225 Forsyth St. Parking Facility	Not a good candidate
DPRCA-Adair Park ~ Warehouse	Included in report
DPRCA-Adams Park - Rec Building	Included in report
DPRCA-Adamsville Recreation Center**	Included in report
DPRCA-Anderson Park Rec Center	Included in report
DPRCA-Arthur Langford Park/Rec Ctr	Included in report
DPRCA-Atlanta Civic Center	Property Sold - Excluded
DPRCA-Atlanta Memorial Park	Not a good candidate
DPRCA-Ben Hill - Recreation Center**	Included in report
DPRCA-Bessie Branham Rec. Bldg.	Included in report
DPRCA-Butler Park-Rec Center	Included in report
DPRCA-Cabbagetown Park	Not a good candidate
DPRCA-Candler Park-Bath House	Not a good candidate
DPRCA-Central Park-Rec Center ~ Gym	Included in report
DPRCA-Coan Multi Purpose Field	Not a good candidate
DPRCA-Collier Park-Recreation Center	Included in report
DPRCA-Cornelius Adolphous Scott Rec.	Included in report
DPRCA-Donald Lee Hollowell	Missing data
DPRCA-English Park-Rec Center	Included in report
DPRCA-Grant Park-Atlanta Cyclorama	Property Sold - Excluded
DPRCA-Grant Park-Rec Center ~ Gym	Included in report

Property Name	Analysis Status
DPRCA-Grove Park ~ Rec Center**	Included in report
DPRCA-J. D. Sims Rec Center	Included in report
DPRCA-Lang-Carson Rec Center	Included in report
DPRCA-M.L.K. North Natatorium	Not a good candidate
DPRCA-M.L.K. Recreation Center**	Included in report
DPRCA-Maddox Park-Greenhouse	Included in report
DPRCA-Margaret Mitchell Square	Missing data
DPRCA-Oakland Cemetery-Sexton Bldg.	Included in report
DPRCA-P.Tree Hills Rec Center ~ Gym	Included in report
DPRCA-Perkerson Park ~ Rec Center	Included in report
DPRCA-Piedmont Park	Not a good candidate
DPRCA-Piedmont Pk-Pool ~ Bath House	Not a good candidate
DPRCA-Pittman Park~Rec Ctr Pool-Bath	Not a good candidate
DPRCA-Powell Pool ~ Bath House	Not a good candidate
DPRCA-Rosel Fann Community Ctr**	Included in report
DPRCA-S.side Sports Cmplx Rec Bldg.	Included in report
DPRCA-Southbend Ctr Arts ~ Culture	Included in report
DPRCA-Thomasville Heights-Rec Ctr	Included in report
DPRCA-Washington Park Natatorium**	Included in report
DPRCA-Wesley Coan Park-Rec Center	Included in report
DPRCA-Zaban Recreation Bldg.	Included in report
Fire Station 1	Included in report
Fire Station 10	Included in report
Fire Station 11	Included in report
Fire Station 12	Included in report
Fire Station 13	Included in report
Fire Station 14	Included in report
Fire Station 15	Included in report
Fire Station 16	Included in report
Fire Station 17	Included in report
Fire Station 18	Included in report
Fire Station 19	Included in report
Fire Station 2	Included in report
Fire Station 20	Included in report
Fire Station 21	Included in report
Fire Station 22	Included in report
Fire Station 23	Included in report
Fire Station 25	Included in report
Fire Station 26	Included in report
Fire Station 27	Included in report
Fire Station 28	Included in report
Fire Station 29	Included in report

Property Name	Analysis Status
Fire Station 3	Included in report
Fire Station 30	Included in report
Fire Station 31	Included in report
Fire Station 34	Included in report
Fire Station 38	Included in report
Fire Station 4	Included in report
Fire Station 5	Included in report
Fire Station 7	Included in report
Fire Station 8	Included in report
Fire Station 9	Included in report
Fire Training Facility	Property Decommissioned - Excluded
Hemphill Water Treatment Plant & Pumping Station	Not a good candidate
OEAM-City Hall**	Included in report
OEAM-Dunbar Recreation Center**	Included in report
OEAM-GA. Hill Neighborhood Ctr**	Included in report
OEAM-John Birdine Neighborhood CTR	Included in report
OEAM-Municipal Court**	Missing data
OEAM-Old AJC Bldg-130 Upper Wall St.**	Included in report
OEAM-Public Safety Annex**	Included in report
OEAM-Public Safety Hqtrs Building**	Included in report
Police Dept. Academy	Missing data
Police Training Academy	Missing data
Police Zone 1	Included in report
Police Zone 3 - Cherokee Ave	Included in report
Public Works-Motor Transport**	Included in report
Public Works-Pipeyard Trailers	Not a good candidate
PW Motor-Svc-Bldg.-Howell Mill Rd	Included in report
PW ST. OPS-Traffic Signals-Flashers	Not a good candidate
Water-Maintenance Bldg.-Hemphill Ave	Not a good candidate
Water-Treat.Plt-Hemphill-Howell Mill	Not a good candidate
Water-Treatment Plant-Chattahoochee	Not a good candidate
WW-Clear Creek CSO	Not a good candidate
WW-Custer Avenue CSO	Included in report
WW-Intrenchment Crk Plant-Treatment-	Not a good candidate
WW-McDaniel Street -CSO	Not a good candidate
WW-R. M. Clayton Plant (Treatment)	Not a good candidate
WW-South River Plant (Treatment)	Not a good candidate
WW-Tanyard Creek CSO	Not a good candidate
WW-Utoy-Creek Plant (Treatment)	Not a good candidate
WW-Warehouse-Office-Englewood Ave	Included in report

**This property is part of the City of Atlanta's Energy Savings Performance Contract

Input Data and Assumptions

For this report, NBI used the most recent 12 months of complete, available data for the primary FirstView analysis. For most buildings, data are from calendar year 2018. A few buildings use 2017 data due to incomplete data availability for 2018. FirstView automatically collects the average temperature for each billing period from a database of historic weather data from the building's zip code or city. The detailed FirstView data tables also include a calculation of weather normalized site EUI. The normalized EUI is calculated using typical meteorological year data (TMY3) from a nearby weather station.

Peer Building Comparison

For this portfolio analysis, NBI included several comparison spectrums to compare building performance to similar, peer buildings. In cases where a clear distinction of similar building types could not be established (for example, "other" building types), NBI created a custom building spectrum based on FirstView analyses of the properties analyzed in this portfolio in order to benchmark each building's energy relative to other properties in Atlanta. In order to create the spectrum, NBI examined the statistical distribution of the FirstView model results for each building. The lower boundary of the spectrum represents the 25th percentile, and the upper boundary the 75th percentile, of building energy use relative to outside air temperature for the full set of buildings in that category.

FirstView End Uses

FirstView breaks down the total energy use into four end use categories, as described below:

- **Electric Baseload.** If there is a period during the year where no heating or cooling is utilized, the only electric energy use in a building is electric baseload. In FirstView, Electric Baseload is calculated as the sum of lighting, plug loads, year round fans/pumps, consistent process loads and electric water heating. FirstView recognizes that these elements of a building's electricity consumption are relatively constant throughout the year and are independent of outside temperature.
- **Heating.** Heating energy is derived in FirstView by analyzing the estimated internal gains, overall heat transfer coefficient, and modeled equipment efficiencies of a building. Using this information, FirstView calculates the energy used for heating (including estimated electricity consumption for fan and pump operation).
- **Cooling.** Cooling energy is derived in FirstView by analyzing the estimated internal heat gains, overall heat transfer coefficient and modeled equipment efficiencies of a building. Using this information FirstView calculates the electrical energy used for cooling (including estimated fan and pump energy use).
- **Thermal Baseload.** Thermal Baseload is derived in FirstView by analyzing a building's summer thermal fuels (natural gas, district steam, or district hot water) use. Typically, this is gas that is used for service water heating. However, some buildings may have additional year-round thermal demand in the form of gas process loads (such as kitchen or laundry equipment).

FirstView Diagnostics

FirstView can provide automated diagnostics for specific building types (offices and buildings broadly similar to office buildings in their usage) in seven categories. The various diagnostics are described below:

- **Shell and Ventilation Efficiency.** The shell and ventilation efficiency are represented by an aggregate U-value, referred to as UA, which describes how efficiently a building responds to changes to outdoor air temperature. A higher UA value means that as the temperature drops, more energy will be needed for heating. Under the same conditions, a building with a lower UA value would use less energy for heating. Previous analyses of office and similar building types have shown that buildings with a UA value greater than 0.3 Btu/(°F-hr-sf) may have inefficiencies in their shell and ventilation, including excess infiltration.
- **Lighting and Plug Loads.** The magnitude of a building's electric baseload is estimated by FirstView's inverse energy model, which includes a calculation of internal heat gain, represented by Q_{in}. This is the estimated watts per square foot that are used inside the thermal envelope of the building, typically composed of lighting and plug loads. For this custom portfolio analysis, NBI analyzed the statistical distribution of Q_{in}. Buildings with a Q_{in} value greater than 1.45 Watts/sf are flagged as having a "high electric baseload". Q_{in} values lower than 0.95 Watts/sf are flagged as "low electric baseload."
- **Thermal Baseload.** Thermal baseload is also estimated by the FirstView inverse energy model. This calculation examines thermal fuel use during the two warmest months of the year (summer). During the warmest months of the year, gas consumption for space heating is typically minimal or zero. Summer gas consumption is attributed to water heating. Calculated thermal baseload energy is converted to an estimate of domestic hot water use (DHW), expressed in gallons/(day-sf). This estimated DHW use is independent of the actual metered water usage at the building.
- **Controls.** The controls indicator compares the amount of heating and cooling that is used in a building to the amount that would be expected for that building, given the calculated occupant loads, shell and ventilation characteristics, envelope, and equipment efficiencies. A large discrepancy between the used and expected values suggests that control errors are creating inefficiencies.
- **Reheat.** At the monthly data level, most buildings will show a slight level of overlapping heating and cooling use in the 50°F – 65°F average monthly temperature range. Excessive reheat is suggested by overlaps covering a wider temperature range, high levels of both heating and cooling, and high summer gas use.
- **External Process Loads.** All electrical loads which cannot be associated with heating, cooling, or internal lighting and plug loads are attributed to external process loads. These external process loads may indicate such loads as pumps, data centers, or other relatively demanding electrical loads.
- **Cooling efficiency.** In FirstView, the cooling efficiency is calculated through the inverse energy modeling process as a cooling coefficient of performance (COP). This COP is not directly analogous to the rated efficiency of equipment; rather, it is a measure of an entire building's response to increased outdoor air temperature. Buildings with a calculated COP greater than 3 are considered to have "good cooling efficiency". A COP of less than 2 is classified as "poor cooling efficiency".
- **Data consistency.** FirstView analyzes data consistency by measuring the goodness of fit between the FirstView inverse energy model and the measured monthly energy use data. This is expressed as an R^2 value. Most buildings show a consistent relationship between outdoor air temperature and energy use, which can be accurately modeled by FirstView with an R^2 of 0.85-.9 or better. R^2 values below 0.85 are classified as having

irregular or “noisy” data. Irregular data may be caused by changes in a building, erratic controls, erroneous data, or a building with significant fluctuations in the number of occupants, occupant density, schedule of occupancy, or process loads that are not well correlated with temperature. Buildings with irregular or noisy data may still have valid analyses from FirstView, depending on the model fit and overall data pattern.

Benchmarking Results and Discussion

Portfolio Summary

To help visualize the consumption data for buildings in the portfolio, Figure 9 summarizes the site energy use intensity, size, and total consumption for each, color-coded by building type. The data reported is the most recent 12 months of full consecutive energy data for each building (typically 2018 data).

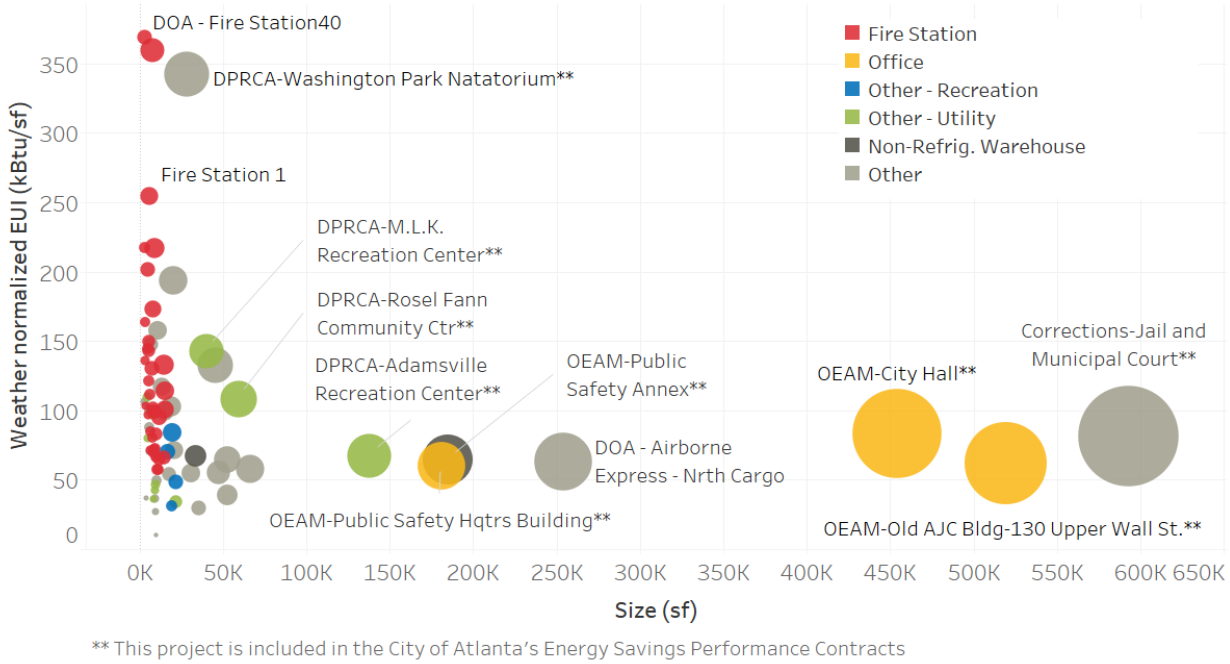


Figure 9: Map of building site EUI by building size for all analyzed buildings. Data points are color-coded by building type. Larger circles indicate more total annual energy use.

Buildings with high EUIs (y-axis) are less efficient and will likely be good candidates for energy savings. The larger and less efficient buildings generally have the greatest potential for energy savings. This same data is shown as a tree map below in Figure **10**. The size of the square indicates total energy usage, while the color indicates building type. Table 16 summarizes where the energy is consumed by building type for those buildings included in this report.

