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Growing a Clean Economy

An Analysis of Equitable Employment Opportunities in Atlanta, GA

Smart Growth America | July 2022

Prepared with support from the Parnership for Southern Equity (PSE)
as part of the Kresge Foundation's Climate Change, Health, and Equity (CCHE) initiative

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Table of Contents

Executive Summary

In recent years, the City of Atlanta has embraced the transition to a cleaner economy by adopting policies, plans, and programs that prioritize the efficient use of energy, reducing polluting emissions, preserving natural resources, and ensuring a cleaner and more sustainable future for the city. These policies which address both mitigation and adaptation are key for addressing the climate crisis, and will also improve livability and offer important economic development benefits. Through local and regional plans and policies such as Resilient Atlanta, One Atlanta Strategic Transportation Plan, Clean Energy Atlanta, the Downtown Sustainability Action Plan, the Regional Development Plan, and Atlanta's Comprehensive Development Plan, the city and region have set proactive frameworks and targets that are meant to drive clean economic growth while addressing shocks and stresses arising from the impacts of climate change.

Investments in new technologies, the creation of workforce training programs, the expansion of scholarships and apprenticeship programs, and increased collaboration among technical colleges and trades to ramp up Atlanta's clean jobs workforce are some of the ambitious initiatives that will lead to achieving Resolution No. 17-R-3510—a resolution to achieve a 100 percent clean energy transition for municipal operations and community-wide by 2035. This resolution, passed unanimously by the Atlanta City Council in 2017, makes Atlanta the 27th city in the country to commit to achieving a 100 percent clean energy transition for municipal operations by 2025 and community-wide by 2035. In 2022, the EPA ranked Atlanta in the top three U.S. metropolitan areas—behind the District of Columbia and Los Angeles—with the most ENERGY STAR certified buildings, with 342 of the city's commercial and multifamily buildings contributing to reduced carbon emissions and energy cost savings. These policies are part of an ecosystem of civic activism and thought leadership advancing the clean energy transition, such as Drawdown Georgia, which brings high-impact climate solutions to communities in Georgia; Atlanta Regional Commission's Green Communities Program, which assists local governments in decreasing operational carbon emissions through building portfolio efficiency and clean energy opportunities; and Solarize Atlanta, which makes solar-powered energy more accessible and affordable for more homes and businesses across Atlanta.

Atlanta is active in a number of networks of cities committed to climate action, including the Resilient Cities Network (previously the 100 Resilient Cities network), Bloomberg Philanthropies' American Cities Climate Challenge, and the Climate Mayors network. These associations demonstrate climate leadership through meaningful actions in their communities to become more resilient to physical, social, and economic shocks and stresses, and offer opportunities for network-based learning.

In order to make economic activity 'cleaner,' a wide range of industry sectors have been increasingly integrating specialized skills and emerging technologies to reduce the environmental impacts, increase efficiencies, and lessen the consumption of scarce natural resources in their operations. Based on historical trends and the policies that have been recently enacted in Atlanta, there are three high-growth areas of the clean economy that are likely to have the greatest job growth potential over the next 10 to 20 years. **These high growth areas include:**

Energy Efficiency

Solar Energy

Green Infrastructure

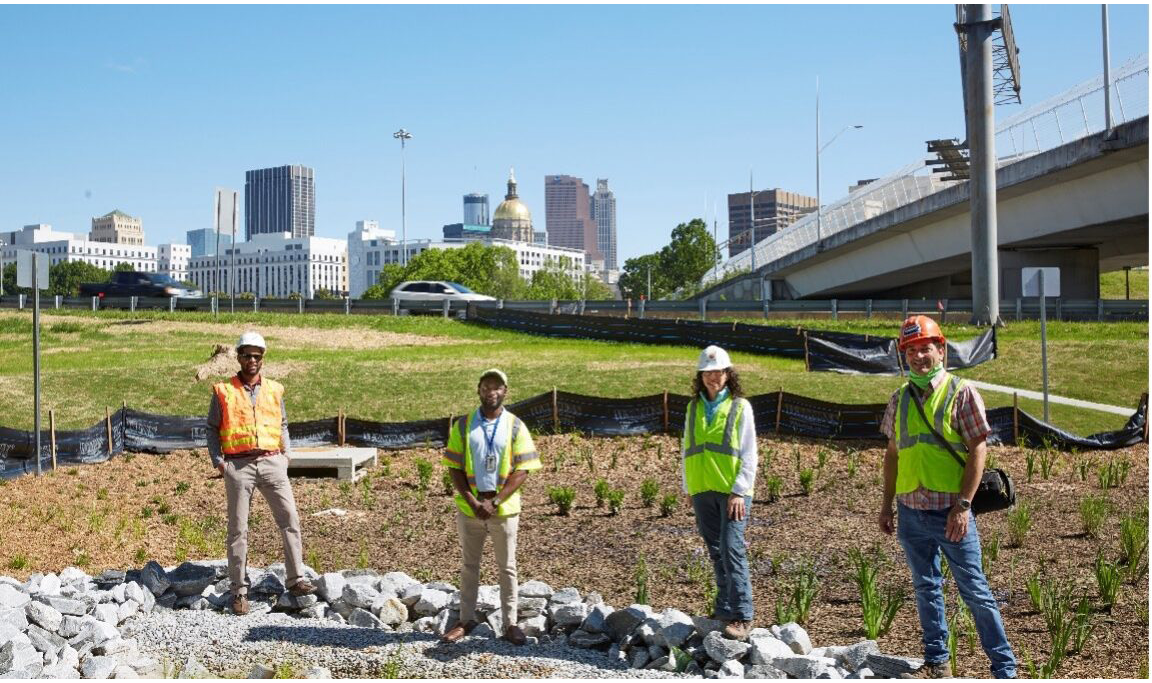
The solar energy industry lies within 'clean energy' and green infrastructure within 'environmental management'. In this study, we categorize clean energy and environmental management jobs as solar and green infrastructure respectively as those are the areas with greatest growth potential in Atlanta.

EXECUTIVE SUMMARY

Under the City of Atlanta's 100% Clean Energy Plan, the Advisory Board has prioritized assessing clean job opportunities and providing education and promotion of energy-efficient programs. The Green Infrastructure (GI) Task Force, created under the City of Atlanta's Department of Watershed Management, is working to integrate green infrastructure throughout the city as well.

This study was conducted to assess job opportunities within Atlanta's emerging clean economy sectors, and to provide insights on potential workforce development strategies while promoting energy-efficient programs associated with the 100% Clean Energy Plan, Water Equity Roadmap strategy, and other relevant policies described across the following sections of this report.

Although Atlanta's leadership has articulated its commitment to scale and implement climate solutions, these goals are accompanied by a substantial challenge: **overcoming a shortage of skills and training.** Of the thirteen established policy and programmatic vehicles that are meant to advance Atlanta's clean economy goals, eleven make mention of workforce goals, but only six of the thirteen actually list actionable steps for the workforce transition needed to achieve the City's clean economy goals. These needs include, but are not limited to, additional staff capacity, technical assistance, and increased outreach to and educational opportunities for community members. Further, only eight of the thirteen plans acknowledge the importance of prioritizing equity in a clean economy transition, as there is a disproportionate energy burden on Atlanta's low-income communities. Of those eight plans which mention equity, only two outline priority actions to address inequities, beyond recognition of needed continued work on income and race disparities in the region. Without supportive policies in place, it is unlikely that workforce development opportunities will be equitable and easily accessible to low-income or Black communities that have been disadvantaged and marginalized by past policies. Equitable workforce development policies and programs will be critical to supporting Atlanta's community members in gaining skills in these high-growth sectors and ultimately advancing Atlanta's clean energy transition.

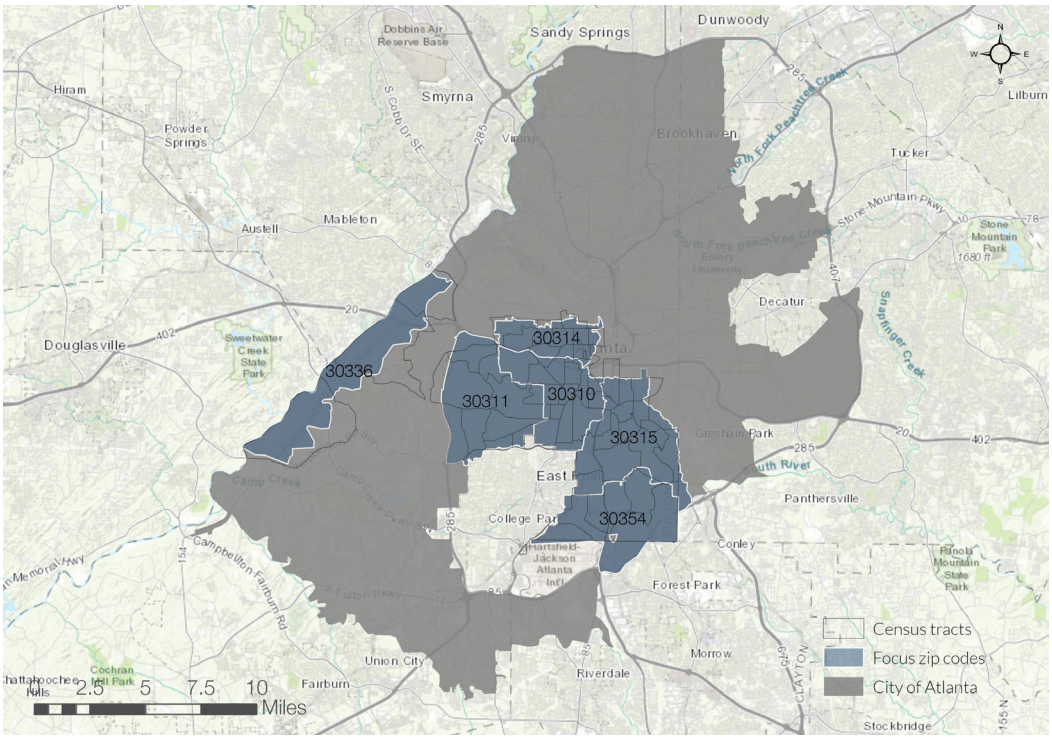


Georgia Department of Transportation 's (GDOT) construction of new green stormwater infrastructure retrofit in the interstate interchange at the heart of downtown Atlanta | Photo by The Sintoses via American Rivers

About this study

This project, which is led by the Partnership for Southern Equity (PSE) and is a part of the Kresge Foundation's Climate Change, Health, and Equity (CCHE) initiative, is focused on how to advance racial equity and shared prosperity with a particular focus on six zip codes in Atlanta that have been impacted disproportionately by environmental hazards and health disparities to analyze the areas for potential workforce development in clean energy. By assessing the potential outcomes regarding the future clean economy, the study identified some of the key issues that could generate inequitable outcomes and limit the potential for wealth creation and retention in lower-income neighborhoods. The study also sought to explore how community-based organizations and local governments can add capacity for community members to most equitably access opportunities in the growing clean economy.

