

# **Miami Forever Carbon Neutral: Growing the New Green Economy**

**Analysis of City of Miami's Green Economy  
and Action Plan for Expansion**

## Executive Summary

Miami finds itself at a unique and consequential moment in time. With the impact of COVID-19 beginning to wane, our City is preparing for economic recovery and growth. At the same time, challenges linked to climate change and longstanding socioeconomic inequities threaten our communities and economy. As a low-lying, subtropical, coastal city, Miami is particularly vulnerable to the impacts of climate change, including rising sea levels, intensifying tropical storms, and increased extreme heat exposure. These impacts disproportionately effect historically underinvested communities, which tend to be populated by individuals that are low-income, predominantly Black, and recent immigrants (climate justice communities), which serves to further amplify the City's wage disparity and higher unemployment rates among Black and non-white Hispanic residents, both of which worsened during the height of the COVID-19 pandemic. This convergence of factors underscores the immense need – and opportunity – for Miami to create economic development policies and initiatives that address climate change, reduce socioeconomic disparities, and increase economic resilience.

**Our carbon mitigation and climate adaptation commitments are directly aligned with our goals to reduce socioeconomic disparities and increase economic resilience.** As we achieve our greenhouse gas reduction (GHG) targets – of 60% GHG reduction below 2018 levels by 2035 and 100% GHG reduction by 2050 – and adapt to other facets of climate change, we will simultaneously drive incremental, but ultimately substantive, change in the South Florida economy towards a greener economy. This new green economy will be anchored by industries that either reduce impact on the environment or produce environmentally friendly goods and services. It will also shape how we live and work in our city and region by creating low-emissions alternatives to how we commute, travel and maintain our homes and offices. Overall, this transition will help diversify the regional economy, increase economic resilience, and drive growth in industries that offer living wage jobs and long-term economic opportunity for Miamians. Ensuring that these new green jobs benefit communities that have been historically disinvested is a critical part of Miami's collective climate justice agenda, as detailed in Miami Forever Carbon Neutral and Resilient 305.

Miami is uniquely well-positioned to become a leader in the United States' broader green economy. With billions of dollars in assets and thousands of households vulnerable to the impacts of climate change, Miami serves as an ideal hub for green investment, innovation, and talent. We have already shown decisive leadership in mitigating our role in climate change and protecting our City from future climate change impacts, as evidenced by the adoption of Miami Forever Climate Ready, Resilient 305, and now, Miami Forever Carbon Neutral (the GHG Plan). This New Green Economy Analysis and Action Plan (Green Economy Plan) identifies the elements of Miami's economy that will support climate action and the shift to the new green economy, and outlines strategies that the City, our partners, and residents, can pursue to ensure that the transition to a carbon-free future benefits all of our communities.

## About this Report

This report builds on 20 years of research to advance a refined view of the now emerging “green economy” across South Florida and the City of Miami. Two focus areas are included:

1. A broad focus on economic growth, job creation, and capital investment in industries that significantly reduce the impact of human activity on the environment.
2. A tactical focus on jobs within Miami's green industries, which includes industries that can be characterized as “Pure Green”, where 100% of the industry output is environmentally friendly, and “Partially Green,” where a portion of the industry's output is environmentally friendly (such as the automobile and building construction industries).

The Green Economy Plan includes findings from analysis of these two focus areas to understand the current green economy, including key industries and assets, green industries that are poised for growth, and occupations that will be impacted by climate action. This analysis is followed by near-term (within one to three years) and mid-term (within four to six years) actions that the City can take to create a strong green economy ecosystem – a network of businesses, organizations, customers, and policies that are driving economic growth - to support implementation of Miami Forever Carbon Neutral and the Miami Forever Bond. The City, however, cannot work alone to grow the new green economy – it requires partners to achieve broad impact. As such, these City-led actions are accompanied by recommendations for the City's partners, businesses, and residents to ensure that the growth of the new green economy benefits Miamians through workforce development training, career pathways, and living-wage jobs. This Plan furthers many objectives established in Resilient305, including goals for building a diverse and inclusive economy, creating youth career opportunities, buying local, and collaborating with local universities.