Table 16: Total energy use distribution by building type

Other	42%
Office	30%
Fire Station	12%
Other - Utility	9%
Non-Refrig. Warehouse	5%
Other - Recreation	2%

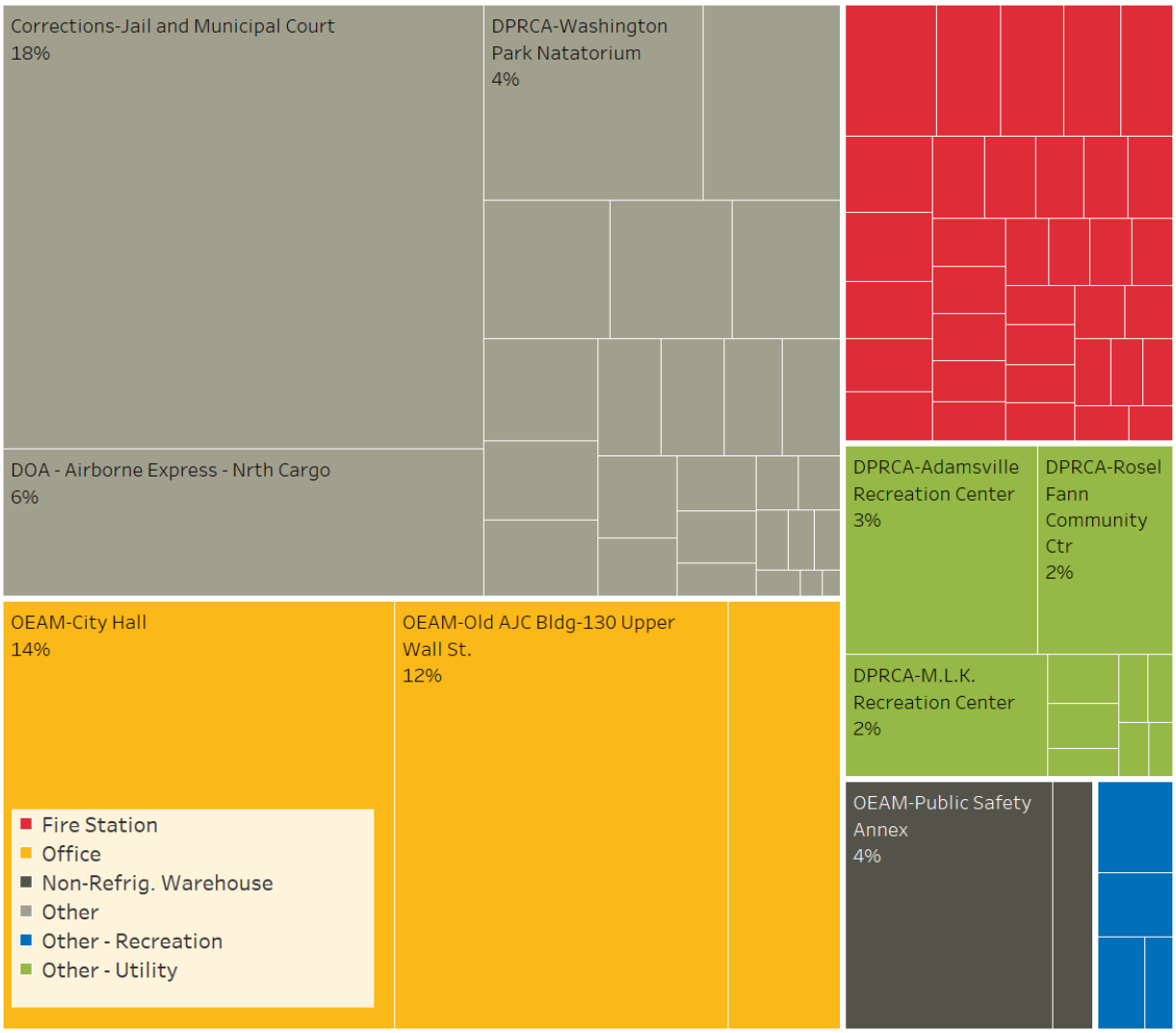


Figure 10: Tree map of total annual building energy use. The size of the blocks represents the amount of energy used, while the percentages indicate the share of the total analyzed portfolio energy consumption. The color scale indicates the building's type as defined in Portfolio Manager.

Facility Benchmarking

Taking a broader look at the portfolio as a whole, the individual buildings are compared to the full set as analyzed with FirstView. The primary comparisons include EUI by end use, total energy use by end use, and diagnostics which can be used to quickly inform decision makers of retrofit opportunity areas by building.

EUI and Total Energy Consumption

The stacked bar charts in Figure **11**, below, show the end use site EUI in the four primary end-use categories for each building. The buildings are grouped in the chart by building type for quick comparison. This holistic view of all analyzed buildings in this portfolio quickly provides some useful insights. The overall breakdown of end-use energy attribution shows that a small number of buildings account for the majority of the energy use for the buildings included in this analysis. This is a common breakdown of energy use in building portfolios of this size.

Many of the features of these figures are covered in the individual building reports, provided separately. Figure **11** through Figure **14** serve to show a high level summary of each building's performance compated to one another. The **building energy use intensity** is shown in Figure **11** and Figure **13**, while the **total energy consumption** for each building is shown in Figure **12** and Figure **14**. The buildings in the figures are grouped by type in order to allow for more detailed side-by-side comparison of building groups. Buildings with high energy usage and/or high EUIs may be good candidates for further investigation such as ASHRAE Level 2 energy audits and actions such as retro-commissioning, or retrofits. These buildings typically have the highest potential for bottom line energy savings, and should therefore be explored for potential savings opportunities that may have a larger impact on energy consumption. Note that certain buildings have higher than average EUIs but use relatively little energy overall. This is an important consideration to keep in mind when selecting buildings to further investigate for retrofit potential.

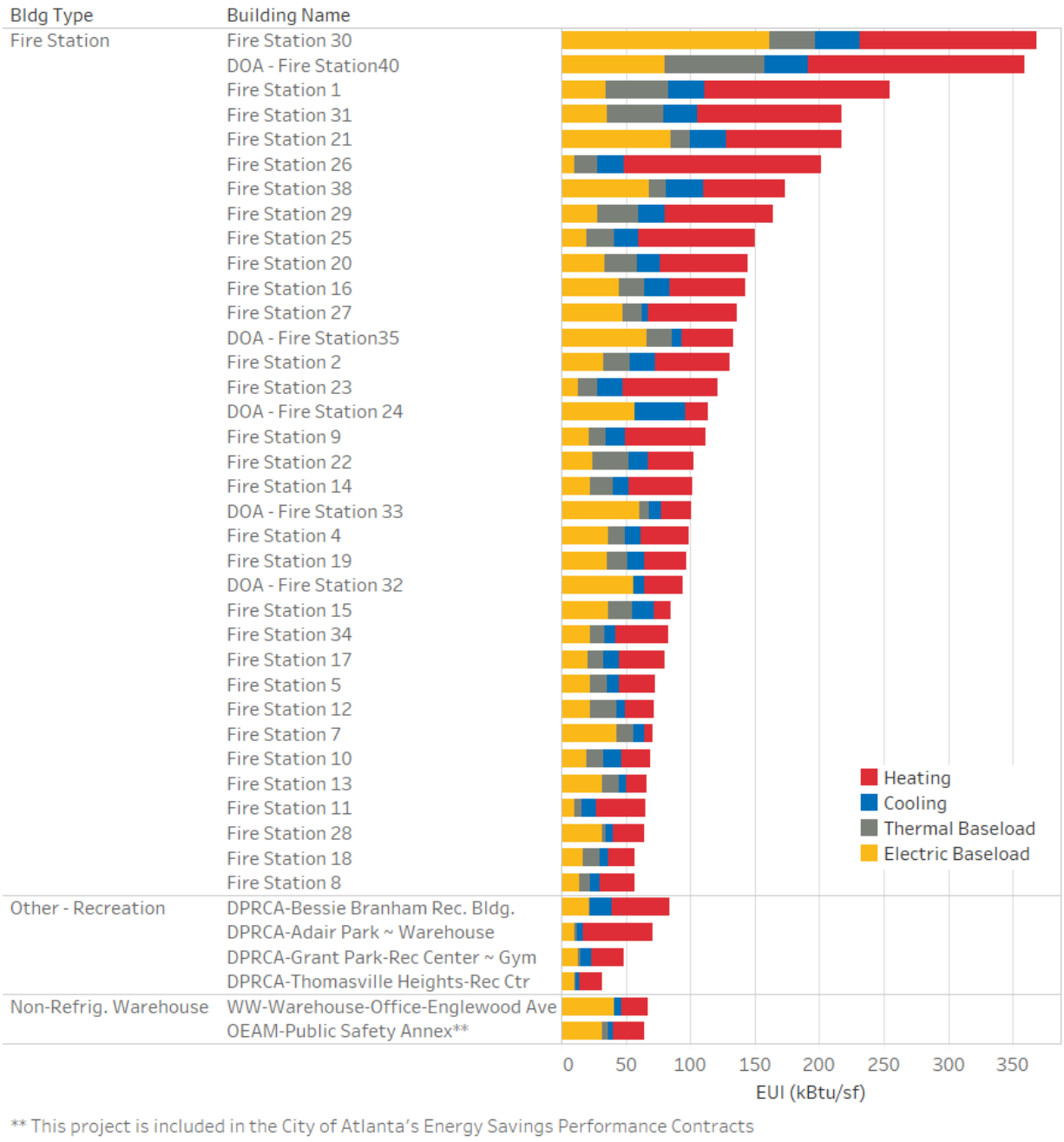
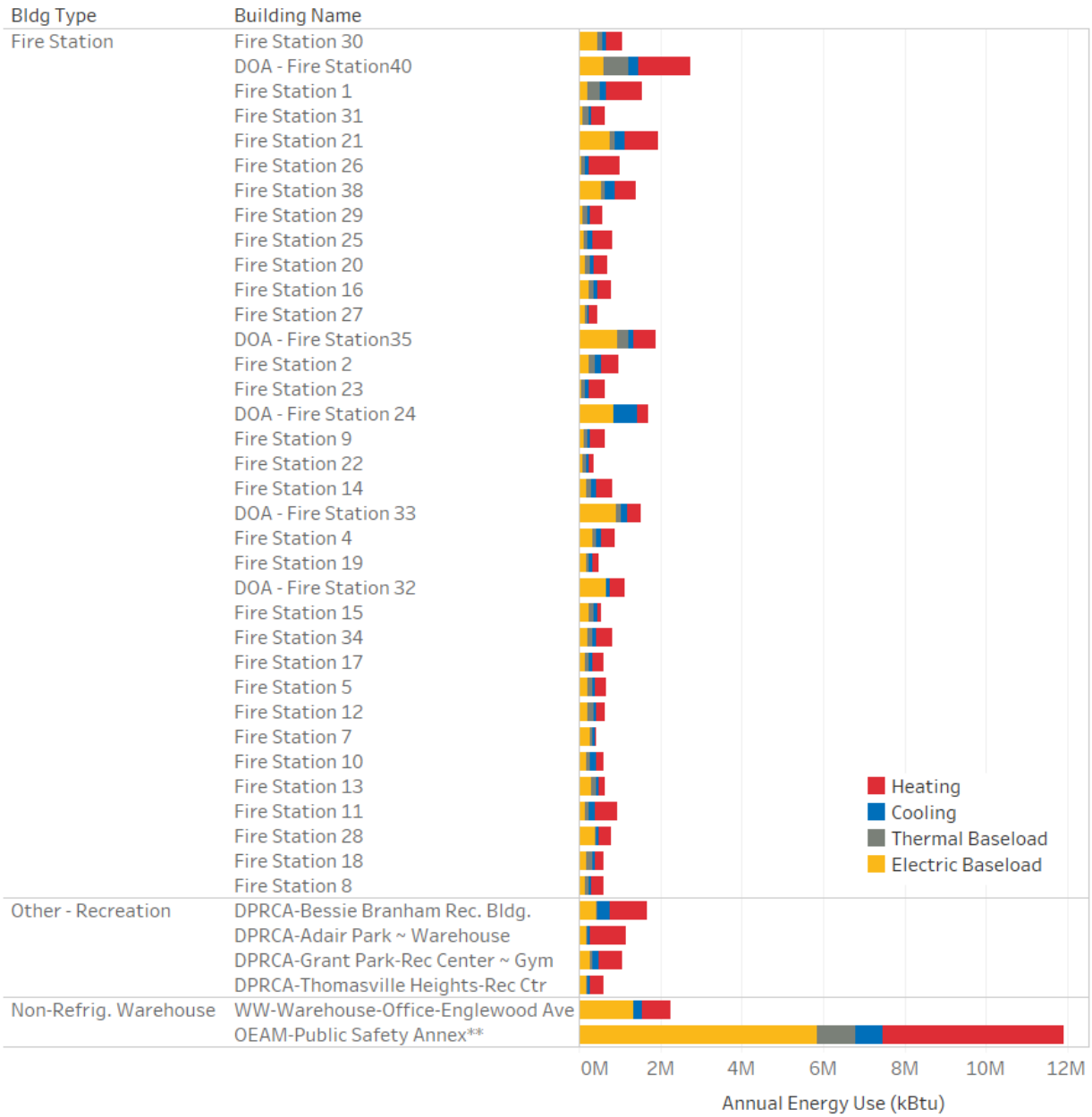


Figure 11: Disaggregated End Use Energy Intensity (kBtu/sf per year), Fire Stations, Recreation, and Warehouses



** This project is included in the City of Atlanta's Energy Savings Performance Contracts

Figure 12: Disaggregated Total End Use Energy Consumption (kBtu per year), Fire Stations, Recreation, and Warehouses