Figure 1. Focus zip codes and corresponding census tracts



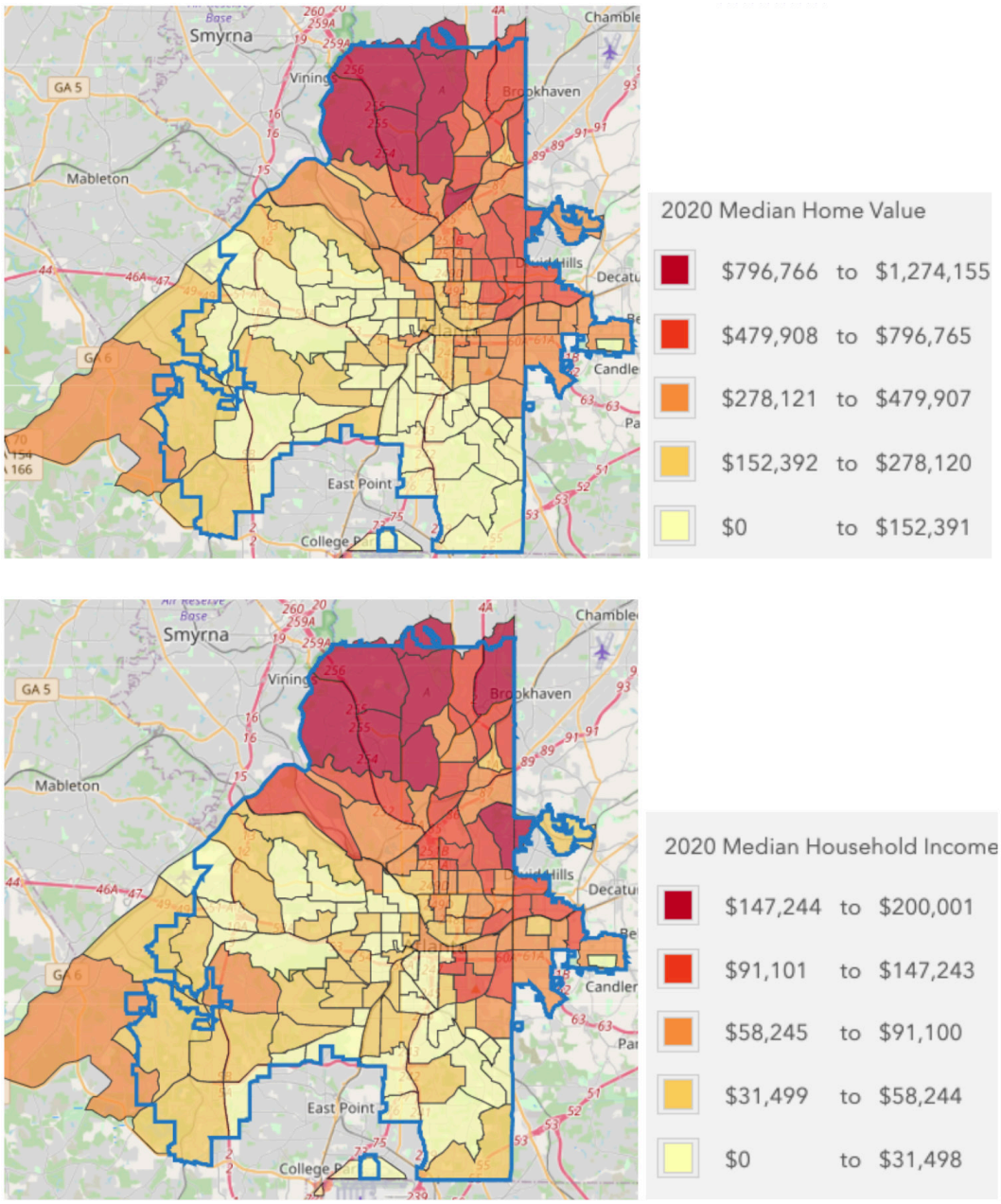
As shown in Figure 1, the six focus zip codes (30310, 30311, 30314, 30315, 30336, 30354) are located in the southwestern portion of Atlanta. These zip codes encompass a wide range of neighborhoods—broadly between Downtown Atlanta and Hapeville, Georgia, which is a community near Hartsfield-Jackson Airport—including Peoplestown, Capitol View, West End, Sylvan Hills, Fort McPherson, and Venetian Hills.

- Many of these neighborhoods host nationally-significant academic and civic institutions that have anchored the community for over a century, like the Atlanta University Center.
- The total population in each of the six focus zip codes significantly decreased between 2000 and 2010 and, although they have more recently experienced an inflow of residents, they have not yet returned to the population levels in the 2000s.
- The median household income (MHI) in the six focus zip codes across the southwestern portion of the city was about half of the overall city's median income in 2019 —as were the median home values (MHV) and average earnings.

Data sources: US Census and Esri Business Analyst

Due to pervasive cycles of disinvestment over the past decades, many of the vacant properties across these neighborhoods have been taken over by investors who are currently holding them until the ongoing development of the Atlanta BeltLine raises the area's property prices, after which many of them are expected to sell to other parties or investors at a high premium. The Atlanta BeltLine was originally envisioned as "a 22-mile loop of trails, transit, and greenspace that will transform the City and become a centerpiece for sustainable growth and connectivity" over the course of 25 years, beginning in 2005. While some parts of this trail that intersect the focus zip codes have already been completed, such as the three mile Westside Trail—other segments—including the Southside Trail—are still under development. Investors holding vacant properties is detrimental to these neighborhoods and residents, especially renters, because it raises property values but does not advance the causes of neighborhood revitalization or historic preservation.

Figures 2 & 3. Atlanta Median Home Values (MHV) and Median Household Income (MHI) by census tract



The City of Atlanta is within the Atlanta-Sandy Springs-Roswell Metropolitan Statistical Area (MSA), which is comprised of 29 counties. Metropolitan statistical areas are useful geographies for data collection and comparison and are designated as places that consist of one or more counties with a city of 50,000 or more people. The percent of the population identifying as a racial minority in the Atlanta-Sandy Springs-Roswell MSA is 47 percent while the average in the focus zip codes is 91 percent as of 2020. The neighborhoods with the highest rates of lower-income households in Atlanta are the ones with the longest average distance to grocery stores while having the lowest access to vehicles, which further illustrates physical barriers in the built environment that many southwest Atlanta residents have to overcome to meet basic necessities like nutritious foods, quality household products, and other basic necessities.

Table 1. Key Demographic indicators (2020)

Site	Total Population	Percent Minority	Median Household Income (MHI)	Median Home Value (MHV)	Average Earnings (individuals)	Percent Below Poverty Line
Atlanta-Sandy Springs -Alpharetta, GA MSA	5,862,424	47%	$68,316	$233,700	$38,834	11%
30310	30,803	90%	$33,868	$203,200	$13,999	27%
30311	36,219	97%	$30,949	$161,000	$17,124	31%
30314	23,263	92%	$29,470	$138,800	$11,278	29%
30315	35,166	85%	$29,777	$167,900	$16,503	32%
30336	1,154	99%	$56,000	–	–	16%
30354	15,573	80%	$40,841	$153,000	$28,251	22%

Data sources: US Census and ACS

Racist land use and development policy, compounded by historic cycles of disinvestment, have resulted in the disparate economic outcomes in Atlanta today. Currently, residents in southwest Atlanta have significantly lower incomes, employment rates, and educational attainment levels than residents city-wide. As new scientific and technological advances continue to be made toward cleaner energy generation, transportation, manufacturing, and other areas of the economy, **the existing socioeconomic gaps will only continue to widen unless local and regional leaders commit to investing the necessary resources to prepare local workers to be competitive in these emerging fields and occupations.**

> If residents are not provided with opportunities and resources to achieve competence in these areas, the inequitable growth of the workforce is likely to continue to reinforce historic inequities.

The continued expansion of the clean economy represents a significant opportunity for the creation of entry-level jobs with upward mobility potential for individuals that have been historically excluded from pathways for wealth-building. As the nation transitions towards cleaner energy generation, there is likely to be significant investment in clean energy, infrastructure, and environmental management projects throughout the country, which will require a high-capacity workforce prepared to execute, maintain, and monitor every component of the process.

EXECUTIVE SUMMARY

In order to support Atlanta's current and future workers' participation in the growing clean economy, this study analyzes the areas for potential workforce development and job creation impact of new clean energy and sustainability policies in the City of Atlanta. By assessing the potential outcomes of existing plans and policies that can lead to job creation in the future clean economy, the study identified some of the key issues that could limit the potential for clean jobs and wealth creation and retention in lower-income neighborhoods, and determine what kinds of support community members with lower incomes will need to be able to participate in the growing clean economy moving forward. With the compounding effects of the global pandemic, economic recession, social unrest, and worsening climate change threats, there has never been a more urgent need to advance clean jobs that are fair and accessible in the years ahead.

Introduction to the Clean Jobs Sector

The term 'clean economy' is broadly used to describe economic activities that contribute to the preservation and restoration of the natural environment. Occupations or lines of work within the clean economy might include those that relate to renewable energy, recycling, clean manufacturing and design, transportation, green infrastructure, pollution remediation, waste management, and agriculture, among others. Generally speaking, these segments of the economy are responsible for supplying technologies, products, and services that have measurable environmental benefits in terms of their abilities to reduce greenhouse gas (GHG) emissions and improve both energy and resource efficiency.

Jobs in these sectors will support goals to reduce emissions and protect communities from the harmful impacts of climate change, and proactive city governments are increasingly focusing on these opportunities in economic growth goals and plans.

The outlook for the national clean economy is bright despite the COVID-19 crisis' impacts

E2's Clean Jobs America 2021 report states that the U.S. clean energy job sector fell more than 11 percent in 2020 as COVID-19 pandemic restrictions prevented energy efficiency workers from entering commercial and residential buildings. Overall, renewable energy jobs fell by nearly 6 percent. Wind energy employment increased slightly, but solar employment fell due to declines in residential solar sales and installation. As a result of the pandemic's detrimental economic impacts, strong policies to support businesses struggling during COVID-19 at the national, state, and local levels have been implemented and have contributed to the recovery of the clean economy sector. Employment levels started to recover as early as the fourth quarter of 2020.

Clean energy remains the most prominent job creator across America's energy sector, employing nearly three times as many workers as the fossil fuel industry—which includes fossil fuel extraction and generation. More Americans work in clean energy than work as middle and elementary school teachers, bankers, farmers, or real estate agents. Median hourly wages for clean energy jobs are 25 percent higher than the national median wage, and generally pay better than most fossil fuel extraction jobs. As both policy and the market responds to the demand and need for more clean energy solutions, this trend in employment will only become more pronounced.

> More Americans work in clean energy than work as middle and elementary school teachers, bankers, farmers, or real estate agents.
>
> *– Roosevelt Institute, 2020*

Clean Economy

Clean jobs are either "jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources" or "jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources."

Energy Efficiency

Any products or services that reduce the amount of energy used, which can include or relate to energy efficient buildings, appliances, vehicles, or other equipment.

Clean Energy - Solar

Energy from renewable sources, which includes wind, solar, biomass, hydro-power, thermal, ocean, and landfill gas. Solar energy technologies convert solar energy to electricity using photo-voltaic panels or by concentrating solar radiation. Activities within this sector range from steps in the process of converting solar energy to electricity, to solar panel manufacturing, scientific research and advancements, to sales, marketing, and installation.