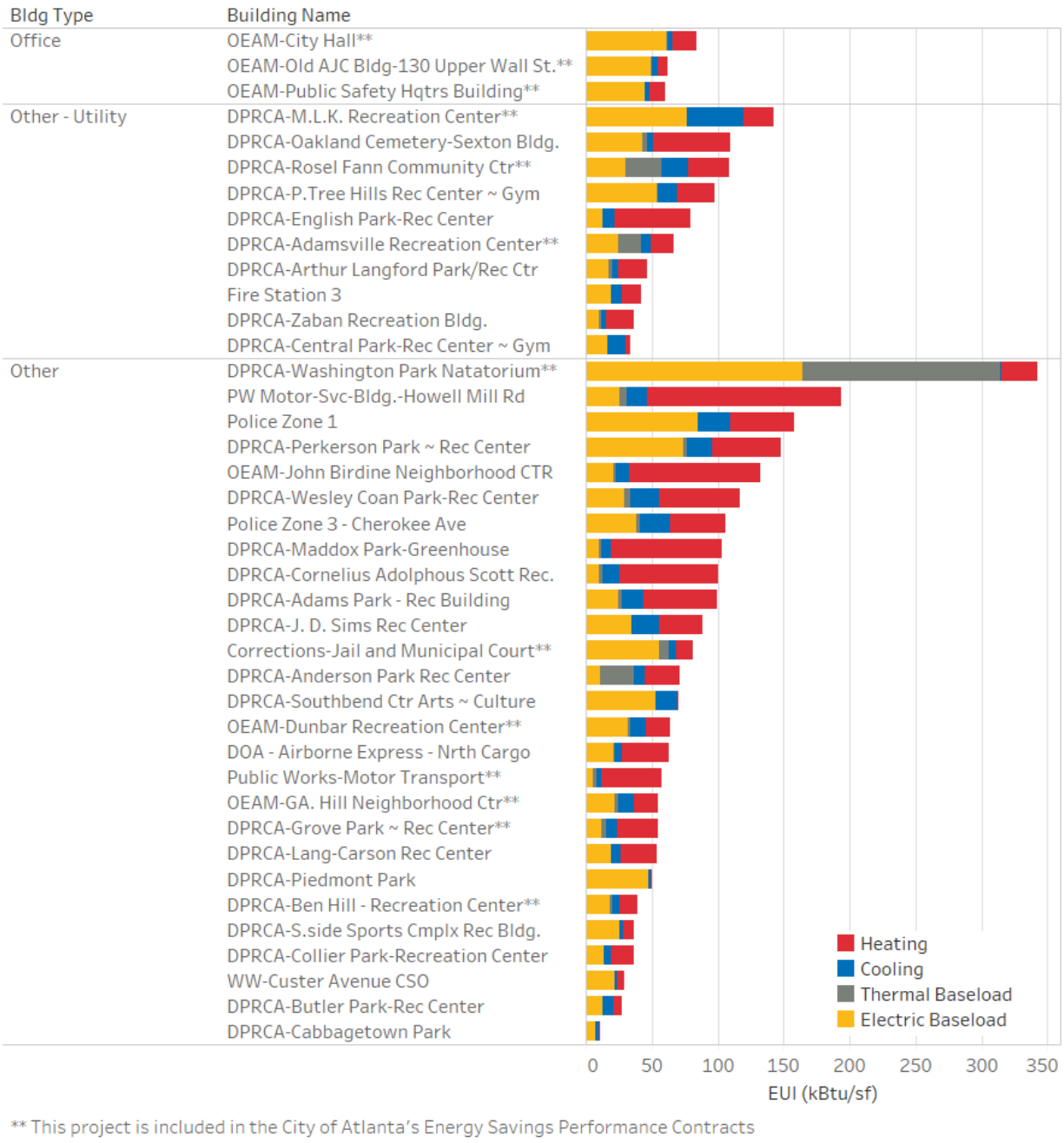


Figure 13: Disaggregated End Use Energy Intensity (kBtu/sf per year), Offices, Utility, and Other Types

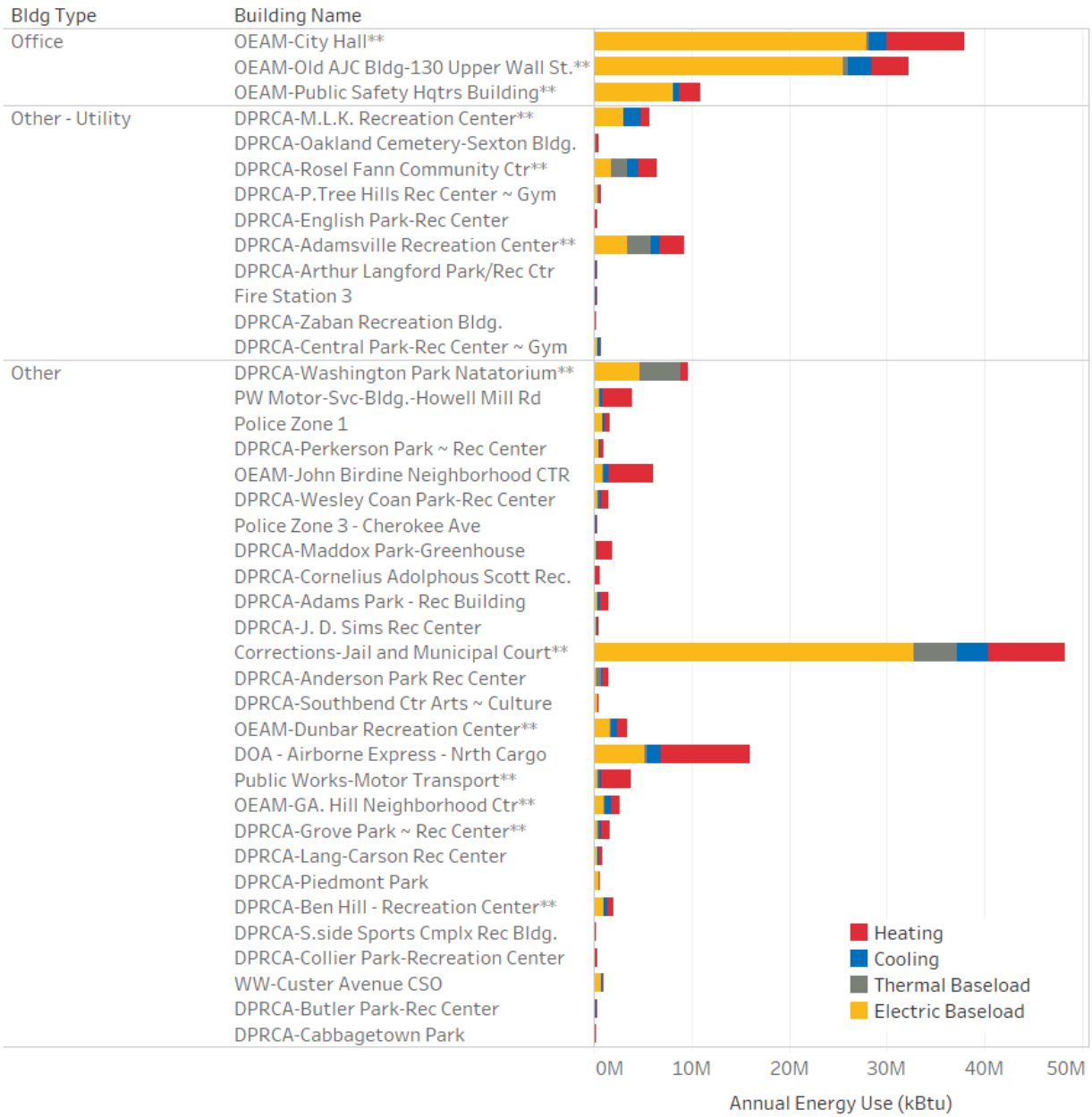


Figure 14: Disaggregated Total End Use Energy Consumption (kBtu per year) , Offices, Utility, and Other Types

Benchmarking Energy Performance

To put the energy performance of these buildings into context at a glance, we compare the weather-normalized site EUI of each building against a comparable benchmark. In this case, the benchmark is from the 2012 CBECS[55]. This allows us to further identify top priority buildings – those that are large, have a high energy intensity, and use more energy than benchmark buildings of a similar type. Benchmark comparisons are also provided in the individual building reports.

Of the 81 buildings listed below, 65 are above targets levels (68% of floor space), 24 of which are more than double the target level (9% of floor space). 13 of the buildings are at or below target levels (23% of floor space).

Table 17: Building Energy Performance Compared to a 2012 CBECS[55] Benchmark

Building Name	Size (ft²)	Weather-Normalized EUI (kBtu/ft²)	Benchmark EUI (kBtu/ft²)	Percent Over Benchmark
DOA - Fire Station 24	14,915	114	56	**+102%**
DOA - Fire Station 32	12,034	95	56	**+68%**
DOA - Fire Station 33	15,178	101	56	**+78%**
DOA - Fire Station35	14,245	133	56	**+136%**
DOA - Fire Station40	7,643	359	56	**+537%**
Fire Station 1	6,087	255	56	**+351%**
Fire Station 2	7,500	130	56	**+131%**
Fire Station 4	8,964	99	56	**+76%**
Fire Station 5	9,090	73	56	**+29%**
Fire Station 7	6,178	71	56	**+26%**
Fire Station 8	10,525	57	56	**+1%**
Fire Station 9	5,831	112	56	**+98%**
Fire Station 10	8,862	69	56	**+23%**
Fire Station 11	14,445	66	56	**+16%**
Fire Station 12	8,822	71	56	**+27%**
Fire Station 13	9,659	66	56	**+17%**
Fire Station 14	8,000	101	56	**+80%**
Fire Station 15	6,500	85	56	**+50%**
Fire Station 16	5,580	143	56	**+153%**
Fire Station 17	7,468	80	56	**+42%**
Fire Station 18	10,845	57	56	**+1%**
Fire Station 19	5,024	97	56	**+71%**
Fire Station 20	4,849	145	56	**+157%**
Fire Station 21	8,925	217	56	**+285%**
Fire Station 22	3,408	103	56	**+83%**

[55] https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/pba3.php

Building Name	Size (ft²)	Weather-Normalized EUI (kBtu/ft²)	Benchmark EUI (kBtu/ft²)	Percent Over Benchmark
Fire Station 23	5,265	121	56	+114%
Fire Station 25	5,549	150	56	+166%
Fire Station 26	4,974	202	56	+257%
Fire Station 27	3,409	136	56	+141%
Fire Station 28	12,000	65	56	+15%
Fire Station 29	3,565	164	56	+191%
Fire Station 30	2,873	369	56	+554%
Fire Station 31	2,873	217	56	+286%
Fire Station 34	10,000	83	56	+47%
Fire Station 38	8,000	173	56	+207%
DPRCA-Adair Park ~ Warehouse	16,479	71	51	+38%
DPRCA-Bessie Branham Rec. Bldg.	19,763	84	51	+64%
DPRCA-Grant Park-Rec Center ~ Gym	21,735	48	51	-6%
DPRCA-Thomasville Heights-Rec Ctr	19,500	31	51	-39%
OEAM-Public Safety Annex**	184,764	65	56	+14%
WW-Warehouse-Office-Englewood Ave	33,276	68	57	+19%
OEAM-City Hall**	454,030	84	57	+47%
OEAM-Old AJC Bldg-130 Upper Wall St.**	519,082	62	57	+10%
OEAM-Public Safety Hqtrs Building**	180,932	60	57	+6%
DPRCA-Adamsville Recreation Center**	137,650	67	51	+31%
DPRCA-Arthur Langford Park/Rec Ctr	9,496	47	51	-9%
DPRCA-Central Park-Rec Center ~ Gym	21,780	34	51	-34%
DPRCA-English Park-Rec Center	4,697	80	51	+55%
DPRCA-M.L.K. Recreation Center**	39,862	143	51	+178%
DPRCA-Oakland Cemetery-Sexton Bldg.	4,294	110	49	+122%
DPRCA-P.Tree Hills Rec Center ~ Gym	8,200	98	51	+91%
DPRCA-Rosel Fann Community Ctr**	59,200	108	49	+120%
DPRCA-Zaban Recreation Bldg.	8,100	36	51	-29%
Fire Station 3	9,162	42	56	-25%
Corrections-Jail and Municipal Court**	592,786	81	92	-12%
DOA - Airborne Express - Nrth Cargo	253,962	63	N/A	-
DPRCA-Adams Park - Rec Building	15,450	99	51	+93%

Building Name	Size (ft²)	Weather-Normalized EUI (kBtu/ft²)	Benchmark EUI (kBtu/ft²)	Percent Over Benchmark
DPRCA-Anderson Park Rec Center	20,602	71	51	+38%
DPRCA-Ben Hill - Recreation Center**	52,446	39	51	-24%
DPRCA-Butler Park-Rec Center	9,583	27	51	-47%
DPRCA-Collier Park-Recreation Center	9,480	37	51	-29%
DPRCA-Cornelius Adolphous Scott Rec.	5,824	101	51	+96%
DPRCA-Grove Park ~ Rec Center**	30,613	55	51	+7%
DPRCA-J. D. Sims Rec Center	5,766	88	51	+72%
DPRCA-Lang-Carson Rec Center	17,550	54	51	+6%
DPRCA-Maddox Park-Greenhouse	18,944	103	N/A	-
DPRCA-Perkerson Park ~ Rec Center	6,621	148	51	+188%
DPRCA-S.side Sports Cmplx Rec Bldg.	3,659	37	51	-28%
DPRCA-Southbend Ctr Arts ~ Culture	6,200	71	49	+43%
DPRCA-Washington Park Natatorium**	28,250	343	N/A	-
DPRCA-Wesley Coan Park-Rec Center	13,200	117	51	+128%
OEAM-Dunbar Recreation Center**	52,411	64	51	+25%
OEAM-GA. Hill Neighborhood Ctr**	47,521	55	37	+50%
OEAM-John Birdine Neighborhood CTR	45,663	132	37	+261%
Police Zone 1	10,578	158	56	+180%
Police Zone 3 - Cherokee Ave	3,292	106	56	+88%
Public Works-Motor Transport**	66,019	58	45	+30%
PW Motor-Svc-Bldg.-Howell Mill Rd	20,255	194	45	+333%
WW-Custer Avenue CSO	35,424	29	44	-33%

***This Building is included in the City of Atlanta's Energy Savings Performance Contracts*

Fire Station Energy Signatures

Figure **15** focuses in on the most common building type in the portfolio – fire stations. The energy signatures plotted show the energy consumption on the y-axis as EUI, and outside air temperature on the x-axis. To the right of the figure, temperatures are hotter, and energy use increases as cooling loads such as air conditioning come online. To the left side of the graphic, energy use increases due to heating. The slope of these lines as well as how high the lines are in the temperate zone (65-75°F) each indicate different areas of building performance.

Several fire stations are highlighted in the graphic as poor performers relative to other fire stations in Atlanta, as well as fire stations nationally. The steep curves on the left side suggest a lot of energy is going to heating, which may be due to poor insulation, high infiltration rates,

and/or inefficient heating. The high energy consumption in the temperate range suggests high energy use from lighting and plug loads. Some of these fire stations may include call centers, which would explain the elevated year-round energy use.

More detail on each of the fire stations are included in the individual building reports, provided separately.