Environmental Management

Systems and processes concerned with minimizing waste and environmental impacts. This includes products and services to conserve and manage natural resources including land, water, or wildlife, and sustainable practices of forestry and agriculture. It also encompasses environmental compliance, education and training, and public awareness.

Green Infrastructure

Includes infrastructure used to manage stormwater by capturing it where it falls with natural elements including, but not limited to, green roofs, bioswales, rainwater harvesting, and permeable pavement.

A note on methodology

Various definitions for the clean (sometimes referred to as the 'green') economy exist, though a single accepted definition detailing and tracking employment within specific sectors, even at the national level, does not exist. This research relies on the definition outlined by the Brookings Institution, which builds upon the definition outlined by the Bureau of Labor Statistics (BLS).[1] According to the BLS, clean jobs are either "jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources" or "jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources". The Brookings Institution worked to define and quantify the clean economy on a nationwide basis along similar lines as "economic activity measured in terms of establishments and the jobs associated with them that (a) produce goods and services with an environmental benefit, or (b) adds value to such products using skills or technologies that are uniquely applied to those products."

The most in-demand jobs and skills are delineated using occupational codes which group together jobs with shared skill sets to help quantify sectors of the economy. The Bureau of Labor Statistics uses the Standard Occupational Classification (SOC) system which is a federal statistical standard used to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data. All workers are classified into one of 867 detailed occupations according to their occupational definition. Detailed occupations in the SOC with similar job duties, and in some cases skills, education, and/or training, are grouped together.

Atlanta has adopted bold policies and plans to address challenging climate realities, namely through reducing greenhouse gas emissions, transitioning to clean energy, and protecting, restoring, and accentuating green infrastructure. These efforts have supported the clean economy, which has a greater proportion of higher paying jobs for those with lower educational qualifications when compared to other industries. On average, employment within the clean economy has hourly wages that exceed national average wages by 8 to 19 percent, and nearly 50 percent of workers do not have more than a high school diploma. Atlanta's efforts to grow a strong, clean economy and build vibrant and resilient communities are reflected in the frameworks, goals, and strategies outlined in the Table 2 below.

The table outlines thirteen of Atlanta's most significant plans that seek to address sustainable development, economic mobility, energy efficiency and preparedness, enhanced green space, and pathways to improved quality of life of all of Atlanta's residents. Despite these efforts, the American Council for an Energy-Efficient Economy (ACEEE), a national nonprofit that seeks to "advance energy efficiency policies, programs, technologies, investments, and behaviors in order to help achieve greater economic prosperity, and environmental protection," reports that it is currently impossible to determine if the City of Atlanta has created a formal role for marginalized community residents or local organizations representing those communities to participate in decision-making that affects the creation or implementation of a local energy, sustainability, or climate action plan."

Table 2. Key city and state plans

Year	Plan (Entity)	Purpose / High level goals	Mention of workforce development
2015	Atlanta Climate Action Plan (City of Atlanta)	A framework for the development and implementation of actions that drive and coordinate local efforts toward a reduction in greenhouse gas emissions by 40 percent below 2009 levels by 2030. Focus areas include: • Commercial & Industrial Buildings • Residential Buildings • Energy Production • Materials Management and Recycling • Water and Wastewater • Management • Transportation • Green Spaces/Food Security	"Climate protection measures can…spur business and job growth during the design, manufacture, and installation of energy efficient technologies" (p.8). "Benchmarking also support local economies because building owners may decide to upgrade their buildings, creating jobs for contractors, engineers, and other building professionals" (p.15). "Increasing solar power in Atlanta could make the city a leader in the region for the solar power industry, create jobs, and boost the economy" (p.21). "Urban agriculture increases economic prosperity by creating jobs and developing new local industries" (p.41).
2017	Resilient Atlanta (City of Atlanta)	A collaborative, action-driven plan that helps Atlanta address the region's most pressing shocks (such as floods, and infrastructure failure) and stresses (such as economic hardship or social inequality). Vision 3 (Build Our Future City Today) and Vision 4 (Design Our Systems to Reflect Our Values) directly address managing climate impacts.	Workforce development is mentioned in the transportation, water-efficiency, humanities, and airport sectors. "The skills obtained by inspectors in the [Water Efficiency Restaurant Certificate (WERC) Program] will serve as a gateway to additional training and job opportunities in the plumbing and water treatment fields" (p.86).
2018	Green Infrastructure Strategic Action Plan (City of Atlanta)	A plan that provides an overview of recommended actions necessary to help address institutional and funding barriers, steer policy, increase effectiveness, and engage partners (city departments, citizens, the development community, and environmental groups) in implementing Green Infrastructure across the City of Atlanta.	"Work with partners to develop a green infrastructure workforce training program and create green collar job opportunities for City residents" (p.12).
2019	Georgia Power 2019 Integrated Resource Plan (Georgia Power)	A 20-year energy plan to prepare for Georgia's future energy landscape. Actions include adding an additional 1,000 MW of renewable resources, continued implementation of demand-side programs, retirement of aging and economically challenged plants, compliance with environmental requirements, and deployment of battery energy storage technologies.	N/A
2019	One Atlanta Strategic Transportation Plan (City of Atlanta)	A roadmap for a safer, more equitable, and more sustainable transportation network in Atlanta. Benchmarks include attracting and maintaining a talented and diverse workforce, to job training and safety enhancements that encourage employees to build careers in the public sector, to workplace safety enhancements and improved emergency response.	"Build a workplace where everyone—from managers to roadway maintenance crews—are encouraged to innovate and improve this city's transportation network" (p.27). "To build streets that work for all Atlantans, we need a workforce that reflects all of Atlanta. Through a clear value statement and a commitment to finding and training great employees, we will demonstrate that ATLDOT is ready to improve not just every street in this city, but every community as well" (p.28).

Table 2. Key city and state plans (continued)

			"Expand the existing intern, scholarship and apprenticeship programs" (p.28). "Build a pipeline of scholarship recipients and apprentices to fill future full-time roles" (p.65).
2019	Clean Energy Atlanta; 2021 Update (City of Atlanta)	An action-oriented plan for a clean energy future that is equitable, cost effective, and sustainable. It outlines the opportunities and challenges the City of Atlanta will face in the coming years to achieve a 100 percent clean energy transition for municipal operations by 2025 and community-wide by 2035. While other sustainability plans set out energy goals, Clean Energy Atlanta is the first plan to exclusively focus on identifying policy actions to achieve Atlanta's clean energy goals.	"The city aims to prioritize opportunities that will benefit the local economy" (p.31). "The Maximizing Atlanta's Local Clean Energy Potential scenario provides the greatest benefits to Atlanta…[leading] to the creation and support of up to 8,000 jobs and reduce overall CO2 emissions by 29.8 million metric tons through 2035" (p.34). "In 2025, more than 90 percent of the projected job creation in the clean energy sector will occur due to energy efficiency, with over 70 percent coming from commercial energy efficiency. Nearly a third of all jobs are in construction, followed by 15 percent in energy and environmental management and smart controls, 13 percent in heating, ventilation, air conditioning and refrigeration, and about 10 percent in both program administration and architecture and engineering services" (p.52). "Collaborate with technical colleges and trades to develop a clean energy workforce" (p.57).
2020	Atlanta Downtown Sustainability Action Plan (City of Atlanta)	A plan that identifies strategies for reducing the environmental footprint of Downtown Atlanta, which is home to 27,000 residents and over 154,000 jobs, to create a healthy and economically strong district. The plan includes 12 strategies to increase energy and water efficiency in buildings, support the transition to renewable energy, reduce greenhouse gas emissions from commuting, send less waste to landfill, create robust green infrastructure, increase access to fresh local food, and foster a culture of sustainability.	"Waste diversion involves focusing on tactics like source reduction, recycling, reuse, food recovery, and composting…Recycling for reuse has significant potential economic benefits, like reducing waste disposal costs, saving landfill space, and creating Jobs" (p.27). "Create a student training program to support small and medium-sized businesses with energy and water efficiency" (p.14).
2020	One Atlanta: Economic Mobility, Recovery & Resilience Plan (City of Atlanta, Invest Atlanta)	A plan with a primary goal to achieve better economic and social outcomes for Atlanta's black and brown communities, where low-income households and high rates of poverty and unemployment persist. It uses an Economic Mobility Index to determine whether economic mobility pathways are operating effectively in different parts of the city, and it outlines 5 strategic objectives to help every Atlantan have equal access to jobs in competitive industries, including IT, utilities, construction, transportation, logistics, manufacturing, food processing, marketing, and design.	"[Invest Atlanta] can attract, retain and support businesses that have a large share of good and promising jobs that do not require a bachelor's degree" (p.28). "New green jobs will also be created in the coming years as the city transitions to 100% clean energy in accordance with the plan "Clean Energy Atlanta: A Vision for a 100% Clean Future" (p.28). "Workforce Atlanta plays a key role in preparing residents for occupations in industry sectors" (p.32). "Invest Atlanta has several tools to support small businesses, including loans, workspace down payment assistance and facade improvement Grants" (p.38).

Table 2. Key city and state plans (continued)

2020	One Atlanta: Housing Affordability Action Plan (City of Atlanta)	A plan building on a 2019 comprehensive, multi-agency housing strategy, which outlines a bold vision to provide a pathway to affordable and equitable housing opportunities for Atlanta residents. The plan has an actionable goal to "expand energy efficiency and home rehabilitation programs" to prevent involuntary displacement and ensure equitable growth (p.12).	N/A
2021	Atlanta Regional Development Plan (Atlanta Regional Commission)	A long-range blueprint detailing investments needed to ensure the metro Atlanta region, with a population projected to grow to 8.6 million people by 2050, has future success and improved quality of life. It builds on what assets the 10-county Atlanta region has and what challenges the region is facing today.	"Sustained investment in infrastructure, workforce, and quality of life will be critical to ensuring the region's economic status as a global business hub" (p.8). "Leveraging investments in creative placemaking, allows communities to develop into unique destinations for both residents and visitors. Based upon the Atlanta Region Arts and Economic Prosperity Study, arts spending within Metro Atlanta equaled approximately $471 million and supported 23,943 jobs (p.24). "Since 2000, the [Livable Centers Initiative] program has invested over $255 million in 122 communities throughout the Atlanta region, helping pay for planning studies and the construction of transportation projects, such as sidewalks and intersection improvements, to bring those visions to life" (p.44). "Jobs in transportation/warehousing, manufacturing, and other goods movement/logistics can play a role in ladders of opportunity, as many of these jobs provide a livable wage but typically do not require a college education" (p.52).
2021	Downtown Atlanta Urban Tree Planting Plan (Central Atlanta Progress)	A plan that aims to increase tree canopy to improve air and water quality, create shade, and enhance Downtown Atlanta's aesthetic by planting over 8,000 trees over ten years. Benefits include cooling of streets, reduction of the urban heat island effect, mitigation of greenhouse gas emissions at the ground level, trapped airborne particulate matter, and increased natural carbon sequestration. Trees will be planted along Downtown's streets, as well as on underutilized land.	N/A
2021	Plan A: City of Atlanta Comprehensive Development Plan (City of Atlanta)	Phase 1 of a plan with a 15-year, citywide community vision to be more intentional about how Atlanta grows by prioritizing people and places and putting infrastructure in service to their lives. It aims to address challenges such as income inequality, expanding mobility and housing options, protecting nature, and providing access to jobs, fresh food, parks and cultural facilities.	"We will prioritize industries with promising jobs, where Atlanta's workforce can be increasingly competitive—information technology, utilities, construction, transportation, logistics, manufacturing, food processing, marketing, design, green economy, and local food systems" (p.109). "Retain and attract a diverse workforce of people with a variety of backgrounds, abilities, talents, skills, and education levels" (p.109).

Table 2. Key city and state plans (continued)

	City of Atlanta Department of Watershed Management Strategic Plan 2022: A One Water Vision		

Will policy changes and market forces bring clean jobs to Atlanta?

Yes, these policy changes are likely to bring clean jobs to Atlanta and present significant opportunities for Atlanta's current and future workforce. Based on the enacted policies impacting Atlanta, there are three different areas of the clean economy that are likely to have the greatest job growth potential. The anticipated high growth areas within the clean economy include:

1. **ENERGY EFFICIENCY** - Includes manufacturing and enhancing products, systems, or services that reduce the amount of energy consumed, which can include energy-efficient buildings, appliances, vehicles, and other equipment.

2. **SOLAR ENERGY** - *Within the clean energy generation sector.* Includes the process of converting solar energy to electricity, from solar panel manufacturing and scientific research and advancements to sales, marketing, and installation.

3. **GREEN INFRASTRUCTURE** - *Within the environmental management sector.* Includes the design and implementation of any infrastructure used to manage stormwater by capturing it where it falls with natural elements including, but not limited to, green roofs, bioswales, rainwater harvesting, and permeable pavement.

Although the above-mentioned plans and policies set out the city's goals to invest in efficient systems, renewables, and green infrastructure, **most of them do not lay out specific actions for workforce transition and training, even if they mention it, and many of them don't report the expected impact on the local workforce.**

Of the thirteen plans analyzed:

11/13 Mention workforce goals, acknowledging a need for training opportunities and scholarship and apprenticeship programs.

6/13 Offer tactics for implementing employment solutions. Of these, the majority discuss the need to train and transition employees from other industries.

8/13 Acknowledge the importance of prioritizing equity in a clean economy transition, as there is a disproportionate energy burden on Atlanta's low-income communities.

2/13 Outline priority actions to address these inequities, beyond recognition of needed continued work on income and race disparities in the region.

Utility costs impose a disproportionate burden on households in the six focus zip-codes where residents have median incomes that are 51 percent lower than the city as a whole, and who are rent overburdened with nearly a third of households paying over 50 percent of their total monthly income on rent.

Looking at Atlanta's Evolving Clean Economy

Detailed research comparing the clean economy across states or regions is not frequently conducted largely due to a lack of comparable data, or even research at the national level.[2] The most recent comprehensive and disaggregated (by Metropolitan Statistical Area) study on the clean economy was conducted in 2011 by The Brookings Institution; while this study remains an important resource, the clean economy, and policies advancing the clean energy transition, have advanced significantly since a decade ago, limiting the report's utility today. However, the study remains useful in understanding trends in the clean economy across the country and in delineating occupations within the clean economy.

This study ranked the Atlanta-Sandy Springs-Marietta metro area as the most diverse metropolitan area clean economy in the nation with jobs spread across 39 segments of the clean economy. The metro area was also rated as the seventh largest metro clean economy in the country with employment clustered in green architecture and construction services. Other moderately clustered segments of the clean economy include recycled content products, green building materials, water efficient products, green chemical products, battery technologies, and appliances.

What is the current clean economy landscape in Atlanta, and what does that mean for the future?

As the cost of many clean technologies decrease and demand for clean energy and efficient technologies are paired with supportive policies and investments, jobs in this sector will continue to be on the rise. To understand how employment in Atlanta's clean economy has changed over the last ten years, this study conducted an analysis of employment within occupational codes in different sectors of the clean economy.[3, 4]

In total, between the years 2011 and 2020, employment in the clean economy in the Atlanta-Sandy Springs-Roswell Metropolitan Statistical Area (MSA) increased by 13 percent (31,300 jobs), nearly keeping pace with the actual population increase. During this time the population of the MSA increased by 15 percent, and the total number of people employed in the labor force increased by 17 percent. Jobs in energy efficiency grew the most over this time period experiencing a growth of 15 percent, or 20,656 jobs. The changes in the three key categories of the clean economy can be seen in the table below. The area that saw the highest workforce expansion in the Atlanta MSA was energy efficiency, with a growth of 15.1 percent, or 20,656 additional jobs available during the same period.

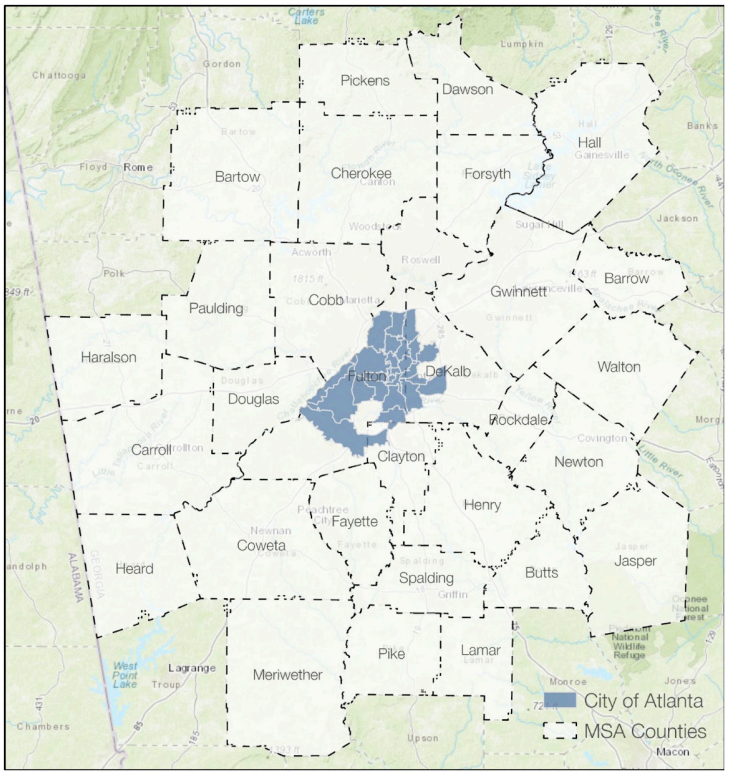


Figure 4. City of Atlanta and Atlanta-Sandy Springs-Roswell MSA

Table 3. Clean economy employment projections, Atlanta-Sandy Springs-Roswell MSA

Category	Employment 2011	Employment 2020	Percent of Total	Percent Change	2029 MSA Job Estimate	MSA Employment Increase Estimate	City Employment Increase Estimate
Energy efficiency	118,480	136,420	50%	15%	157,076	20,656	1,942
Clean energy	92,990	102,020	37%	10%	111,927	9,907	931
Green Infrastructure	30,210	34,540	13%	14%	39,491	4,951	465
Totals	**241,680**	**272,980**	**100%**	**13%**	**308,494**	**35,514**	**3,338**

As of 2019, the city of Atlanta comprised 8.6 percent of the employed population in the MSA and 8.9 percent of the MSA population 16 and older. Between 2011 and 2019, the city's share of the MSA's employees increased at a faster rate than its share of the population—meaning that jobs were coming to the city at an even faster rate than people were moving there.

Tables 4 & 5. Atlanta and MSA population and labor force

Total Employed in Labor Force	2019	2011	Percent Increase
Atlanta	250,473	200,419	25%
MSA	2,915,977	2,488,056	17%
Atlanta share of MSA total	**8%**	**8%**	–

Population 16+	2019	2011	Percent increase
Atlanta	407,960	345,964	18%
MSA	4,584,199	3,981,271	15%
Atlanta share of MSA total	**9%**	**9%**	–

Data Source: 2011 and 2019 ACS 5 Year Estimates

Table 6. Atlanta and MSA clean economy projections

Category	2029 MSA Jobs Estimate	MSA Employment Increase Estimate	City Employment Increase Estimate
Energy efficiency	157,076	20,656	1,942
Clean energy	111,927	9,907	931
Environmental Management	39,491	39,491	465
Totals	**308,494**	**35,514**	**3,338**

Extrapolating these trends, it is estimated that in the next ten years the City of Atlanta will continue to expand its labor force at a faster rate than the MSA (meaning that Atlanta's share of the MSA's employment would be at least 9.4 percent in 2029), and will thus capture a larger share of the estimated increase in clean economy jobs. Even with Atlanta capturing a larger share of clean economy jobs at 9.4 percent of all new clean economy jobs until 2029 (see Table 5), past trends would only indicate that an additional 3,338 jobs would be coming to the City of Atlanta. Additional clean economy jobs available in other parts of the MSA may be available to those in the focus zip codes, though transportation poses a challenge to accessing these jobs. The MSA encompasses 29 counties and covers a large geographic footprint spanning more than 130 miles north and south and over 140 miles east and west. Thus, even for the 63 percent of people who rely on a personal vehicle to drive alone to work, jobs in the vast majority of the MSA are not feasible for daily commutes both in terms of time and cost.

While growth in the clean economy has been modest in the last ten years, past job growth is not the only predictor for the number of jobs that will become available over the next ten years in Atlanta. Strong policies and programs in Atlanta, in the last five years especially, have prioritized clean economy activities. These job-creating policies mean the number of jobs available in the next ten years will exceed those created in the previous ten years. Clean Energy Atlanta is one of the only plans in place in Atlanta that provides an estimate of jobs that will be provided as a result of the programs and policies proposed. The plan estimated the addition of 8,000 jobs as the city transitions to 100 percent clean energy between 2017 and 2035.

What clean economy jobs and skills will be most in demand and what are their associated skills?

Based on past trends in the clean economy within the Atlanta MSA, and plans and associated policies and programs in place, the following jobs and skills are projected to be the most in demand in the next 10-20 years in the three identified key areas of the clean economy. These jobs and associated skills expected to be most in demand can be seen in the jobs detailed in Tables 7 - 9. In the next section, the educational requirements and expected average wages of each of these occupations are also given in Tables 11 - 13. The skills and associated educational requirements in each of the three areas of the clean economy range from manual labor to more technical skill sets that can often be learned through vocational training or on-the-job training programs.

Occupations within the clean economy often employ similar skill sets to those across other more established sectors of the economy, though some retraining or specialized training may be required. For example, jobs in energy efficiency or clean energy can be found within other industry categories including engineering, construction, management, architecture, and others, even if the words 'energy' or 'efficiency' are not part of the job title. In cases where jobs are posted which include exposure to the clean economy, job applicants with some skills related to the clean economy—or at least an interest in or understanding of the clean economy—may have an edge in the hiring process.

Top growth occupations within the clean energy sector of the clean economy include those that are explicitly related to solar energy, such as solar photovoltaic installers, but also span other broad skill sets in engineering and different types of equipment management.