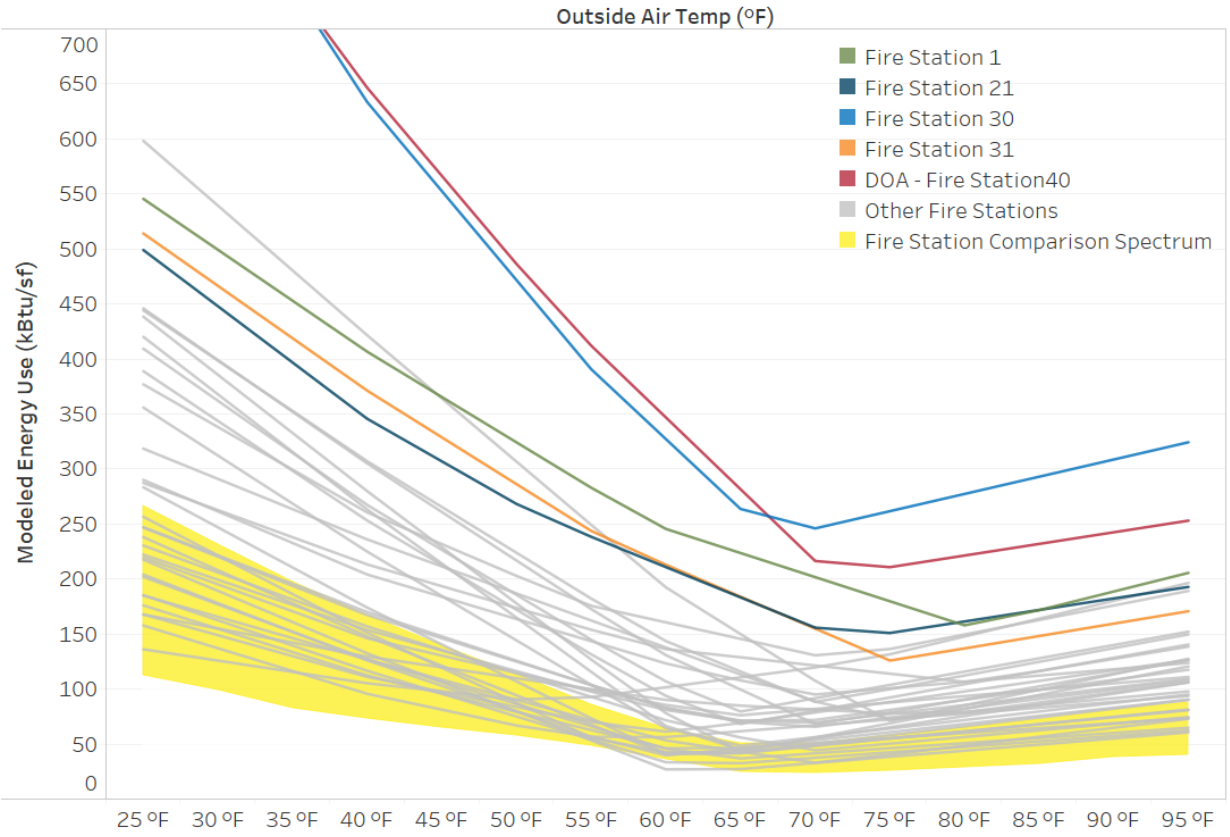


Figure 15: Energy signatures of each fire station analyzed in FirstView. The yellow band represents the middle 50% of energy performance observed from all fire stations historically analyzed in FirstView.

Diagnostics

A high-level perspective of the buildings presented above is given by a summary of FirstView diagnostics. The various diagnostics are defined as follows:

- **Occupant Load**: Estimated internal heat gain in the building due to people, lights, and plugs.
- **Shell and Ventilation Efficiency**: Winter weather dependent energy performance of the building, taking into account insulation, infiltration, ventilation rates, and HVAC heating efficiency.
- **Cooling Efficiency**: Summer weather dependent energy performance of the building, taking into account insulation, infiltration, ventilation rates, and HVAC heating efficiency.
- **Control Inefficiencies**: This estimates the concurrence of higher than expected heating and cooling loads, typically when the outside air temperature is between 50°F and 65°F.

- **Thermal Baseload**: Estimated energy usage attributed to domestic/service hot water and other temperature independent thermal loads.
- **Data Consistency:** Orderly building analyses typically have a model fit R^2 value of 0.9 or greater. Those analyses with an R^2 of less than 0.85-0.9 and inconsistent usage patterns are flagged as irregular. This should be considered when interpreting the results and conclusions as it will reduce the accuracy of the results and analysis.

The last column in the table below indicates whether the building was selected to be part of a guaranteed energy savings performance contract where energy conservation measures were installed in 2019-2020 or projected to be installed by 2022.

Building Name	Lights and Plug Loads	Shell and Ventilation Efficiency (Heating)	Cooling Efficiency	Control Problems	Thermal Baseload	Data Noise	Part of ESCO
Corrections-Jail and Municipal Court	High	Typical	Good	Moderate	High	Orderly	Yes
DOA - Airborne Express - North Cargo	Low	Typical	Typical	None	Typical	Orderly	No
DOA - Fire Station 32	High	Poor	Good	None	Typical	Orderly	No
DOA - Fire Station 33	High	Poor	Typical	None	High	Orderly	No
DOA - Fire Station35	High	Poor	Good	Large	High	Orderly	No
DOA - Fire Station40	High	Poor	Good	Large	High	Orderly	No
DPRCA-Adair Park ~ Warehouse	Low	Poor	Typical	None	Typical	Irregular	No
DPRCA-Adams Park - Rec Building	Low	Poor	Typical	None	Typical	Orderly	No
DPRCA-Adamsville Recreation Center	Low	Typical	Typical	Large	High	Orderly	Yes
DPRCA-Anderson Park Rec Center	Low	Poor	Good	None	High	Orderly	No
DPRCA-Arthur Langford Park/Rec Ctr	Low	Typical	Typical	None	Typical	Orderly	No
DPRCA-Ben Hill - Recreation Center	Low	Typical	Typical	None	Typical	Orderly	Yes
DPRCA-Bessie Branham Rec. Bldg.	Low	Poor	Typical	None	Typical	Orderly	No
DPRCA-Butler Park-Rec Center	Low	Good	Poor	None	Typical	Irregular	No
DPRCA-Central Park-Rec Center ~ Gym	Low	Typical	Poor	None	Typical	Irregular	No
DPRCA-Collier Park-Recreation Center	Low	Typical	Typical	None	Typical	Irregular	No
DPRCA-Cornelius Adolphous Scott Rec.	Low	Poor	Typical	None	Typical	Orderly	No
DPRCA-English Park-Rec Center	Low	Poor	Typical	None	Typical	Irregular	No
DPRCA-Grant Park-Rec Center ~ Gym	Low	Typical	Typical	None	Typical	Orderly	No

DPRCA-Grove Park ~ Rec Center	Low	Typical	Typical	None	Typical	Orderly	Yes
DPRCA-J. D. Sims Rec Center	Typical	Poor	Typical	None	Typical	Orderly	No
DPRCA-Lang-Carson Rec Center	Low	Poor	Good	None	Typical	Irregular	No
DPRCA-M.L.K. Recreation Center	High	Poor	Typical	None	Typical	Orderly	Yes
DPRCA-Maddox Park-Greenhouse	Low	Poor	Good	None	Typical	Orderly	No
DPRCA-Oakland Cemetery-Sexton Bldg.	Typical	Poor	Good	None	Typical	Orderly	No
DPRCA-P.Tree Hills Rec Center ~ Gym	High	Poor	Typical	None	Typical	Orderly	No
DPRCA-Perkerson Park ~ Rec Center	High	Poor	Typical	Large	Typical	Orderly	No
DPRCA-Rosel Fann Community Ctr	Low	Poor	Poor	Large	High	Orderly	Yes
DPRCA-S.side Sports Cmplx Rec Bldg.	Low	Good	Good	None	Typical	Orderly	No
DPRCA-Southbend Ctr Arts ~ Culture	High	Typical	Typical	None	Typical	Orderly	No
DPRCA-Thomasville Heights-Rec Ctr	Low	Typical	Typical	None	Typical	Orderly	No
DPRCA-Washington Park Natatorium	High	Poor	Good	Large	High	Orderly	Yes
DPRCA-Wesley Coan Park-Rec Center	Low	Poor	Typical	None	High	Orderly	No
DPRCA-Zaban Recreation Bldg.	Low	Typical	Typical	None	Typical	Orderly	No
Fire Station 1	Typical	Poor	Typical	Large	High	Irregular	No
Fire Station 10	Low	Poor	Typical	None	High	Orderly	No
Fire Station 11	Low	Poor	Typical	None	High	Orderly	No
Fire Station 12	Low	Poor	Typical	None	High	Orderly	No
Fire Station 13	Typical	Typical	Typical	None	High	Orderly	No
Fire Station 14	Low	Poor	Typical	None	High	Orderly	No
Fire Station 15	Typical	Typical	Poor	Moderate	High	Orderly	No
Fire Station 16	Typical	Poor	Typical	None	High	Orderly	No
Fire Station 17	Low	Poor	Typical	None	High	Irregular	No
Fire Station 18	Low	Poor	Typical	None	High	Orderly	No
Fire Station 19	Typical	Poor	Typical	None	High	Irregular	No
Fire Station 2	Typical	Poor	Typical	None	High	Irregular	No
Fire Station 20	Typical	Poor	Poor	Large	High	Orderly	No
Fire Station 21	High	Poor	Typical	Large	High	Orderly	No
Fire Station 22	Low	Poor	Typical	Moderate	High	Orderly	No
Fire Station 23	Low	Poor	Typical	None	High	Orderly	No
Fire Station 25	Low	Poor	Typical	Large	High	Orderly	No

Fire Station 26	Low	Poor	Typical	Large	High	Orderly	No
Fire Station 27	High	Poor	Good	None	High	Orderly	No
Fire Station 28	Typical	Poor	Good	None	Typical	Orderly	No
Fire Station 29	Low	Poor	Typical	Large	High	Orderly	No
Fire Station 3	Low	Poor	Typical	None	Typical	Irregular	No
Fire Station 30	High	Poor	Typical	None	High	Orderly	No
Fire Station 31	Typical	Poor	Typical	Large	High	Irregular	No
Fire Station 34	Low	Poor	Typical	Moderate	High	Orderly	No
Fire Station 38	High	Poor	Typical	Large	High	Orderly	No
Fire Station 4	Typical	Poor	Typical	Moderate	High	Orderly	No
Fire Station 5	Low	Poor	Typical	None	High	Irregular	No
Fire Station 7	Typical	Typical	Typical	None	High	Irregular	No
Fire Station 8	Low	Poor	Typical	None	High	Orderly	No
Fire Station 9	Low	Poor	Typical	None	High	Irregular	No
OEAM-City Hall	High	Poor	Good	None	Typical	Orderly	Yes
OEAM-Dunbar Recreation Center	Typical	Typical	Typical	None	Typical	Orderly	Yes
OEAM-GA. Hill Neighborhood Ctr	Low	Typical	Typical	None	Typical	Orderly	Yes
OEAM-John Birdine Neighborhood CTR	Low	Poor	Typical	Large	Typical	Irregular	No
OEAM-Old AJC Bldg-130 Upper Wall St.	High	Typical	Good	None	Typical	Orderly	Yes
OEAM-Public Safety Annex	Typical	Typical	Good	Moderate	High	Orderly	Yes
OEAM-Public Safety Hqtrs Building	Typical	Typical	Good	None	Typical	Orderly	Yes
Other Fire Stations	High	Poor	Poor	None	Typical	Orderly	No
Police Zone 1	High	Poor	Typical	None	Typical	Orderly	No
Police Zone 3 - Cherokee Ave	Typical	Poor	Typical	None	Typical	Orderly	No
Public Works-Motor Transport	Low	Typical	Good	None	Typical	Orderly	Yes
PW Motor-Svc-Bldg.-Howell Mill Rd	Low	Poor	Typical	Large	High	Orderly	No
WW-Custer Avenue CSO	Low	Typical	Good	None	Typical	Irregular	No
WW-Warehouse-Office-Englewood Ave	Typical	Poor	Good	None	Typical	Orderly	No

These same diagnostics are available in the individual building reports, provided separately. It is important to note that the diagnostics for Occupant Load (Electric Baseload) and Shell & Ventilation Efficiency are derived from this dataset and will inherently be centered on “typical” values specifically for peer buildings, by building type. Automated diagnostics have been developed for office (and broadly similar) buildings. After noting high-priority buildings from

above, review the individual building reports and diagnostics to identify the first places to check potential areas for improvement in those buildings (e.g., HVAC controls).

Findings and Recommendations

The sections below summarize the findings of this report. Detailed reports for each building are provided separately.

Portfolio-Wide

Consideration of energy consumption by buildings in this portfolio must start with a broad review of all facilities. A review of the buildings studied in this portfolio indicates that electric baseload accounts for approximately 54% of the total energy use, as shown in Figure 16. This area may provide an opportunity for solutions that can be repeated across multiple facilities. The electric baseload can be targeted with lighting and plug load reduction programs, including traditional lighting retrofits as well as a review of scheduling and occupancy/daylight-based control solutions.

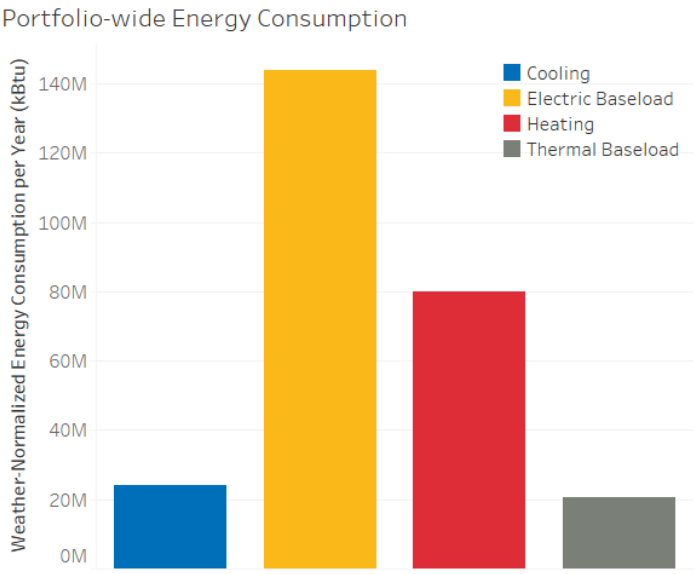


Figure 16 Energy consumption end use breakdown for the City of Atlanta portfolio

Total Energy Use

The Municipal Court and Jail is the largest consumer, consuming a little over 13% of the portfolio annual energy use. However, this building is performing well. Given its large size, there may still be opportunities for cost-effective savings, such as with an LED lighting retrofit. Another large consumer is **City Hall**, which uses just over 10% of the portfolio energy use. City Hall consumed 47% more energy than comparable government office buildings and will therefore likely have opportunities for savings. EnergyStar rated equipment, lighting sensors to dim and turn off lights, and other measures to address lighting and plug load energy use should be investigated. City Hall may also have a data center, which could explain the high electric baseload and offer another avenue to reduce the high electric energy use. Both of these buildings were included as part of a guaranteed energy savings performance contract through Johnson Controls in which lighting, building envelope, mechanical, controls, water conservation, and ventilation upgrades were implemented by June of 2019. Because our analysis used utility data from 2018, it is possible that the issues noted have already been addressed.