1. Energy Efficiency

Jobs in energy efficiency are broadly defined as jobs that cover both the production and installation of any products or services that reduce the amount of energy used. These types of products can include energy-efficient buildings, appliances, vehicles, and other equipment and infrastructure, all of which require design, engineering, installation, customer services and maintenance. Working in energy efficiency offers good opportunities for professional growth and competitive compensation, as well as the chance to contribute to the mitigation of the greenhouse gas emissions which are leading to climate change.

Jobs in energy efficiency can be found within other industry categories like engineering, construction, management, architecture, and many others, even if the words 'energy' or 'efficiency' are not part of the job title. For example, about 1 out of 5 (17 percent) construction workers across the country do something related to energy efficiency even if their job title doesn't reflect that. In the US, about half of all jobs in energy efficiency are generally related to construction, 20 percent to professional services, and 14 percent to manufacturing. Most energy efficiency jobs can actually be found within more 'traditional' energy sectors — like electricity, geological, or hydrologic —but in order to be considered an energy-efficient job, the scope of the position must be focused on or contribute to the reduction of the amount, cost, and environmental impact of energy production and operations to some extent.

Atlanta has adopted bold policies to act on climate change, including achieving a 100% clean energy transition for municipal operations and community-wide by 2035. These policies will lead to the increased need for professional services related to energy efficiency and mean that Atlanta is likely to offer more jobs in this sector than other cities and towns without these types of policies in place.

Efficiency was the energy sector that saw the highest job growth in Atlanta between 2011 and 2020. The number of local jobs specifically within the energy efficiency sector (whether construction, professional services, manufacturing, or another category) grew by 15 percent (20,656 additional jobs) over the past decade. This means that there are more opportunities within this sector than ever before and young people in Atlanta should consider entering one of these careers, as there will continue to be increasing demand for these skills.

Energy efficiency workers working on and repairing HVAC systems, and compressed air pumps.

Photos by Fulford Heating and Cooling

Table 7. ENERGY EFFICIENCY OCCUPATIONS	OCCUPATION CODE	COMMON JOB TITLES	JOB DESCRIPTION
Assistant Electricians	473013	Electrician Helper, Electrician's Helper	Help electricians by performing duties requiring less skill. Duties include using, supplying, or holding materials or tools, and cleaning work area and equipment.
Construction Laborers	472061	Bituminous Asphalt Technician, Construction Laborer, Construction Worker, Drop Crew Laborer, Equipment Operator (EO), Form Setter, Post Framer, Scaffolding Operator, Site Work Laborer, Toolman	Perform tasks involving physical labor at construction sites. May operate hand and power tools of all types: air hammers, earth tampers, cement mixers, small mechanical hoists, surveying and measuring equipment, and a variety of other equipment and instruments. May clean and prepare sites, dig trenches, set braces to support the sides of excavations, erect scaffolding, and clean up rubble, debris, and other waste materials.
Installation, Maintenance, and Repair Workers, All Other	499099	Building Mechanic, Equipment Engineering Technician, Facilities Technician, Maintenance Engineer, Maintenance Journeyman, Maintenance Man, Maintenance Mechanic, Maintenance Specialist, Maintenance Technician, Maintenance Worker	Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of a building in repair. Duties may involve pipe fitting; HVAC maintenance; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.
Automotive Service Technicians and Mechanics	493023	Automobile Mechanic, Automotive Drivability Technician, Automotive Mechanic, Automotive Service Technician, Heavy Line Technician, Lube Technician, Master Automotive Technician, Mechanic, Quick Service Technician, Service Technician	Diagnose, adjust, repair, or overhaul automotive vehicles.
Heating, Air Conditioning, and Refrigeration Mechanics and Installers		A/C Tech , HVAC Installer, HVAC Mechanic, HVAC Specialist, Refrigeration Mechanic, Refrigeration Operator, Refrigeration Technician, Systems Mechanic, Transportation Refrigeration Technician	Install or repair heating, central air conditioning, HVAC, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves.
Industrial Machinery Mechanics	499041	Industrial Machinery Mechanic, Industrial Mechanic, Loom Fixer, Loom Technician, Machine Adjuster, Machine Mechanic, Maintenance Technician, Mechanic, Overhauler, Sewing Machine Mechanic	Repair, install, adjust, or maintain industrial production and processing machinery or refinery and pipeline distribution systems. May also install, dismantle, or move machinery and heavy equipment according to plans.
Plumbers, Pipefitters, and Steamfitters	472152	Drain Technician, Fire Sprinkler Service Technician, Pipe Fitter, Pipe Welder, Pipefitter, Plumber, Residential Plumber, Service Plumber, Sprinkler Fitter, Steamfitter	Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Includes sprinkler fitters.
Construction Managers	119021	Concrete Foreman, Construction Area Manager, Construction Foreman, Construction Manager, Construction Services Manager, Construction Superintendent, Job Superintendent	Plan, direct, or coordinate, usually through subordinate supervisory personnel, activities concerned with the construction and maintenance of structures, facilities, and systems. Participate in the conceptual development of a construction project and oversee its organization, scheduling, budgeting, and implementation. Includes managers in specialized construction fields, such as carpentry or plumbing.

2. Solar Energy

Solar energy jobs are within the clean energy generation sector and include all positions involved in the process of converting solar energy to electricity, from solar manufacturing and scientific research and advancements to sales, marketing, and installation. For example, solar manufacturing is the process of making system components such as solar modules, inverters, racking equipment, batteries, and other important components of a solar photovoltaic (PV) system (solar panels to generate electricity directly from sunlight). According to the 2020 National Solar Jobs Census, workers in manufacturing jobs represented 14 percent of all industry employment, while sales and distribution, and operations and maintenance represented 11 percent and 4 percent of all jobs, respectively.

The U.S. solar industry employed 231,474 workers in 2020, with a trajectory to reach 400,000 solar jobs by 2030. As of 2017, the state of Georgia had a very low concentration of energy employment with only 1.4 percent of Georgia's state employment being in the energy sector compared to 2.4 percent of national employment. Additionally, only 1.4 percent of the nation's electric power generation jobs are in Georgia, though solar makes up the largest segment of the state's electric power.

Educational and job training requirements are then presented based on O*Net data for each occupational code. After a 30 percent increase in jobs over the previous year, in 2019 Georgia ranked No. 1 in solar jobs growth in the Solar Foundation's Solar Jobs Census. This ranking, the most recent available from the foundation, also placed Georgia sixth in total solar manufacturing employment. Atlanta's plans and policies aim to make clean energy system operations more efficient, resilient, and conducive to continued growth and economic prosperity, and they are likely to lead to increased interest in solar from commercial, residential, institutional, and utility groups, leading to demand for solar sales, installation, and maintenance. The cost of solar in Atlanta is expected to decline into the future and decline faster as more solar is deployed. As a result, more homes and businesses may find it attractive to go solar, leading to further growth in this job sector.

Nearly all solar jobs require familiarity with basic practices of the industry, construction, or electrical knowledge. This familiarity can be acquired through apprenticeship, internships, and other educational initiatives through vocational schools and universities. The personal skills of communication, ability to follow directions, attention to detail, and customer service can be gained through educational exposure and practice. Compensation in the solar industry is comparable with similar occupations in other energy industries and higher than U.S. averages for most of the same positions, making these opportunities lucrative and attractive for young members of the workforce.

Solar panel roof instalation | Photo via The Guardian

Table 8. SOLAR ENERGY OCCUPATIONS	OCCUPATION CODE	COMMON JOB TITLES	JOB DESCRIPTION
Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	512028	Assembler, Electrical Assembler, Electromechanical Assembler, Electromechanical Equipment Assembler, Electronic Assembler, Electronic Technician, Electronics Assembler, Mechanical Assembler, Production Associate, Wiring Technician	Assemble or modify electromechanical equipment or devices, such as servomechanisms, gyros, dynamometers, magnetic drums, tape drives, brakes, control linkage, actuators, and appliances.
Operating Engineers and Other Construction Equipment Operators	472073	Back Hoe Operator, Engineering Equipment Operator, Equipment Operator, Forklift Operator, Heavy Equipment Operator, Hot Mix Asphalt Operator, Motor Grader Operator, Operating Engineer	Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement.
Solar Photovoltaic Installers	472231	Installer, PV Design Technician (Photovoltaic Design Technician), Photovoltaic Installer (PV Installer), Solar Designer, Solar Installer, Solar Installer Technician, Solar Photovoltaic Installer (Solar PV Installer), Solar Technician	Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks.
First Line Supervisors of Construction Trades and Extraction Workers	471011	Coal Mine Production Foreman, Construction Foreman, Construction Supervisor, Electrical Supervisor, Field Operations Supervisor, Field Supervisor, Insulation Foreman, Roustabout Field Supervisor, Sheet Metal Foreman, Site Superintendent	Directly supervise and coordinate activities of construction or extraction workers.
Solar Sales Representatives and Assessors	401107	Energy Consultant, Sales Associate, Sales Representative, Salesman, Solar Consultant, Solar Sales Representative	Contact new or existing customers to determine their solar equipment needs, suggest systems or equipment, or estimate costs.
Industrial Engineers	172112	Continuous Improvement Engineer, Engineer, Facilities Engineer, Industrial Engineer, Operations Engineer, Plant Engineer, Process Engineer, Project Engineer, Quality Engineer, Research and Development Engineer	Design, develop, test, and evaluate integrated systems for managing industrial production processes, including human work factors, quality control, inventory control, logistics and material flow, cost analysis, and production coordination.
Mechanical Engineers	172141	Application Engineer, Design Engineer, Design Maintenance Engineer, Equipment Engineer, Mechanical Design Engineer, Mechanical Engineer, Process Engineer, Product Engineer, Project Engineer, Test Engineer	Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of equipment such as centralized heat, gas, water, and steam systems.
Electrical Engineers	172071	Circuits Engineer, Design Engineer, Electrical Controls Engineer, Electrical Design Engineer, Electrical Engineer, Electrical Project Engineer, Instrumentation and Electrical Reliability Engineer, Power Systems Engineer, Project Engineer, Test Engineer	Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.

3. Green Infrastructure

Green infrastructure includes plantings and structural elements that manage stormwater by capturing it where it falls, directing it, and improving water quality through natural processes. Types of green infrastructure include but are not limited to, green roofs, bioswales, rainwater harvesting systems, rain gardens, and permeable pavement. Green infrastructure can look like a row of trees along a major city street, greening an alleyway, constructing a wetland near a residential housing complex, or protecting large open natural spaces and wetlands. When green infrastructure systems are installed throughout a community, city, or across a regional watershed, they can provide cleaner air and water as well as significant value for the community with flood protection, diverse habitat, and beautiful green spaces.

When it rains, impervious surfaces, like rooftops and asphalt, prevent rainwater from soaking into the soil, causing stormwater runoff. The stormwater collects litter, oil, excess nutrients from fertilizers, and sediments as it flows across the ground causing pollution in the groundwater and local water sources. Green infrastructure investments can clean and recharge groundwater, reduce potable water demand, and mitigate some of the heat island effects of dense urban areas. Green infrastructure also has many social benefits by increasing exposure to the natural environment, reducing exposure to harmful substances and conditions, and providing opportunities for recreation and physical activity. All across the nation, cities are proving that green infrastructure is a holistic approach to flood mitigation, can improve water quality cost effectively, and can make communities healthier, safer, and more livable, while also spurring economic development.