Shell and Ventilation Efficiency

Many buildings in the portfolio showed signs of inefficiency in their shell and ventilation system, including nearly every fire station. This is a common diagnostic for fire station whose bay doors open frequently, simulating a leaky, poorly insulated building. High-performance fire stations

have adopted sideways-opening bay doors, which offer better performance and provide firefighters with a better line of sight on when the truck has clearance to exit the station on a call. The worst performers are: **Fire Station 30**, **Fire Station 40**, **Fire Station 27**, and **PW Motor-Svc-Bldg.-Howell Mill Rd**. The full list is available in the appendix. For these buildings, excess outside air rates, poor control settings, high infiltration rates, and 24-hour fan schedules may be present. Demand controlled ventilation and heat recovery ventilation systems may provide significant savings for buildings other than fire stations.

Electric Baseload

Fire Station 30, **DPRCA-Washington Park Natatorium**, and **Fire Station 21** have the highest electric baseloads in the portfolio. These buildings should be considered for measures that address: lighting power density, lighting controls, plug loads, and 24-hour fan operation. This category is the most important to focus on for portfolio-wide energy performance upgrades. It is important to note that the Natatorium was also included as part of a guaranteed energy savings performance contract through Ameresco in which lighting and HVAC control upgrades were implemented by June 2020. Because our analysis used utility data from 2018, it is possible that lighting, lighting control upgrades and fan operation may have already been addressed in this building.

Gas Baseload

Most buildings in this portfolio had thermal baseloads within expected parameters, except the **DPRCA-Washington Park Natatorium**, **Fire Station 40**, **Fire Station 1**, and **Fire Station 31**. Most of the winter gas usage is reflected in the shell and ventilation efficiency parameter. However, a handful of buildings had elevated gas baseloads (gas use during the summer months). Although fire stations tend to have higher thermal baseloads than other buildings due to cooking and showering, the fire stations listed here are projected to use 2-3x more energy for domestic hot water than the average fire station in this portfolio. The Natatorium is a high use building type and expectedly uses a lot of gas throughout the year. As noted above, perhaps because of its high gas use, the Natatorium was included as part of a guaranteed energy savings performance contract through Ameresco. Our analysis of utility data from 2018 suggests a high performance gas equipment such as condensing boilers or electric heat pump water heaters should be considered for this building. However, it is possible this equipment may have already been installed as part of the performance contract.

Top Candidates for Further Investigation

The candidates for deep energy retrofits listed in Table 18 either have high overall energy use, relatively high energy use intensities, or both. They also generally have specific opportunities for energy savings across various end-uses. These buildings may offer the greatest amount of absolute energy savings to lower the portfolio wide energy use. The first step for these buildings is to **review their energy consumption data for errors**[56] and review master plans, if any (e.g., will this building be sold or demolished?). One should also review what work was completed after 2018 and whether this work significantly changed the Weather Normalized Site EUI calculated from 2018 utility data. For example, City Hall, M.L.K Recreation Center and Rosel Fann Community Center are all buildings that were a part of the energy savings performance contract and the issues noted below may have already been resolved. Finally, one should check

[56] Common data errors include duplicate meters, incorrect building size, incorrect data entries (e.g., extra 0s), etc. A small error in data entry into Portfolio Manager can cause a large change in the analysis.

for any available utility programs, and conduct a focused ASHRAE Level 2 energy audit. Further information on each building is available in the individual building reports provided separately.

Table 18: Top Candidates for Further Investigation (Retro-commissioning and Retrofit)

Building Name	Size, sf	Weather Normalized Site EUI, kBtu/sf	Top Diagnostics
OEAM-City Hall**	454,030	84	- High electricity use (lights, plugs) - Poor shell and ventilation
DOA – Fire Station40	7,643	359	- High summer gas use - High electric baseload (lights, plugs) - Controls issues (check simult. Heat and cooling)
PW Motor-Svc-Bldg.-Howell Mill Rd	20,255	194	- High summer gas use (water heating or ext loads) - Poor shell and ventilation - Controls issues (check simult. Heat and cooling)
OEAM-John Birdine Neighborhood CTR	45,663	132	- Poor shell and ventilation - Controls issues (check simult. Heat and cooling)
DPRCA-M.L.K. Recreation Center**	39,862	143	- High electricity use (lights, plugs) - Poor shell and ventilation
DPRCA-Rosel Fann Community Ctr**	59,200	108	- Inefficient cooling - Poor shell and ventilation - Controls issues (check simult. Heat and cooling)

****This property is part of the City of Atlanta's Energy Savings Performance Contract

The energy signatures for each of these top candidate buildings are plotted below in Figure **17** with a comparison spectrum that is made up of other buildings in the portfolio. The majority of other buildings from the City of Atlanta portfolio fall within the yellow band (25th to 75th percentile). In this figure, it is important to not only note that the signatures are considerably higher than the benchmark band, but in some cases the slope of the line is sharper as well, particularly for **Fire Station 40** and **PW Motor Svc Bldg**. **City Hall** does outperform the portfolio, especially toward the colder temperatures, but its large size combined with the fact that it uses approx. 50% more energy than benchmark offices make it a good candidate for significant energy savings.

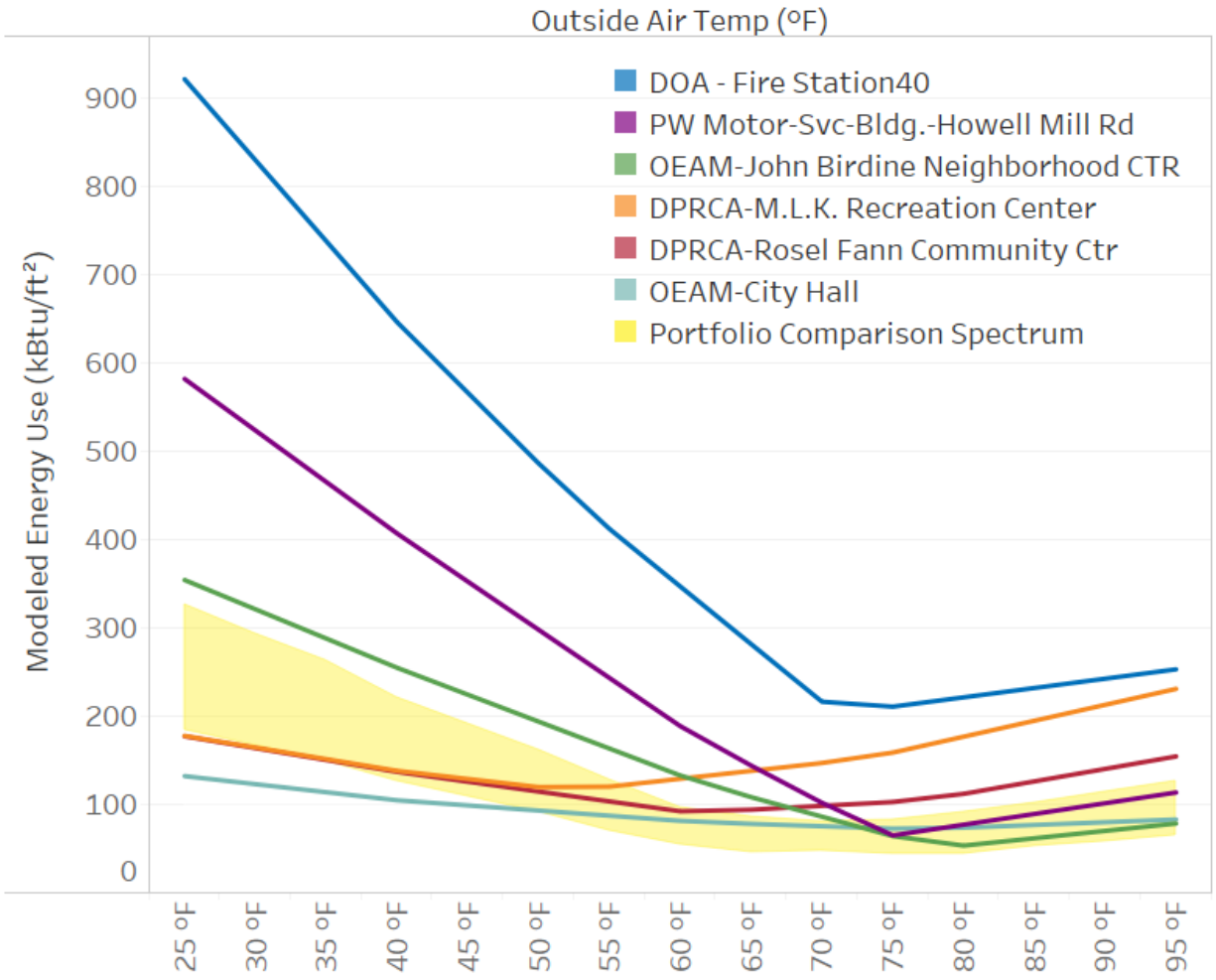


Figure 17: Energy Performance Signatures of the Top Candidates for Further Investigation. The legend lists each building as it appears from top to bottom on the left side of the figure.

Zero Energy Retrofit Candidates

On the opposite end of the energy usage spectrum, there are some candidates which may have the potential for a Zero Energy (ZE) retrofit. These buildings have low overall site EUIs, typically 50 or less, and with deep energy retrofits the buildings' EUIs might be reduced below 40 kBtu/sf, in range with the great majority of ZE buildings that NBI has observed. Figure 18 shows the energy performance of all the ZE Verified and ZE Emerging buildings known by NBI as of October 2020. Several of these buildings are in Atlanta, including the upcoming ASHRAE Headquarters, the Kendeda Building at Georgia Tech, and the Carbon Neutral Energy Solutions Lab, also at Georgia Tech.

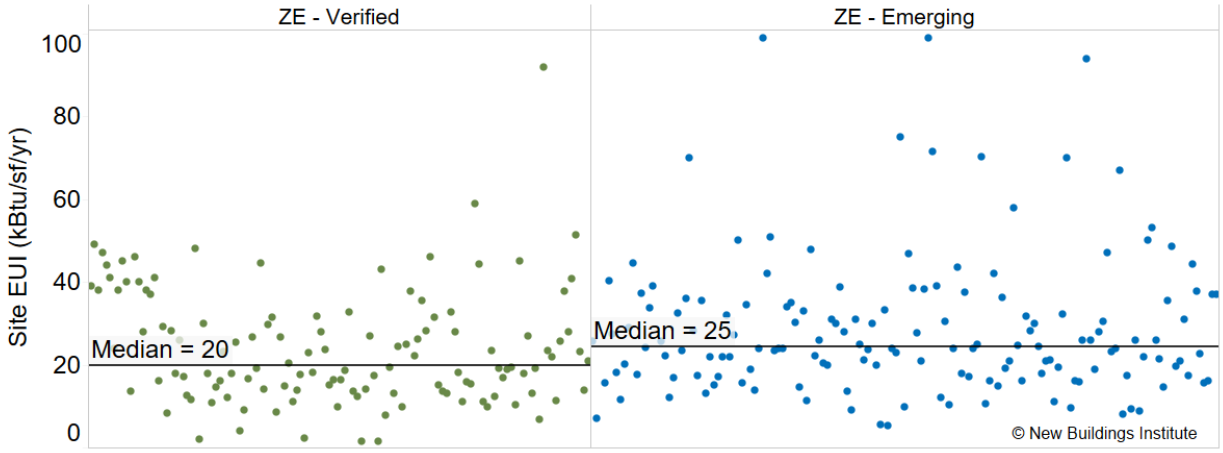


Figure 18: Site EUIs of Zero Energy Buildings across North America[57]

By further improving the overall energy efficiency of these select buildings with coordinated deep energy retrofits, the buildings' energy usage could be reduced to a point at or below the available annual solar budget for the site (that is, the amount of energy that can be generated through on-site renewables over the course of one year). The potential to reach zero energy depends on many factors, including the number of floors, potential savings via improvements in controls, HVAC equipment, as well as occupancy and building type.

When considering ZE retrofits it is critical to focus first on passive systems, energy load reductions, and energy efficiency, and only then layer in renewables (e.g., onsite solar PV panels) to offset the reduced energy needs of the building. Table 19 below highlights the top ZE retrofit candidate buildings. In some cases, the available onsite roof or other area may not be enough to reach ZE alone, and community solar or similar options should be considered. Finally, when installing onsite renewable energy systems, it is important to retain or retire the Renewable Energy Credits (RECs) to avoid double-counting of environmental benefits and maintain the ability to claim ZE.

Care should be taken to validate the energy consumption figures in this report prior to any action on these buildings. The buildings we are recommending are relatively small and have high onsite solar potential. Solar PV budgets are roughly estimated[58] based on available roof area, location, orientation, and roof angle and reported as renewable production intensity (RPI) in kBtu/sf. The RPI is analogous to an energy use intensity and shows annual energy production per square foot which offsets the energy use. Generally, low-rise buildings with open roof plans and few shading obstructions have the best solar budgets. Some sites may be good candidates for pole-based tracker arrays or parking lot canopy solar panels. A range of RPI values is

[57]ZE - Verified: Buildings which NBI has verified to have reached net zero energy performance over the course of a year
ZE - Emerging: Buildings with a stated goal of reaching net zero energy performance, but have not yet reached a year of verified net zero performance which has been verified by NBI
[58] http://www.solarroofcalculator.appspot.com/

displayed rather than a single value to capture potential solar installations on the ground or on canopies.

Table 19: Potential Zero Energy Retrofit Candidates

Building Name	Size, sf	Site EUI, kBtu/sf	Estimated RPI, kBtu/sf
DPRCA-Thomasville Heights-Rec Ctr	19,500	31	15-20
WW-Custer Avenue CSO	35,424	29	12-30

These candidates do not have sufficient space on the roof to reach zero energy without operational changes or equipment upgrades in the building to bring down energy use. However, these buildings do appear to have favorable parking lot or open space configurations for solar canopy installations. While costlier, canopies do provide a secondary benefit of shading for cars, as well as high public visibility of the solar installation and policy initiative. By leveraging this additional space, most of these buildings can reach zero energy. Other buildings are performing within the range of potential zero energy performance, but do not have enough space for solar, or appear to have shading from trees on site, and were therefore not included in the list above.