Permeable pavement is one way to reduce stormwater run-off, and through the Southeast Atlanta Green Infrastructure Initiative, the Department of Watershed Management implemented approximately six miles of permeable pavers in the communities of Peoplestown, Mechanicsville, and Summerhill, resulting in nearly 5 million gallons of stormwater runoff to be captured. Careers in hardscaping—or the nonliving portion of a landscape—may range from installer to designer to entrepreneur, where entry-level positions often require a high school diploma or previous experience in landscaping. For career growth in green infrastructure, employers may prefer candidates who have earned certification in Leadership in Energy and Environmental Design (LEED) or accreditation from the National Green Infrastructure Certification Program (NGICP). Additional desirable skills may include creative thinking, design sensibility, project management, and experience with Geographic Information Systems (GIS). Careers focused on the design of green infrastructure such as landscape architects, horticulturalists, hydrologists, and engineers, typically require Bachelor's or Master's degrees and certification or accreditation programs.

Since 2017, the City of Atlanta's adoption of the Green Infrastructure Strategic Action Plan through the City's Department of Watershed Management has been supplementing traditional gray stormwater infrastructure systems (simply described as pavement and pipes) with innovative green infrastructure solutions both for private development as well as capital improvement projects that are aesthetically appealing, environmentally friendly, and cost-effective. The Department of Watershed Management currently has more than 1400 employees, with 48 percent of those employees eligible for retirement in the next five to ten years, so efforts to recruit skilled workers will be increasing in the coming years.

Between the years 2011 and 2020, environmental management jobs in the Atlanta MSA increased by 14.3 percent and are estimated to increase by 4,950 jobs by 2029. Job types that fully focus on green infrastructure or include green infrastructure-related skills can include construction, landscaping and groundskeeping, urban forestry, tree care, ecological restoration, maintenance and repair, mechanics, engineering, and landscape architecture, among others. The vast majority of jobs in these occupations (with the exception of environmental engineering, landscape architecture, and construction management) are accessible to workers who do not have a four-year college degree. Because of these relatively accessible education barriers, green infrastructure occupations can offer workforce development opportunities. As the sector continues to expand and mature, candidates with specific "green infrastructure" skills or certifications may be preferred, so expanding training opportunities will be especially important. Notably, understanding of proper maintenance and management of green infrastructure is critical to the system's functioning, providing the expected flood protection and remaining pleasant and attractive to community members.

Construction workers and managers on site | Photos by MBJ and S.C. Air National Guard /Jacob Steimer

Construction managers direct the construction of energy-efficient infrastructure and equipment from early concept to facility completion. They supervise a diverse workforce, ensure compliance with all laws and safety requirements, and ensure the effectiveness of services and processes.

Table 9. GREEN INFRASTRUCTURE OCCUPATIONS	OCCUPATION CODE	COMMON JOB TITLES	JOB DESCRIPTION
Landscaping and Groundskeeping Workers	373011	Gardener, Greenskeeper, Grounds Maintenance Worker, Grounds Person, Grounds Specialist, Grounds Worker, Groundskeeper, Landscape Specialist, Landscape Technician, Outside Maintenance Worker	Landscape or maintain grounds of property using hand or power tools or equipment. Workers typically perform a variety of tasks, which may include any combination of the following: sod laying, mowing, trimming, planting, watering, fertilizing, digging, raking, sprinkler installation, and installation of concrete wall units.
Septic Tank Servicers and Sewer Pipe Cleaners	474071	Drain Cleaner, Drain Technician, Public Works Technician, Septic Cleaner, Septic Pump Truck Driver, Septic Tank Service Technician, Service Technician, Sewer Bricklayer	Clean and repair septic tanks, sewer lines, or drains. May patch walls and partitions of tank, replace damaged drain tile, or repair breaks in underground piping.
Tree Trimmers and Pruners	373013	Arborist, Climber, Grounds Worker, Groundsman, Laborer, Plant Health Care Technician, Tree Climber, Tree Trimmer, Trimmer	Using sophisticated climbing and rigging techniques, cut away dead or excess branches from trees or shrubs to maintain right-of-way for roads, sidewalks, or utilities, or to improve appearance, health, and value of tree. Prune or treat trees or shrubs using handsaws, hand pruners, clippers, and power pruners. Works off the ground in the tree canopy and may use truck-mounted lifts.
First Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	371012	Field Manager, Golf Course Superintendent, Grounds Crew Supervisor, Grounds Foreman, Grounds Maintenance Supervisor, Grounds Manager, Grounds Supervisor, Groundskeeper Supervisor, Landscape Manager, Landscape Supervisor	Directly supervise and coordinate activities of workers engaged in landscaping or groundskeeping activities. Work may involve reviewing contracts to ascertain service, machine, and workforce requirements; answering inquiries from potential customers regarding methods, material, and price ranges; and preparing estimates according to labor, material, and machine costs.
Environmental Science and Protection Technicians, Including Health	194042	Environmental Technician, Laboratory Technician, Public Health Sanitarian, Sanitarian, Water Quality Analyst, Water Quality Specialist	Perform laboratory and field tests to monitor the environment and investigate sources of pollution, including those that affect health, under the direction of an environmental scientist, engineer, or other specialist. May collect samples of gases, soil, water, and other materials for testing.
Geoscientists, except Hydrologists and Geographers	192042	Engineering Geologist, Environmental Protection Geologist, Exploration Geologist, Geological Specialist, Geologist, Geophysicist, Geoscientist, Hydrogeologist, Mine Geologist, Project Geologist	Study the composition, structure, and other physical aspects of the Earth. May use geological, physics, and mathematics knowledge in exploration for oil, gas, minerals, or underground water; or in waste disposal, land reclamation, or other environmental problems.
Environmental Scientists and Specialists, Including Health		Environmental Analyst, Environmental Health and Safety Specialist, Environmental Programs Specialist, Environmental Protection Specialist, Environmental Scientist, Environmental Specialist, Hazardous Substances Scientist, Registered Environmental Health Specialist (REHS), Research Environmental Scientist	Conduct research or perform investigation for the purpose of identifying, abating, or eliminating sources of pollutants or hazards that affect either the environment or public health. Using knowledge of various scientific disciplines, may collect, synthesize, study, report, and recommend action based on data derived from measurements or observations of air, food, soil, water, and other sources.
Landscape Architects	171012	Accredited Professional in Building Design and Construction, Architect, Land Planner, Landscape Architect, Landscape Designer, Landscape Planner, Park Planner, Planner, Professional Landscape Architect (PLA)	Plan and design land areas for projects such as parks and other recreational facilities, airports, highways, hospitals, schools, land subdivisions, and commercial, industrial, and residential sites.

What can residents expect from these jobs, in terms of pay ranges, qualifications and long-term opportunity?

The clean economy broadly mirrors the larger economy as there are a range of educational requirements for occupations ranging from having no educational requirements to graduate degree requirements. Within the occupations analyzed in the clean economy, only 37 percent of jobs require either a bachelor's or master's degree. However, while many occupations do not require high levels of formal education, almost a third (29 percent) typically require a high school degree plus some type of post-secondary education or training. The preference for some sort of apprenticeship, certification, or training can still represent a barrier for those who are not aware of such opportunities.

Table 10. Educational requirements for clean economy occupations

Sector	Number of jobs*		Educational Requirements (% within each sector)			
		% of All Jobs	High School	Vocational/On-the-Job/Associates	Bachelor's	Master's
Energy efficiency	104940	47%	41%	51%	8%	0%
Clean energy	89370	40%	20%	7%	73%	0%
Green infrastructure	30590	14%	53%	20%	14%	13%
Total	**224,900**	**100%**	**77,450**	**65,680**	**77,740**	**4,030**
			34%	**29%**	**35%**	**2%**

This labor market dynamic also provides an important opportunity to counteract income inequality, by opening up job opportunities with family-supporting wages for "middle-skilled" workers, including those who have struggled during the prolonged COVID-19 pandemic. Expanding outreach and support for apprenticeships and creating pathways between high schools and job programs are thus critical in connecting potential employees in the six focus zip codes in Atlanta to in-demand jobs. Average annual salaries for occupations in each of the three areas of the clean economy can be seen in Figures 2 - 4 below. There is a clustering of occupations with salaries between $38k/year and $56k/year though there is a significant proportion of occupations both above and below this range. Georgia's minimum wage is set at the Federal Minimum of $7.25 an hour which is only around $15k/year. The median rent for a one-bedroom apartment or home in Atlanta was $1,223 as of 2020, meaning that rent alone would cost $14,676.9 Occupations in the clean economy, therefore, offer an opportunity to earn higher wages with many opportunities coming with limited educational barriers.