If pursuing zero energy for any of these candidate buildings, and more detailed solar potential analysis should be conducted in order to verify the expected annual generation for your custom installation. In addition, the energy use values shown above should be verified for accuracy as there are some known errors elsewhere in the Portfolio Manager dataset.

Next Steps

The results of this analysis with the FirstView tool suggest a number of next steps that the City of Atlanta should consider in its strategic approach to energy improvement across its portfolio of buildings. The buildings highlighted in this report can be targeted for audits or upgrades as recommended in the body of this report. The actual actions taken as a result should be tracked as part of an overall evaluation of impacts. It would be instructive to re-analyze buildings that have taken steps to reduce their energy consumption a year or more after those steps have been implemented. In summary:

- Prioritize buildings to create list of candidates for ASHRAE level 2 audits, taking into account recommendations laid out in this report
- Review building end-use breakdown and diagnostics. Compare with any existing internal facility assessments to identify end-of-life equipment that can easily address poor performance areas
- Create an economic argument for retrofit and maintenance based on potential savings estimates that arise from audits or facility assessments with the help of energy management personnel
- Review departmental budgets to identify feasible retrofit opportunities, taking into account energy cost savings
- Consider developing a strategic energy management plan to help the department reach internal and state-wide energy and carbon reduction goals
- Consider ZNE retrofits as part of a strategic plan to advance departmental energy, carbon, and budgetary goals

In addition, NBI recommends continuing current energy tracking and benchmarking efforts already underway within the City of Atlanta. This ongoing information is critical to empower continuous improvement of building performance across the buildings portfolio which can ultimately lead to significant energy and cost savings. The City of Atlanta has shown strong data management in Portfolio Manager which will empower the city to track progress, estimate energy cost savings, and report their climate leadership to stakeholders.

Appendix C: Example Municipal Building Policy

Goal

Achieve portfolio-wide zero emissions in municipal buildings operations by 2035 by prioritizing proven energy efficiency strategies, eliminating the use of non-emergency fossil fuel systems and appliances, and requiring the generation, or procurement of, renewable energy sources to offset emissions from building operations.

Definitions

a) *New construction*: Newly constructed building that have never been used or occupied for any purpose.
b) *Proposed design*: A description of the proposed building used to estimate annual energy use and fossil fuel combustion for determining compliance based on total building performance (source: IECC)
c) *Major renovation*: Any repair, alteration, addition, or improvement of a building or structure, where either the cost of which equals or exceeds 50% of the market value of the structure, before the improvement or repair is started, or where the work area exceeds 50% of the building's gross floor area.
d) *Site Energy Use Intensity* (EUI): A measurement that normalizes a building's site energy use relative to its size. A building's energy use intensity is calculated by dividing the total net energy consumed in one year by the gross floor area of the building, excluding the parking garage.
e) *Energy use intensity:* Is reported as a value of thousand British thermal units per square foot per year. (Source: WA HB 1257)
f) *Design Target:* The annual energy use intensity calculated for a *proposed design*.
g) *Propose Design:* A computer representation of the actual proposed building design, or portion thereof, used as the basis for calculating the *design target*.
h) *Greenhouse Gas (GHG) Emissions:* A measure used to determine and compare the emissions of various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalent (CO2e) emissions from carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are included. The CO2e for a gas is calculated by multiplying the weight of the gas by its associated GWP. (Source: ASHRAE Standard 105)
i) *On*-site renewable electricity: The annual electricity production from on-site renewable energy systems. On-site renewable shall be located on any of the following (Source: ZERO code):
    i) The building
    ii) The property upon which the building is located

iii) A property that shares a boundary with and is under the same ownership on control as the property on which the building is located
iv) A property that is under the same ownership or control as the property on which the building is located and is separated by a public right-of-way.

j) Renewable Energy Certificate (REC): A tradable instrument that represents the environmental attributes of one megawatt hour of renewable electricity generation and is transacted separately from the electricity generated by the renewable energy source; also known as “energy attribute” and “energy attribute certificate.” (Source: ZERO Code)

k) Electric Vehicle Supply Equipment (EVSE): The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

l) EV Capable Space: A designated parking space that is provided with conduit sized for a 40-amp, 208/240-volt dedicated branch circuit from a building electrical service panel to the parking space and sufficient physical space in the same building electrical service panel to accommodate a 40-amp dual-pole circuit breaker and sufficient electrical capacity to provide no less than 8 amps at 208/240 vols.

m) EV Ready Space: A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an EVSE, and be located in close proximity to the proposed location of the EV parking spaces.

Scope

1) Commencing with this policy, all City owned, occupied, or leased buildings must take action to achieve net-zero emissions. This shall be achieved in new construction, major renovation and energy retrofit projects larger than 5,000 square feet by implementing the following strategies:
    a. Prioritizing energy efficiency by achieving appropriate *Site EUI* targets.
    b. Specifying electric sources for space conditioning, water heating, cooking, lighting, and all other non-emergency functions.
    c. Offsetting building operational energy use with renewable energy sources.
2) Additionally, the Offices of Sustainability and Capital Projects shall work with all city departments to develop a plan for the elimination of sources of fossil fuel combustion within their existing buildings by 2035.
3) To further reduce GHG emissions from buildings, the following strategies are encouraged, but not required, as part of new construction and major renovation projects.
    a. Account for and take steps to reduce the embodied carbon emissions associated with building materials.
    b. Account for GHG emissions from refrigerants and take steps to promote the use of low global warming potential (GWP) refrigerants.
    c. Account for GHG emissions from transportation sources and promote electrification of the city's vehicle fleet.

Implementation

1) All new construction projects larger than 5,000 square feet shall use energy modeling to demonstrate that the proposed design meets, or is lower than, the applicable Site Energy Use Intensity targets specified in Table 20. Building types not included in Table 20 shall exceed the applicable version of energy code by at least 20%.

Table 20: Proposed EUI Site Targets for New Construction Projects

Building Type	**Site EUI Target for New Construction (kBtu/sq.ft./yr)**
Community Center	X
Fire Station	X
Laboratory	X
Library	X
Medium Office (≤100,000 Sq. Ft)	X
Museum	X
Non-refrigerated Warehouse	X
Operations Yard (Vehicle service)	X
Police	X
Recreation Center	X
Refrigerated Warehouse	X
Restaurant	X
Senior Center	X
Theater	X

2) All Major renovation projects larger than 5,000 square feet shall use energy modeling to demonstrate that the proposed design meets, or is lower than, the applicable site Energy Use Intensity targets specified in Table 21, or exceeds the applicable version of energy code by 15% or more. All other building types not included in Table 21 shall exceed the applicable version of energy code by 15% or more.

Table 21: Proposed EUI Targets for Major Renovation Projects

Building Type	**Site EUI Target for Major Renovations (kBtu/sq.ft./yr)**
Fire Station	X
Library	X

Building Type	Site EUI Target for Major Renovations (kBtu/sq.ft./yr)
Medium Office (≤50,000 Sq. Ft)	X
Non-refrigerated Warehouse	X
Operations Yard (Vehicle service)	X
Police	X
Recreation Center	X
Refrigerated Warehouse	X
Restaurant	X

3) All new construction and major renovation projects shall be designed and operated without using fossil fuel systems and appliances for meeting space conditioning, water heating, cooking, lighting, and all other non-emergency functions.
4) All new construction and major renovation projects shall offset their GHG emissions, on an annual basis, by generating renewable energy from on-site sources, and or purchasing renewable energy from off-site sources using the following calculation method:
   a. Determine GHG emissions from energy consumption in accordance with ASHRAE Standard 105, Section 7 using GHG emissions factors published by the EPA[59].
   b. Offset the equivalent amount of GHG emissions, as determined in in 4a, using renewable energy from the acceptable sources indicated in Table 22. This shall be accomplished by using the corresponding procurement factors when converting renewable electricity to GHG emissions.
   c.

Table 22: Acceptable Renewable Energy Sources

Source	Procurement Factor	Additional Requirements
Onsite Renewables	1.0	Located within the site boundary
Community renewables	0.75	
Renewable Energy Integration Facility (REIF)	0.75	
Virtual Power Purchase Agreement	0.75	

[59] https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Self-Owned Off-Site Renewables	0.75	Generation asset shall not be sold separately from the building that is claiming credit

i) The following requirements apply to all off-site renewable energy procurement methods:
   (1) The City shall sign a legally binding contract to procure qualifying off-site renewable energy with a minimum duration of 20 years.
   (2) RECs and other environmental attributes associated with the procured off-site renewable energy shall be assigned to the building for the duration of the contract.
   (3) The renewable energy generating source shall be photovoltaic systems, solar thermal power plants, geothermal power plants, wind turbines, and eligible fuel cells.
   (4) The generation source shall be located where the energy can be delivered to the building site by the same utility or distribution entity; the same ISO or RTO; or within integrated ISO's (electric coordination council).

5) Projects that are not classified as new construction or major renovations shall meet the following requirements:
   a. Energy retrofit projects shall install measures and/or equipment that results in less energy consumption at the site, moving beyond like-for-like replacements.
   b. Energy retrofit projects shall prioritize measures that result in the replacement of fossil fuel systems and appliances used to meet space conditioning loads and or provide hot water with high-efficiency all-electric systems and appliances.
   c. All fossil fuel systems and appliances used to space conditioning, water heating, cooking, lighting, and all other non-emergency functions shall be replaced with all-electric systems and appliances upon the end of that system or appliances useful life.
6) New construction and major renovation projects with parking facilities for passenger and light duty vehicles shall include Electric Vehicle (EV) charging infrastructure that meets the following requirements:
   a. No less than 40% of parking spaces shall be *EV-capable*, *EV-Ready*, or *EVSE* installed, of which at least 10%, and no fewer than one, shall be *EVSE* installed.
   b. The requirements for accessible spaces shall be separately calculated and parking at accessible spaces where an EVSE is installed shall not be limited to electric vehicles.
   c. The building electrical panel that contains the physical space to accommodate the future installation of circuit breakers for *EV-capable* spaces shall have sufficient electrical capacity to provide no less than 8 amps at 208/240 vols per EV Capable space.

Annual GHG Emissions Reporting

1) All new construction projects and major renovations larger than 5,000 square feet completed after the adoption of this policy must disclose the following information to the Office of Sustainability:
    a. Prior to submission of final building permit, the architect or engineer of record shall submit a GHG Emissions Compliance report that includes:
        i. Documentation of the applicable energy efficiency requirements:
            1. Energy modeling documentation that the *proposed design* has a *site EUI* less than or equal to the *design target*; or
            2. The *proposed design* exceeds the applicable version of energy code by 20% or more if a new construction project; or
            3. The *proposed design* exceeds the applicable version of the energy code by 15% or more if a major renovation
        i. An inventory of all fossil fuel consuming appliances and equipment and confirmation that space conditioning and hot water heating are met with all-electric systems and appliances.
        ii. An estimate of the annual GHG emissions associated with the project.
        iii. A renewable energy assessment that identifies the renewable energy sources that will used to offset the estimated GHG emissions on any annual basis.
    b. Within 2 years of final certificate of occupancy, and every year thereafter, the following shall be disclosed:
        i. A weather normalized site energy use intensity for the previous 12 months.
        ii. Documentation that the project has achieved a GHG emissions balance of zero where the total calculated emissions associated with the building operation is less than or equal to the emissions avoided as a result of generating or procuring renewable energy over the course of the year.
2) By 2025, all City Departments shall submit a detailed plan to the Sustainability Department that identifies and prioritizes the strategies needed to eliminate fossil fuel combustion within each building by 2035. This plan shall include:
    a. An inventory of each facilities fossil fuel combustion equipment and the useful life remaining for that equipment
    b. The necessary actions and investments needed to eliminate fossil fuel systems
    c. A timeline for substantial alterations and system replacement efforts
    d. Priority actions for system replacement efforts that have the greatest potential return on investment based on cost analysis that includes the cost of carbon emission impacts.
    e. Identifies potential locations for the installation of on-site renewable energy systems

Requirements for non-compliance

1) If the reporting requirements of this policy determine that building has failed to meet its energy efficiency target within a +5% margin, it must meet the following requirements:
    a. Conduct an investment grade energy audit that identifies a suite of energy efficiency measures and management measures for the building, to bring the building in line with its stated energy efficiency goals.
    b. Adopt an implementation plan for implementing the identified energy efficiency measures that may include a phased approach that addresses systems or equipment that do not need to be replaced before the end of its useful life.
2) If the reporting requirements of this policy determine that the GHG emissions from the project exceed its avoided GHG emissions within a +5% margin, it must select one of the following:
    a. Meet the requirements of #1 of this section to reduce the GHG emissions associated with building operations in effort to bring the project in line with the emissions avoided from the renewable energy associated with project, on an annual basis.
    b. Procure additional renewable energy in order to achieve a GHG emissions balance of zero.

References:

- ASHRAE Standard 105 (Methods for Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions)

Appendix D: Commercial Energy Use Intensity Target Analysis

Energy targets help identify the incremental improvement that would be necessary in each code cycle to get to 100% clean goals. The methodology used to generate energy targets utilizes multiple sources of data about building performance. These include determination studies about existing codes, multiple zero energy performance target studies as outlined below.

This is used inform energy performance target setting in Atlanta by establishing “book ends” of how buildings are performing now, and how they will need to perform in order to meet Atlanta’s climate action goals.

Energy Code Performance

For energy code performance predictions, NBI leverages energy modeling determinations by the U.S. Department of Energy[60]. Code determinations establish the expected energy performance for the national model base codes, including the International Energy Conservation Code and ASHRAE 90.1. Code determinations are specific to climate zones, and Atlanta falls into climate zone 3A.

Atlanta has just adopted the 2020 edition of the Georgia State energy code, which is a locally customized version of the 2015 IECC[61]. The energy code includes supplements and amendments put in place by the state of Georgia[62]. NBI did not conduct a full analysis of the energy impacts of the supplements and amendments to the energy code. The values presented herein to represent the energy code performance are based on the 2015 IECC determination analysis conducted by the Department of Energy, which established that the code amendments weaken the stringency of the code.

Zero Energy Performance Targets

Zero energy performance targets are the energy use intensity targets for each building type based on the maximum site efficiency using current technologies (without renewables). These targets represent the 2035 end-point for the potential savings analysis. Zero energy performance levels are based on research compiled and conducted by NBI. This data set pulls together a mix of modeled analyses and measured performance data for existing zero energy buildings in North America. Each data source represents a particular building type and is specific to Atlanta’s climate zone (3A). Table 23 summarizes the measured performance data, technical potential studies and energy modeling analyses that support the zero energy EUI target development.

[60] https://www.energycodes.gov/development/commercial/prototype_models
[61] https://www.atlantaga.gov/government/departments/city-planning/office-of-buildings/construction-codes
[62] https://www.dca.ga.gov/sites/default/files/iecc_2020_amendments_0.pdf

Table 23: Published sources informing the performance target development.

Title	Author	Description	Publication Year	Measured/Modeled
NBI Getting to Zero Database[63]	NBI	Continuously updated repertoire of zero energy buildings in North America	2019	Measured and Modeled
Advanced Energy Design Guides[64]	Multiple	Detailed design guide for K-12 school and office buildings to achieve zero energy operation	2019	Modeled
The City of Toronto Zero Emissions Buildings Framework[65]	Multiple	Study to identify feasible maximum performance targets for zero energy buildings in the city of Toronto to meet its climate goals	2017	Modeled
Development of Maximum Technically Achievable Energy Targets for Commercial Buildings[66]	GARD Analytics	National study of best anticipated building performance using best-practice design and operations strategies	2015	Modeled
The Technical Feasibility of Zero Net Energy Buildings in California[67]	ARUP	Study of the best achievable building performance as a basis for zero energy code targets	2012	Modeled
Built to Perform: An industry led pathway to a zero carbon ready building code[68]	Multiple	Australian modeling analysis to establish zero carbon ready building targets	2018	Modeled

[63] https://newbuildings.org/resource/getting-to-zero-database/
[64] https://www.ashrae.org/technical-resources/aedgs
[65] https://www.toronto.ca/wp-content/uploads/2017/11/9875-Zero-Emissions-Buildings-Framework-Report.pdf
[66] http://www.gard.com/
[67] https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10721
[68] https://www.asbec.asn.au/wordpress/wp-content/uploads/2018/10/180703-ASBEC-CWA-Built-to-Perform-Zero-Carbon-Ready-Building-Code-web.pdf

Title	Author	Description	Publication Year	Measured/Modeled
Technical Feasibility Study for Zero Energy K-12 Schools[69]	NREL	Maximum achievable energy performance study focused on schools	2016	Modeled

Zero energy performance targets based on these data sets are shown in Figure **19**. This figure plots how zero energy sources compare by building type. Generally, the net zero performance target combines an average of maximum technical potential studies (i.e., studies that quantify the lowest energy building possible via modeling) and median EUI values for existing zero energy projects. In combining the data from those sources to establish the net zero energy performance target, NBI gave greater weight to measured data from existing buildings than modeling studies and normalized measured data from various climate zones to Atlanta's climate using conversion factors to equitably compare energy use between different climate zones.[70]

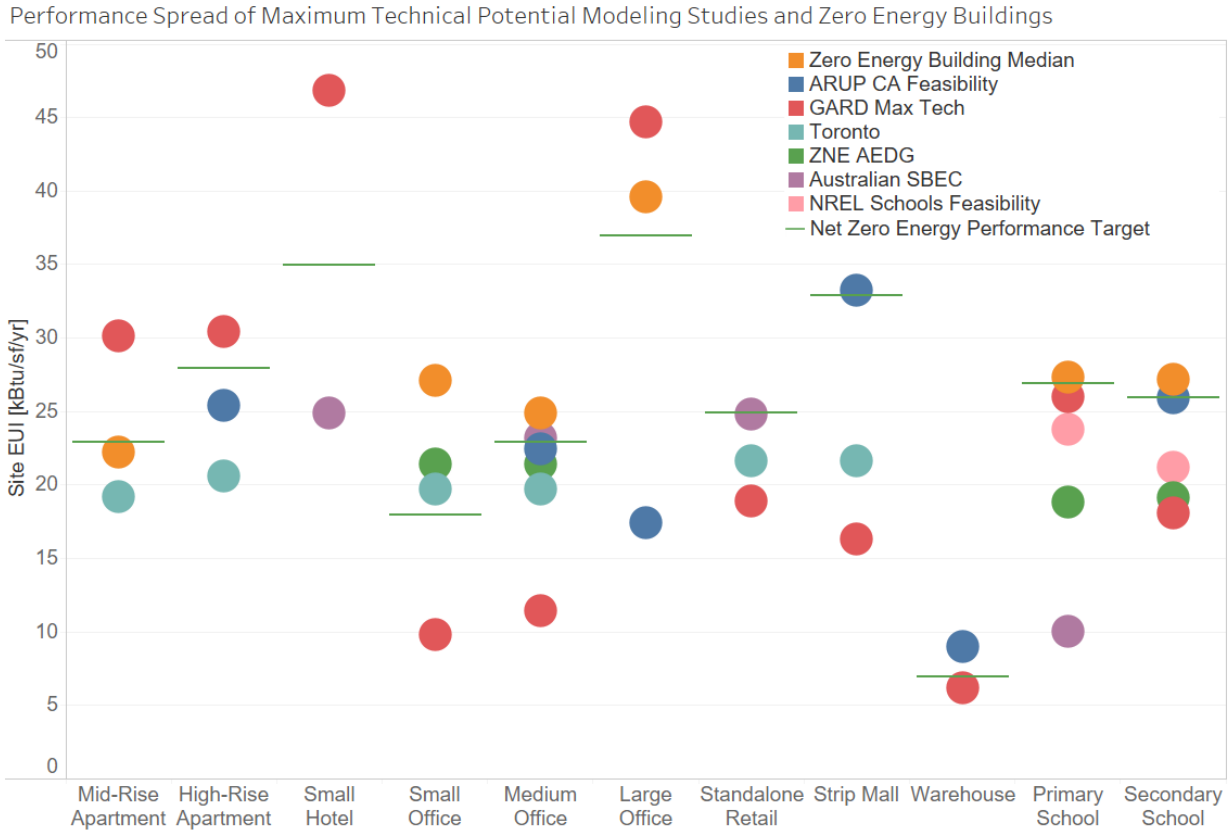


Figure 19: Net Zero Energy Data and Performance Targets by Building Type for Atlanta's Climate Zone

[69] https://www.nrel.gov/docs/fy17osti/67233.pdf

[70] For more details, please see the Zero Energy Target Setting summary report available here: https://newbuildings.org/resource/zero-energy-commercial-building-targets/.

EUI Comparison

In Figure **19**, building types are separated because different building types have different performance characteristics and expected energy use. High-energy use in one building type may be low for another. Therefore, targets have been developed on a building type by building type basis. In addition, data in this analysis consistently represents the Atlanta climate zone.

It is important to note that these EUI targets are “site EUI” and only consider energy consumed at the building, rather than considering the complete supply chain and fuel types that contribute to source energy. Also, this analysis looks at energy which is related to, but is not the same as carbon or greenhouse gas emissions.

In Figure **20**, the modeling analyses representing zero energy performance levels are shown as blue circles, and the estimated 2020 Atlanta Energy Code (based on the 2015 IECC) performance levels are grey circles. The measured energy data for existing zero energy buildings adjusted for the Atlanta climate zone are included as orange circles, where available

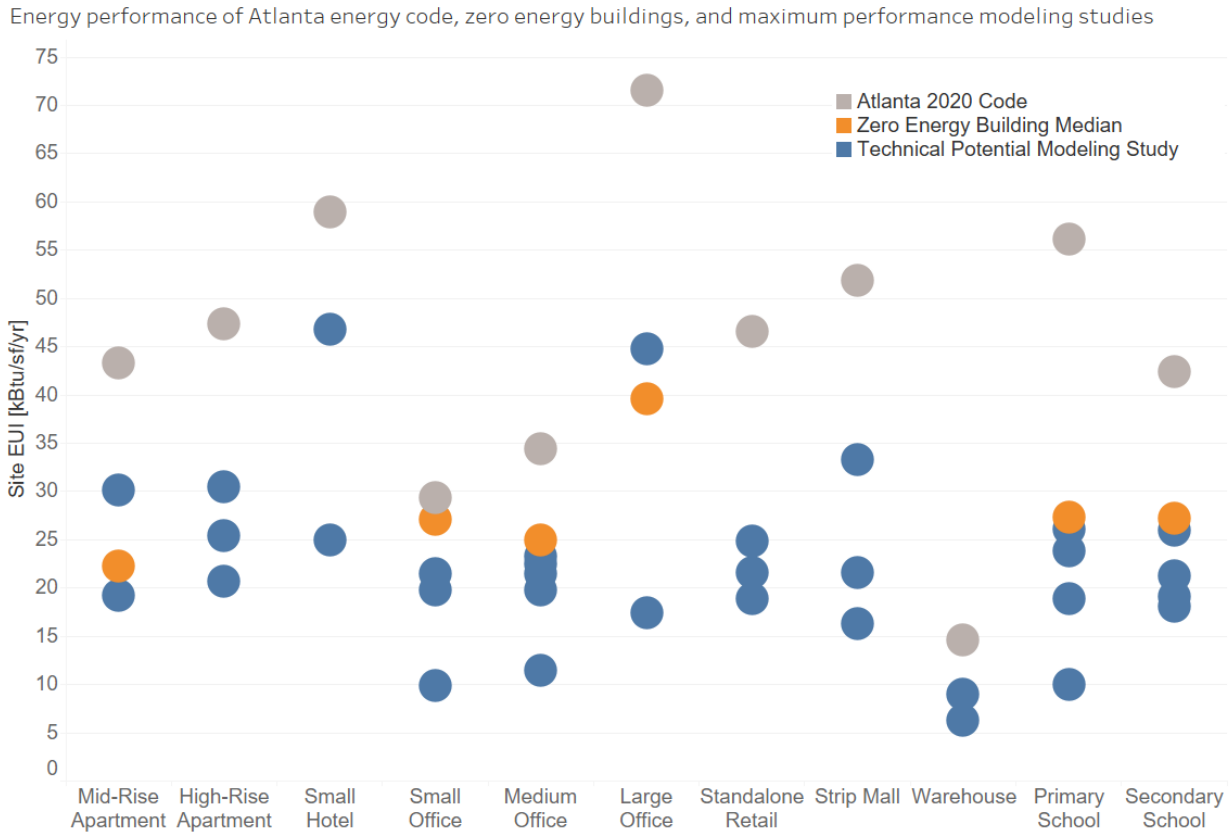


Figure 20: Site EUI from Multiple Data Sources by Building Type for Atlanta

Table 24 summarizes the site EUIs for the estimated 2020 Atlanta Energy Code Performance, and the NBI suggested net zero performance targets by building type. Due to technological advancements, the performance level of building that achieve net zero energy may improve over time, therefore the zero energy performance target end point may change going forward. These are the "bookends" of code performance.

Table 24: Comparison of Current Atlanta Code and Net Zero Site EUI Targets in kBtu/square foot - year

Building Type	2015 IECC (kBtu/square foot - year)	Net Zero Energy Performance Site EUI Target (kBtu/square foot - year)	Percent Reduction Needed to Meet the Target
High-Rise Apartment	47	28	41%
Large Office	71	37	48%
Small Office	29	18	39%
Medium Office	34	23	33%
Mid-Rise Apartment	43	23	47%
Standalone Retail	47	25	46%
Small Hotel	59	35	41%
Warehouse	15	7	52%
Primary School	56	27	52%
Secondary School	42	26	39%
Strip Mall	52	33	36%

Energy Code Trajectory for the Atlanta Energy Code

Focusing on the differential between code and net zero performance, FIGURE plots a course for predicted building performance improvements to zero by 2035. The 2020 points are representative of the Atlanta code (based on 2015 IECC). For each building type, Figure **21** extrapolates from current code estimates to the net zero performance in 2035 (assuming a three-year code improvement cycle). Then, assuming equal Energy Use Intensity (EUI)

progress in each cycle to get from where we are to where we are going, we plot a straight line for each building type. This does not take into account the probability that net zero buildings in the future may perform even better from an energy perspective. If this is the case, the net zero end points may need to be revisited and calibrated at each code cycle increment.

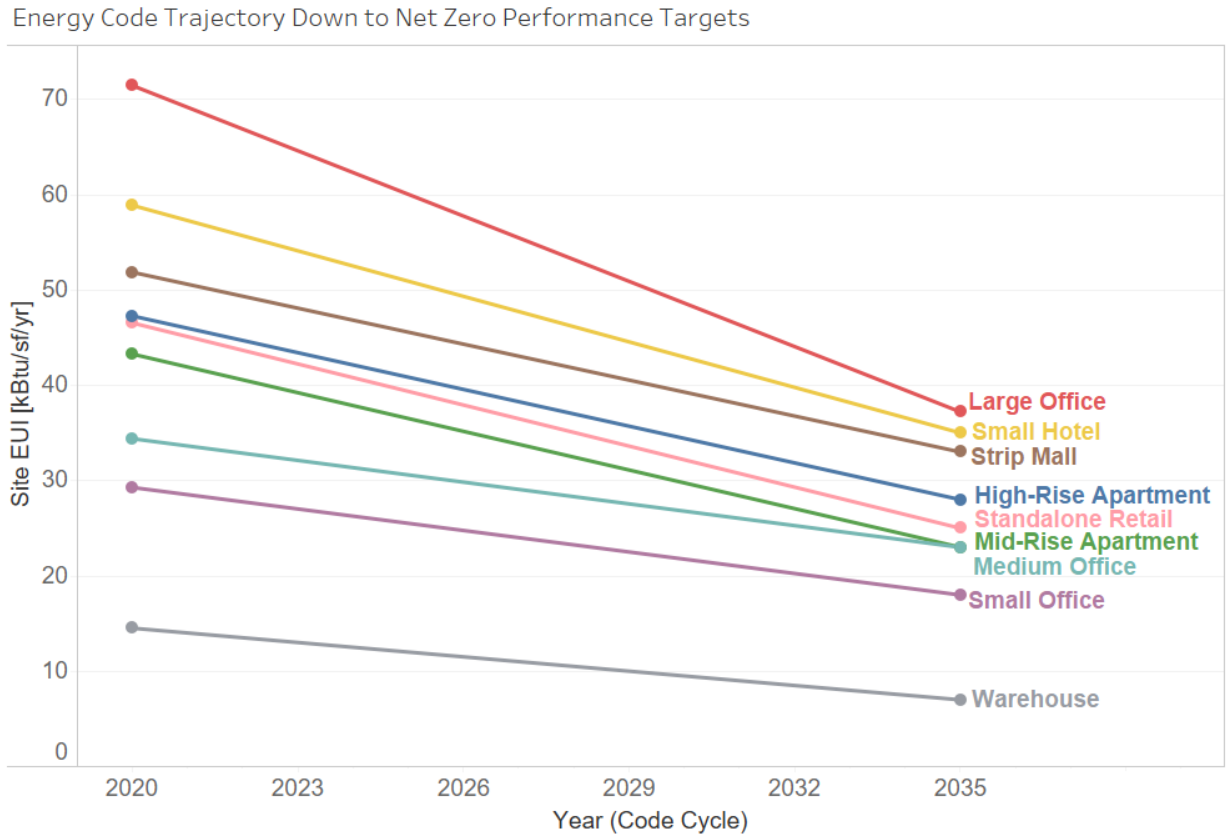


Figure 21: Energy Code Performance Trajectory to Zero Energy by Building Type

Table 25 details the site EUI for each building and code cycle from the plotted scenario. The savings for the five code cycles (2022, 2025, 2028, 2031, and 2034) will need to average 11% (Range: 8-14%) across building types. Looking historically at energy code improvements of both Standard 90.1 and IECC suggests that consistent savings of 11% may be out of the range of expectations for national model codes. It will therefore be imperative for Atlanta to continue to push beyond model codes.