Solar PV installation by GRID Alternatives volunteers

Figure 2. Average salaries for Energy Efficiency occupations

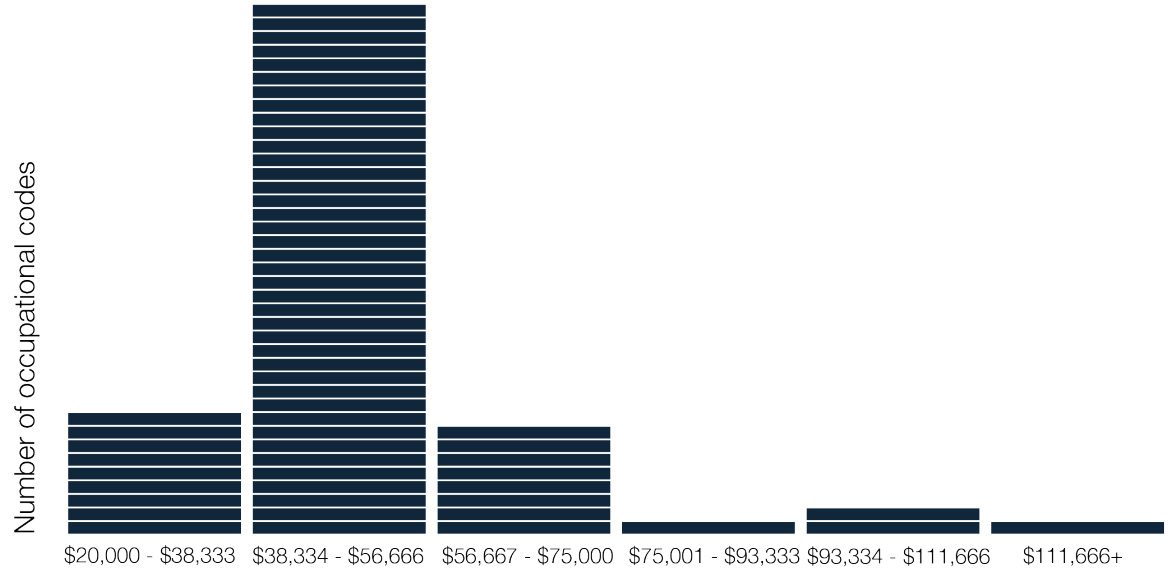


Figure 3. Average salaries for Clean Energy occupations

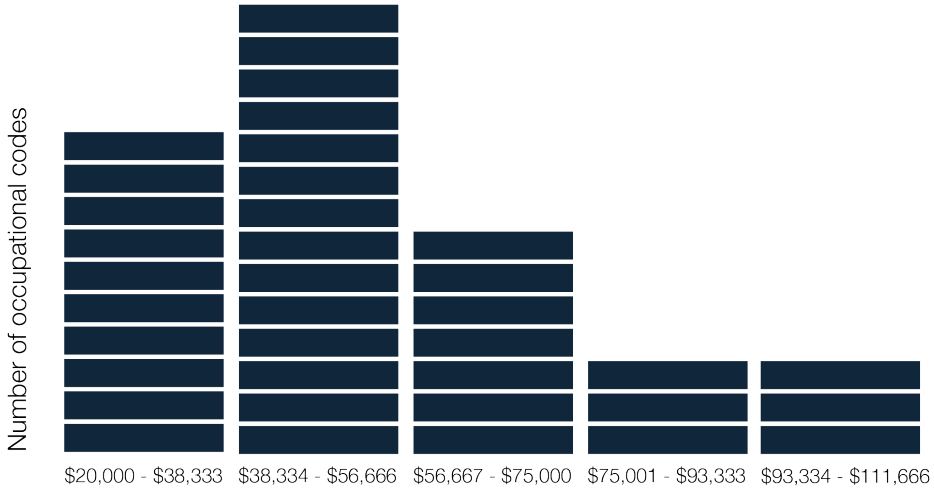
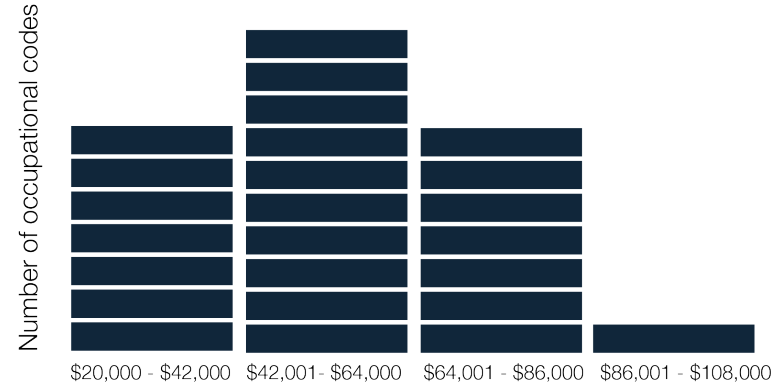


Figure 4. Average salaries for Green Infrastructure occupations



A note on methodology

The Bureau of Labor Statistics uses the Standard Occupational Classification (SOC) system which is a federal statistical standard used to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data. All workers are classified into one of 867 detailed occupations according to their occupational definition. Detailed occupations in the SOC with similar job duties, and in some cases skills, education, and/or training, are grouped together.

The income ranges for each of the sectors of the clean economy were based on the statistical spread of the average salaries for the occupations.

The average salaries in Atlanta, and the national salary range and common educational requirements for the occupations that will be most in demand, are shown in detail in Tables 11 - 13. These are the same occupations as those shown in Tables 7 - 9 which detailed the common job titles and descriptions. The educational requirements and average salaries among these most in-demand occupations reflect the trends across the three sectors of the clean economy more broadly as well. While some occupations require higher levels of education, there are many opportunities for those with high school degrees or vocational training. While the salaries for the occupations with fewer educational requirements tend to be lower in general, especially for entry-level positions, there are still opportunities to earn higher wages as an employee progresses in their career.

Urban gardeners | Photo by US Department of Agriculture

Table 11. ENERGY EFFICIENCY OCCUPATIONS	AVERAGE ATLANTA SALARY	AVERAGE NATIONAL SALARY	RANGE NATIONAL SALARY	COMMON INITIAL EDUCATIONAL REQUIREMENTS
Assistant Electricians	$36,180	$36,720	$27,680 - $47,790	High school diploma or equivalent No work experience Less than 1 month on-the-job training
Construction Laborers	$37,710	$44,130	$28,820 - $70,310	No formal educational credential No work experience Less than 1 month on-the-job training
Installation, Maintenance, and Repair Workers, All Other		$45,380	$29,080 - $66,450	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
Automotive Service Technicians and Mechanics	$47,530	$47,990	$29,010 - $75,100	Postsecondary certificate No work experience Less than 1 month on-the-job training
Heating, Air Conditioning, and Refrigeration Mechanics and	$52,310	$54,690	$34,320 - $78,210	Postsecondary certificate No work experience More than 1 year on-the-job training
Industrial Machinery Mechanics	$57,580	$58,780	$37,370 - $79,270	
Plumbers, Pipefitters, and Steamfitters	$56,350	$63,350	$36,700 - $99,920	High school diploma or equivalent No work experience Apprenticeship
Construction Managers	$100,220	$108,210		Bachelor's degree No work experience 1 to 12 months on-the-job training

Table 12. SOLAR ENERGY OCCUPATIONS	AVERAGE ATLANTA SALARY	AVERAGE NATIONAL SALARY	RANGE NATIONAL SALARY	COMMON INITIAL EDUCATIONAL REQUIREMENTS
Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	$37,930	$39,630	$28,820 - $57,240	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
Operating Engineers and Other Construction Equipment Operators	$41,900	$48,360	$39,150 - $65,640	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
Solar Photovoltaic Installers		$47,670	$37,860 - $55,760	
First Line Supervisors of Construction Trades and Extraction Workers		$75,060	$47,330 - $108,120	High school diploma or equivalent 5 years or more work experience No on-the-job training
Solar Sales Representatives and Assessors	$79,540	$86,650	$39,770 - $171,060	Bachelor's degree No work experience 1 to 12 months on-the-job training
Industrial Engineers	$90,200	$95,200	$60,850 - $129,620	Bachelor's degree No work experience No on-the-job training
Mechanical Engineers	$96,930	$97,000	$60,750 - $136,210	Bachelor's degree No work experience No on-the-job training
Electrical Engineers	$114,290	$107,890	$63,630 - $162,930	Bachelor's degree No work experience No on-the-job training

Table 13. GREEN INFRASTRUCTURE OCCUPATIONS	AVERAGE ATLANTA SALARY	AVERAGE NATIONAL SALARY	RANGE NATIONAL SALARY	COMMON INITIAL EDUCATIONAL REQUIREMENTS
Landscaping and Groundskeeping Workers	$34,210	$35,240	$24,170 - $47,630	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
Septic Tank Servicers and Sewer Pipe Cleaners	$37,590	$45,390	$29,310 - $61,890	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
Tree Trimmers and Pruners	$42,070	$47,450	$30,180 - $64,210	High school diploma or equivalent No work experience 1 to 12 months on-the-job training
First Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	$50,090	$53,270	$34,600 - $78,880	High school diploma or equivalent Less than 5 years work experience No on-the-job training
Environmental Science and Protection Technicians, Including Health	$52,370		$30,050 - $76,810	High school diploma or equivalent 5 years or more work experience No on-the-job training
Geoscientists, except Hydrologists and Geographers	$64,430	$103,550	$48,880 - $172,490	Bachelor's degree No work experience No on-the-job training
Environmental Scientists and Specialists, Including Health	$83,810	$81,240	$46,200 - $129,070	Bachelor's degree No work experience No on-the-job training
Landscape Architects	$84,710	$74,980	$43,260 - $115,380	Bachelor's degree No work experience Internship or residency

Moving Forward

How can policymakers, PSE, and other partners support residents to prepare for this market opportunity?

The clean economy in Atlanta could present many opportunities to the residents of the six focus zip codes PSE is supporting within the Climate Change, Health and Equity initiative, especially within the energy efficiency, solar energy, and green infrastructure sectors. Many city plans and strategies state ambitious greenhouse gas reductions targets and other sustainability goals, and a few reference the need to support community members in training for these clean economy jobs. However, clearly stated intentions to expand workforce programs in Atlanta are largely missing from the city's plans and policies.

Some non-profit organizations and community-based organizations in Atlanta have offered workforce training focused on clean jobs, such as the Urban Green Jobs initiative co-created by the Nature Conservancy and Habesha; the Southface Institute, which has co-hosted green buildings job trainings with Booker T. Washington High School; the Greening Youth Foundation, which engages under-represented youth while connecting them to careers in conservation; the EPA in partnership with City of East Point to offer environmental workforce development job training and classes; and the National Wildlife Federation's Earth First youth-centered leadership development program. While these trainings have been important resources to the community, they are not scaled to meet the needs of existing community members given the likely growth in opportunity in clean jobs in Atlanta. Although Atlanta's clean economy vision—and relevant policies to support this vision—presents an enormous opportunity for local workers to enter high-potential careers and contribute to the environmental mitigation and adaptation efforts of their community, the transition will only be successful if there are proactive steps taken to ensure that Black and Brown folks, women, and other historically under-represented community members are fairly and equitably represented in these jobs. In the U.S., the existing clean economy workforce has significant disparities in the proportion and types of jobs held by racial minorities and women. The Brookings Institution reported in 2019 that, despite accounting for almost 47 percent of the U.S. general workforce, "the clean energy economy workforce is older, dominated by male workers, and lacks racial diversity when compared to all occupations nationally. Fewer than 20 percent of workers in the clean energy production and energy efficiency sectors are women, while Black workers fill less than 10 percent of these sector's jobs." Regarding the under-representation of women, the American Center for Progress more recently published an article that found that "from founders and C-suite positions to entrepreneurs and skilled labor, women comprise only 25 percent of workers in the energy sector and 32 percent of the renewable energy workforce…Women also hold only 25 seats on the boards of the world's 200 largest utilities, representing 16 percent of board members…While women's leadership representation in clean energy has grown, gender parity remains elusive."

The enacted policies and plans in Atlanta to expand the local and regional clean economy offer a foundation to build upon existing programs and incentivize more workforce training and transition programs focused on equity. To strengthen the representation of historically under-served community members in these emerging fields and careers, training opportunities and resources should be concentrated in areas that lack resources in terms of access to knowledge, professional networks, and associated economic opportunities. Social networks and assets play a big role in these access disparities. In addition to focusing on reaching a specific number of clean economy jobs as proposed in the Clean Energy Atlanta Plan, the Atlanta Regional Development Plan, and other policies that informed this study, decision-makers and community groups should place a stronger emphasis on building connections and partnerships with clean economy hiring organizations.

An analysis by S&P Global around The Changing Face of Energy based on S&P Global Market Intelligence people data for the constituents of the S&P Global BMI Energy (Sector) Index and S&P Global BMI Utilities (Sector) Index presents some of the steps that utility companies around the country are taking to increase the diversity of their workforce across all levels. Specifically, S&P's analysis detailed activities like "creating networking groups, having senior managers mentor or sponsor budding leaders, and attempting to diversify the pool of applicants considered during the hiring process…outreach to schools and sponsorship of educational programs."