Table 25: Code Performance Trajectory to Zero Net Energy Performance by Building Type

Building Type	Site EUI (kBtu/square foot-year)						Average Savings per Cycle
	2020	2023	2026	2029	2032	2035	
High-Rise Apartment	47	43	40	36	32	28	10%
Large Office	71	65	58	51	44	37	12%

Small Office	29	27	25	23	20	18	9%
Medium Office	34	32	30	28	25	23	8%
Mid-Rise Apartment	43	39	35	31	27	23	12%
Standalone Retail	47	42	38	34	29	25	12%
Small Hotel	59	54	49	45	40	35	10%
Warehouse	15	13	12	10	9	7	14%
Primary School	56	50	44	39	33	27	14%
Secondary School	42	39	36	33	29	26	9%
Strip Mall	52	48	44	41	37	33	9%

EUI Target Implications in the Prescriptive and Performance Approach

The EUI targets outlined in Table 25 are an important cornerstone of the new construction code strategy to zero energy in Atlanta. They serve as a clear indicator to building owners and designers on how buildings of a like type in the Atlanta market will be expected to perform going forward. Below is a brief outline of how EUI targets might be used by the city and local building market actors.

- In the **prescriptive approach**, EUI targets can be used to calibrate the performance goals for future iterations of the prescriptive code in order to ensure that it is sufficient to achieve the energy performance targets for various building types. This will be done through energy modeling and calibration. If EUI targets are not achieved, Atlanta can leverage new provisions in the 2021 International Energy Conservation Code (specifically section C406 options in commercial and the flex points packages in residential) to increase the savings required locally. Thankfully, these code provisions, which are new in the 2021 IECC, offer flexibility and provide an easy mechanism for the city to require increased efficiency while minimizing modifications to the model code.
- In the **performance approach**, EUI targets can be used to eliminate the need for a "percent better than code" modeling approach. For certain building types where EUI targets are appropriate, energy modelers can simply create a building model where the predicted EUI meets the target, as opposed to needing to create a code baseline model for comparison. One significant advantage of this approach is that it eliminates the need for a code comparison model. This will be a savings of time and money for the energy modeler and therefore the building owner using the performance approach as the path to code compliance. However, it is imperative that energy modeling assumptions are standardized, even beyond what is already required in the ASHRAE Appendix G Performance Rating Method.
- In the **benchmarking and disclosure** program, energy targets will presumably align with predicted EUI disclosed in the code compliance documents. With this data, the city is in a position to remind owners (and their energy modelers) about how the building

actually performs compared to these predictions. This can close an important feedback loop in the buildings market. Most energy modelers have no idea how the buildings that they model actually perform, so this information will help inform and improve their modeling process. This is key to transitioning energy modeling from an estimation tool to a predictive one. Conversely, most building owners do not know how their buildings were intended to perform. This information will provide information to owners and facilities staff about how well buildings are meeting their design expectations.

- In **BPS**, EUI targets in new construction codes create a connection between code compliance in today's new construction as they transition to compliance with tomorrow's existing BPS. Energy targets for each code vintage can have their own standards, which are more efficient than those set for existing buildings today. This helps to ensure that newly constructed and recently renovated buildings are set to a higher standard than today's existing building stock and do their part to meet the City of Atlanta's 100% clean goal.

Appendix E: Zoning Bonuses and Incentives

Many cities in the United States have created zoning incentive programs to achieve a number of public policy objectives including affordable housing, green buildings, conservation of open spaces and agricultural lands, inclusion of common spaces and amenities for residents. The approaches researched and listed below include those focused on green building and energy performance.

Arlington, VA - New development project teams may request additional bonus density and/or height in exchange for LEED certification and Energy Star Portfolio Manager certification within 4 years of occupancy. Projects designed and constructed to achieve at least LEED Gold certification plus two Arlington priority credits plus Net Zero Energy Building certification through the International Living Future Institute may apply for bonus density above 0.55 FAR. Affordable housing projects receiving tax credits from the Virginia Housing Development Authority (VHDA) are allowed to earn bonus density using the EarthCraft green building rating system at the Gold or Platinum certification level.

Austin, TX – Under Section 25-2-586 Downtown Density Bonus Program, developers can pay a fee instead of meeting the standard to receive density bonus to pay for neighborhood development or affordable housing. Under section (E)(8) Green Building Community Benefit, owners may receive FAR bonus area or height bonuses if the project substantially complies with the Urban Design Guidelines as determined by the Design Commission. The applicant must also provide streetscape improvements along all public street frontages, consistent with the Great Streets Standards. In addition, the building must achieve two stars under the Austin Energy Green Building program. If the owner does not achieve the AEGB or LEED certification within nine months of occupancy, the owner must pay into the Affordable Housing Trust Fund the bonus fee that was initially granted.

Bar Harbor, ME – Bar Harbor, Maine provides a density bonus for an increase in the market-rate dwelling units that meet LEED standard “or an approved equivalent.” The bonus applies in a Planned Unit Development and compliance is demonstrated with a certification program application or by affidavit of a team member.

Boston, MA - The City created plans that recommend new density bonus zoning for two major neighborhoods. The plans are allowing developers to increase height or floor area in exchange for low-income restricted units. The areas are distinctly different, and the resulting policies reflect this.

> The Plan: JP/Rox Planning Report recommends design guidelines go beyond LEED standards to ensure new buildings and large development projects reduce carbon emissions and environmental impacts. Passive practices include efficient building envelopes and orientation while active, innovative strategies and technologies include building-integrated renewable energy, energy storage, and community solar.
>
> The Plan: South Boston Dorchester Avenue Planning Report recommends sustainability leadership and carbon free development as demonstrated by a minimum of LEED Gold, with platinum as the goal. The South Boston Dorchester Avenue neighborhoods will also require renewable energy. The work in Boston is not done. The next step is to develop

EUI targets and renewable energy requirements that are required to achieve the carbon emission reduction goals outlined in both neighborhood plans.

Bothell, WA – Under Bothell Ordinance number 2028, developers who apply for LEED or the National Green Building Standard can reduce the required number of on-site parking spaces. In addition, the city offers a fee-bate for green buildings with up to a 50 percent rebate for achieving LEED Platinum or National Green Building Standard Gold.

Emeryville, CA - The Emeryville Municipal Code has a FAR bonus points schedule for affordable units. Half of the points needed to achieve FAR bonuses must come from affordable housing. Remaining points, up to 50, can be earned by providing a variety of community benefits. 50 points can be earned for buildings that are zero net energy and produce as much energy as they create over the course of a year. A number of other options are provided to earn points, such as financial contributions to specific funds (citywide park fund, city underground utility fund, etc.) or public improvements.

Pittsburgh, PA - The City of Pittsburgh has sustainable development bonuses (both floor area and height) that promote green building, LEED certified building, and waste reduction. LEED Certified buildings have a cap of 20% floor area (FAR) increase and 20% of height beyond of specifications in that district. The penalty for not achieving LEED certification is 1% of the construction costs.

Portland, OR – The City of Portland has an Administrative Rule covering Energy Efficiency Building Requirement for Planned Development Bonus in certain use zones. The rule places additional requirements on development in commercial/mixed use zones necessary in order to achieve floor area and height bonuses. The rule requires an energy target and certification program participation. It uses building type specific Energy Use Intensity targets as outlined below for 50,000 square foot buildings.

Use Type	Baseline EUI (kBtu/sf)	Baseline Reduction (percentage)	EUI Standard (kBtu/sf)
Residential			
Multifamily Dwelling	55.3	50	27.7
Commercial			
Financial Office*	73.1	70	21.9
Fitness Center	42.6	70	12.8
Hotel	69.3	70	20.8
Medical Office*	77.5	70	23.2
Office*	79.3	70	23.8
Retail*	72.0	70	21.6
Institutional			
Adult Education	71.0	70	21.3
College	131.9	70	39.6
K-12 School*	71.1	70	21.3
Library	103.6	70	31.1
Meeting Hall	30.7	70	9.2
Performing Arts	37.4	70	11.2
Preschool	73.2	70	22.0
Residence Hall*	74.2	70	22.2
Senior Care	107.5	70	32.2
Vocational School	63.1	70	18.9

* For these Use Types, the Baseline EUI and EUI Standard varies depending on building size, and the values presented on Table 1 are based on a 50,000 square foot building. The online Architecture 2030 Zero Tool may be used as an alternative to the table to determine the size-specific Baseline EUI. The size-specific EUI Standard is calculated by multiplying the Baseline EUI by a 70 percent reduction factor.

The rule allows for customized EUI, for example applicants can use of the Architecture 2030 Zero Tool to determine the EUI standard that must be achieved, or building projects in the Energy Trust of Oregon "Path to Net Zero" utility incentive program can use the EUI target as determined as a participant in that program. Owners must follow up with proof of certification and an as-built EUI which can be published publicly by the Bureau of Planning and Sustainability. Penalties for noncompliance can be up to 5% of the Project Valuation as set forth in the permit. Penalties are based on the percent less than EUI achieved as outlined below.

Table 2 – Maximum Penalty Calculation

Percentage of EUI Reduction	Penalty (percentage of Project Valuation)
95 to less than 100	0.5%
90 to less than 95	1.0%
85 to less than 90	1.5%
80 to less than 85	2.0%
75 to less than 80	2.5%
70 to less than 75	3.0%
65 to less than 70	3.5%
60 to less than 65	4.0%
less than 60	5.0%

Sacramento, CA – Height bonuses are available to projects that are designed and built to exceed CALGreen reach code and are energy efficient. Reaching Tier 1 in CALGreen allows a

10% height bonus, while Tier 2 under CALGreen can receive a 20% height bonus. A separate bonus is allowed for green roofs, but together the height bonus cannot exceed 30%.

Santa Rosa, CA – This white paper describes recommendations for a point system where points are provided for the production of affordable housing, with additional points available for: open spaces, historic/landmark preservation, family-sized units, infrastructure/capital improvements, public art, or other innovative community benefit. The recommendation was to provide up to 60/80/100% of base density depending on considerations like capacity of the neighborhood, existing density of the residential neighborhood, access to transit, proximity to schools and single family neighborhoods, existing site conditions, infrastructure, and impediments. This incentive does not involve energy, but is

Seattle, WA – The City of Seattle has a number of incentives related to green and energy efficient buildings. The Living Building pilot program (23.40.060) provides specific types of bonuses for up to 17 buildings that (1) participate in either the International Living Future Institute's Living Building Challenge or petal certification (water, energy or materials); (2) demonstrate an EUI target 25% below those used elsewhere in the Seattle Energy Code (section C401.3); (3) does not include gas combustion; and (4) uses only non-potable water. The Living Building pilot programs runs through December 2025. It allows developers to request additional departures from the Seattle Land Use Code through Design Review and earn the following benefits:

- Up to 25 percent more floor area
- Up to 30 percent more floor area if saving an unreinforced masonry structure
- 12.5 feet of additional height for residential construction or 15 feet of additional height for non-residential construction in zones with height limits of 85 feet or less
- 25 feet of additional height for residential construction or 30 feet of additional height for non-residential construction in zones with height limits greater than 85
- Additional design departures for the pilot programs as specified in SMC 23.41.012D

The Living Building pilot project must document certification with a report to the city within two years of occupancy. This provides a clear verification procedure, ensuring that targets are achieved. Penalties include $500 / day for non-submittal of the report, up to 25% of the construction value according to a table provided in the pilot ordinance.

To qualify for the Architecture 2030 Challenge pilot program, a project must:

- Qualify for design review or review by a special district or historic review committee
- Be located within an urban center, excluding lots within the shoreline or the international special review districts
- Renovate an existing structure that qualifies as a substantial alteration as determined in the Seattle Energy Code and the Seattle Existing Building Code
- Retain either the opaque portions of all exterior walls or the superstructure of existing structures (the foundation, structural frame, floor framing, and slabs of the structure)

The environmental requirements are to:

- Reduce predicted total energy use by 25 percent, or more based on the Energy Use Intensity (EUI) targets in the Target Performance Path of the Seattle Energy Code Section C401.3, and use no fossil fuel for space and water heating
- Reduce annual stormwater runoff and potable water use by at least 50 percent from program baselines
- Reduce single-occupant vehicle trips for work and non-work-related trips to percentages equal to or better than rates defined in the Seattle Comprehensive Plan

The Architecture 2030 pilot program in Seattle expires on December 31, 2025 or when 20 projects enroll in the 2030 Challenge Height Performance Existing Building Pilot. Architecture 2030 does not verify the performance of the energy or water outcomes. The city is responsible for verifying the predicted values meet the eligibility requirements.

Sunnyvale, CA – Sunnyvale has a Green Building Program that allows density bonuses for LEED certification. It provides a detailed table of incentives for projects to add floor area to an existing site, qualify for the incentive if all buildings at the existing site meet CALGreen and LEED. FAR bonuses are granted for new construction, core and shell, commercial interiors, existing buildings. Single family, multifamily, commercial new construction and commercial tenant improvements are all eligible for the incentive.

West Hollywood, CA – Ordinance number 17-1005 rescinds the Green Building Policy which required all new commercial development with three or more units must either pursue LEED or comply with the Green Building Point System. The city allowed reduced parking in exchange for achieving at least 90 points from the points matrix to reach the 90-point threshold. Projects had to submit a preliminary and final green building plan if they were not pursuing LEED certification (at the lowest “certified” level). In addition, the old Green Building Policy incentives promoted green roofs in multi-family and mixed used projects and allowed for tradeoffs between private and common open space. The 2007 Green Building Policy was rescinded because the city recognized the progress that the green building industry made including the establishment of several national sustainable design standards, the adoption of the CALGreen building code, and the State trend toward zero net energy. According to their website, the city facilitated a series of working group meetings to update their policy in 2017. This involved soliciting feedback from stakeholders and representatives from the development, architecture, construction, housing, and sustainable design industries, as well as residents and local business owners.