One of the most impactful approaches to strengthening diversity and inclusion within the clean economy workforce is to reach out to young people still in their formative years and guide them to understand that these jobs, whether highly technical or not, can be attainable for anyone. Of the 224,900 jobs analyzed for this study, 34 percent only require a high school diploma, but 29 percent do require an associate degree or some vocational training for entry, while 35 percent require a Bachelor's degree. On average, those living in the six focus zip codes have high school diploma-attainment rates comparable to those at the city level but, on average, about 12.8 percent of residents from the focus zip codes have a Bachelor's degree or equivalent as opposed to 25.5 percent in Atlanta overall (American Community Survey, 2019, 5-year estimates). Jobs that require apprenticeships, on-the-job training, or higher levels of formal education can necessitate an awareness of opportunities in the industry at an even earlier age.

Although occupations in emerging fields within the Atlanta clean economy—from clean technology to smart grids and recycling—involve a diverse range of skill sets, and most of them actually require only a high-school diploma for entry-level positions, people still mostly associate jobs related to engineering, science, and other highly specialized skills to the clean economy, which deters racial minorities, women, and folks from lower-income backgrounds from pursuing these career paths. Lack of awareness—and of resources to increase awareness—is one of the biggest barriers for BIPOC, women, and lower-income community members. There is already work underway to support Atlanta's workforce's transition toward a cleaner future, like many of Georgia Power's workforce development programs.

There is already work underway to support Atlanta's workforce's transition toward a cleaner future, like many of Georgia Power's workforce development programs. Based on the local workforce's current characteristics, and the specialized industry sectors and related occupations that are projected to grow in the city over the next few decades, local leaders and stakeholders could mitigate furthering existing inequities through:

1. Aligning efforts across sectors to support the local workforce

> No single agency or region will address our challenges and needs alone – there must be coordination between local, regional, state, and federal leaders to address the existing and ever-evolving energy and workforce needs.

According to Georgia Power, one of the biggest challenges power companies in Atlanta face is employing a well-trained and skilled lineworker staff. As a result of the efforts of their workforce development program and other industry partners within Georgia, four technical colleges across the state now offer Electrical Lineworker Apprentice Certificate programs—including Atlanta Technical College.

Local non-profits and institutions have the opportunity to support local community members, including those facing greater institutional barriers to high-paying jobs, as well as employers seeking talent in the current challenging labor market. Establishing direct partnerships with employers presents one important opportunity to support community members and demystify the clean economy jobs landscape.

Organizations like PSE can engage in a process and/or power-mapping exercise to identify the key players involved in the pathway toward different clean economy careers, including clean utility and technology companies, and academic or alternative training institutions. Many of these companies are already investing in more equitable and inclusive recruitment processes by sending representatives into under-represented communities to conduct outreach and let local residents know about the opportunities, and by covering a large portion of their new employees' training costs.

Local non-profit organizations might also partner with small businesses by providing them with economic incentives to offer support for new and prospective employees, and even to hire and train more people in the community through 'local-hiring programs.' Atlanta's Solar Energy Procurement Agreement (SEPA) contract, for example, includes a 35 percent Small Business Enterprise (SBE) goal for suppliers and subcontractors used in the contract. The City's SEPA contractor partnered with a DC-based solar installer to establish local workforce training programs through engaging WorkSource Atlanta, Atlanta's workforce development authority, and other community stakeholders.

WorkSource Atlanta Regional, which is managed by the Atlanta Regional Commission's Workforce Solutions division, provides a range of services for individuals seeking employment. WorkSource Atlanta's offerings include the ChooseATL Young Leaders Network, a program for young professionals under 40 to get "access to the business community, a network of peers, and a conduit to have real impact around the region." ChooseATL posts their latest updates on their career bank and their social media pages, including training opportunities for established and emerging professionals and leaders in the Atlanta area. Similarly, the Southface Institute in Atlanta offers building science and workforce development training in a variety of energy efficiency fields with a focus on building performance, health and safety, energy and water, green infrastructure, and green building certifications.

While local non-profit organizations are already doing important and much-needed work in this area, there is significant opportunity to scale given the likely number of clean jobs becoming available in Atlanta in the near future.

CASE STUDY

The GRID Alternatives (GRID) model is to make solar PV technology practical and accessible for low-income communities, while providing pathways to clean energy jobs. GRID was selected by the California Public Utilities Commission to serve as the statewide program manager for its groundbreaking Single-family Affordable Solar Homes (SASH) incentive program, prompting an expansion across California in 2008. GRID is now the nation's largest non-profit solar installer, serving families throughout California, Colorado, the Mid-Atlantic region, tribal communities, and some international program partners with communities in Nicaragua, Nepal, and Mexico. Their workforce development programs give job seekers the practical experience and networking opportunities they need to compete for local solar company positions. GRID's training philosophy is to help job seekers gain skills in different aspects of the solar industry. Their training offers the unique opportunity to participate in the installation process from start to finish. Trainees learn while participating in real-world solar installations and getting a complete picture of the industry by meeting the clients and communities served.

CASE STUDY

Local leaders can provide funding to help employers upscale and provide these kinds of jobs. The Forest Park Conservancy (FPC) is a community supported non-profit in Portland, OR. FPC's Green Jobs Training and Internship program provides BIPOC (Black, Indigenous, and People of Color) young adults aged 18-26 years old with relevant hands-on professional experience and support to pursue a career in the conservation and natural resources field. FPC has partnered with The Blueprint Foundation, Wisdom of the Elders, Ecotrust, Columbia Land Trust, and West Multnomah Soil & Water Conservation District in hosting interns for a 12-month period, providing continuous support and mentorship. The internship helps participants to gain hands-on experience in fieldwork and shadow experienced professionals while earning a living wage and developing a professional network. Participants also receive multiple training opportunities to obtain technical and project-based skills in topics applicable for a successful career in the environmental sector and personal and professional development. FPC and their partners are committed to supporting the interns during the program and after its completion, including flexibility in work schedule, transportation assistance, and connection to destination employers.

Solar grid worker | Photo by GRID Alternatives Mid-Atlantic

2. Workforce engagement and development programs

Building a clean economy equitably and inclusively must begin with ensuring people are equipped with the skills needed to obtain jobs across all levels. Many of Atlanta's adopted plans acknowledge the need for investments in new technologies, the creation of workforce training programs, the expansion of scholarships and apprenticeship programs, and increased collaboration among technical colleges and trades to ramp up Atlanta's clean jobs workforce. There are several ambitious initiatives and movements that support these efforts already underway, such as Drawdown Georgia, which brings high-impact climate solutions to communities in Georgia; Atlanta Regional Commission's Green Communities Program, which assists local governments in decreasing operational carbon emissions through building portfolio efficiency and clean energy opportunities; Solarize Atlanta, which makes solar-powered energy more accessible and affordable for more homes and businesses across Atlanta; and The Nature Conservancy Urban Green Jobs Program, which is a paid training program that teaches youth and families about green space management, urban agriculture, and other conservation topics from industry experts. However, there must be significantly more programs offered to make sure the jobs created in the clean economy go to a large percent of low-income and Black, Indigenous People of Color.

Union apprenticeship programs, pre-apprenticeship programs, readiness programs, on-the-job training programs, etc. must offer family-sustaining wages, childcare support, transportation, and other supplies and resources to ensure community members who have historically been left behind are equipped to transition into clean job roles. This includes the youth, women, people who are formerly incarcerated, and other under-represented workers. For example, Oakland, CA's Rising Sun's Climate Careers employment and training program addresses climate change by employing youth to provide energy efficiency services to over 52,700

Participants of the Chesapeake Bay program for green jobs in Baltimore | Photo by Chesapeake Bay Program via Flickr

Northern California residences. They train and employ Bay Area and San Joaquin youth to conduct Green House Calls in their home communities. At each Green House Call, a team of two youth Energy Specialists provide residents with an energy and water assessment, energy and water saving installations (light bulbs, shower heads, etc.), and further conservation tips, all at no cost. Benefits include a valuable service to residents, positive environmental impacts, and paid employment, training, mentorship, and a wonderful summer experience for youth. Impacts are evident in the numbers: Climate Careers employs 1,985 youth, serves 52,794 homes with Green House Calls, and has served 100 cities to date, engaging in broad-based partnerships to advocate for clean workforce development and environmental justice throughout the region and the state.

Youth training and employment programs are also an excellent way to educate and train early-career professionals in sector-specific jobs. It is critical to start with the youth (next generation); unless we're embedding this basic knowledge and skill set in the youth, then large scale change will likely not happen. Local leaders and partners should invest in more STEM programs, after school programs, equipment, and other supportive resources to offer young and future professionals the possibility to join the clean economy workforce. For example, through the Department of Energy and Environment (DOEE), the Green Zone Environmental Program (GZEP) partners with the Marion Barry Summer Youth Employment Program to provide youth and young adults, ages 14 to 24, the opportunity to learn about energy and environmental issues, complete community-based environmental work projects such as rain gardens and storm drainv markers, and prepare for careers. DOEE provides GZEP participants with the opportunity to learn from experts about energy and environmental issues facing the District, gain experience working on projects that will expose participants to a variety of green infrastructure practices; develop the skills necessary to compete for today's clean jobs; and establish or deepen their connection to the environment. The learning outcomes from the GZEP allow participants to gain valuable knowledge from attending professional development workshops to enhance their skills in interview preparation, resume writing, and college and career planning.

3. Data reporting and processes

In order to better understand and assess jobs and skills associated with the clean economy at smaller geographic levels, resources must be dedicated to analyzing this sector of the economy at all levels. The Bureau of Labor Statistics began efforts towards this end in 2010, but budget cuts in 2013 resulted in these data collection efforts being discontinued. Advocacy for continued federal data collection efforts, and local efforts to size and understand the clean economy will be necessary as the clean economy expands as a result of both policy and market forces.

Resources: O*NET Online and Career One Stop

The Career One Stop website and O*NET Online websites compile useful background information for each occupational code including data on salaries, required qualifications, training, opportunities, and much more on a locational basis. The portal also includes a Certification Finder to explore certification programs and resources that can help community members boost their qualifications for clean economy jobs.

Endnotes

1. In 2010, the Bureau of Labor Statistics (BLS) began to undertake the task of defining and quantifying green jobs under the BLS Green Jobs Initiative. Because funding for this program was cut in 2013, work to collect statistics on green jobs or the clean economy through industries or occupations in the US Bureau of Labor Statistics (BLS), North American Industry Classification System (NAICS), or Standard Occupational Classification (SOC) system data was halted. Due to these data limitations, the Brookings Institution worked to define and quantify the clean economy on a nationwide basis along similar lines.

2. Because there is no national consensus or regularly collected primary data on the clean economy and its associated jobs, other studies rely on their own methodology and even data collection at times when funding is available. This results in data that is not comparable across geographic extents, and data which is infrequently collected or available.

3. Brookings designated NAICS codes in the clean economy were matched to corresponding occupational codes to analyze changes in the Atlanta metro area.

4. It is important to note that many of these occupations are not exclusively within the clean economy which leads to overestimates of employment within the clean economy. Educational and job training requirements are presented based on Using O*Net data for each occupational code.

Other reports and resources this report draws on, not already linked in the report:

1. Advancing Inclusion through Clean Energy Jobs, The Brookings Institution
2. Uplifting Women in the Clean Economy, American Progress article
3. Diversity in the US Energy Workforce, NASEO
4. Building a Just Transition for a Resilient Future, The Worker Institute at Cornell (ILR)

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