## Key Findings

Key findings from this research include:

- **Miami's green economy and green jobs are resilient and poised for growth:** The "green" components of Miami's green sectors, which were defined as part of this analysis and include Energy, Buildings, Transportation, Waste Management, Sensors, Instruments and related Research and Development (R&D), Education, Regulation & Advocacy, and Climate Resilient Infrastructure, supported 5,150 green jobs in 2019 and roughly \$1.1 billion in output. These green sectors experienced 3.8% annualized growth from 2015 to 2019, compared to 1% annualized growth for Miami's non-green industries. Since the onset of COVID-19, green industries have been more resilient (with little to no job losses) in comparison to Miami's traditional sectors, such as Tourism and Professional Services. (*Chapter 4: Green Jobs are Resilient and Poised for Growth*)
- **The growth of Miami's green economy is the result of spending by traditional sectors:** In 2019, traditional sectors, such as Higher Education, Local Government, and Healthcare, spent \$5 billion on goods and services from green sectors, primarily Buildings and Transportation. While traditional sectors are not "green" today, transitioning to a green economy requires moving these industries incrementally towards becoming greener through gradual sustainable purchases. This can occur in response to technical advances, market forces, and evolving government policy that facilitates the adoption of green business practices. Local government policies and investments, including those related to electric vehicle (EV) infrastructure, LEED certified buildings, building efficiency guidelines, and adaptation programs, are playing an important role in encouraging green purchases by traditional sectors. (*Chapter 4: Traditional Industry Sectors Will Grow the New Green Economy*)
- **Municipal procurement policies play a key role in catalyzing the new green economy:** Local government currently spends \$330 million per year in industries that are part of the green economy – three times the spending of any other sector. The scale of government spending within the local economy underscores the impact that City policies can have in creating demand for green goods and services and for supporting growth of green industries. While local government is spending \$330 million annually in industries that are part of the green economy, most of these industries are considered "Partially Green", suggesting that not all government purchases are green – yet. Procurement policies that prioritize climate-friendly investments will have an outsized role in ensuring that local government's spending directly supports the green economy. (*Chapter 4: Traditional Industry Sectors Will Grow the New Green Economy*)
- **Green industries have a higher share of jobs that pay living wages than traditional industries in Miami:** In general, across all occupations, those categorized as green tend to offer higher pay for middle-skilled workers – 65% have a median wage greater than the living wage (compared to 47% of all Miami occupations). Given the rapid growth in the green economy since 2010, the median wage of green jobs has the potential to climb as spending and demand for green jobs increases. Importantly, ensuring equitable access to living wage green jobs will require intentional work from the City and our economic development partners through the development of green career pathways, workforce training opportunities, and hiring support. (*Chapter 4: Green Jobs Are Higher Paying and More Accessible*)
- **There are many occupations that are employed across multiple green industries and demand for these occupations is already expected to grow over the next 10 years – even without the support of Miami's forthcoming climate actions.** The occupations that are employed across multiple green industries provide clear direction to workforce intermediaries and educational institutions on which green occupation pathways should be prioritized in the near-term. (*Chapter 5: Green Occupations*)

Although this analysis uncovers the scale of recent growth in Miami's green economy since 2015, engagement with local civic and nonprofit organizations and the private sector identified parallel weaknesses to be overcome if the new green economy is to grow in step with our GHG Plan:

- **Greater Miami needs a green economy champion:** While there is regional consensus about the importance and potential of Miami's green economy, there is no dedicated champion that can focus solely on the sector's growth. Miami-Dade County, Beacon Council, Catalyst Miami, have all expressed support for scaling a green economy sector but a central entity or person is needed to combine and guide all stakeholders and their efforts. This champion could play a lead role in ensuring that there is a functioning green economy ecosystem to support future job creation, in conducting outreach with emerging green economy firms to clarify workforce needs and market challenges, and in developing partnerships with local workforce intermediaries and universities.
- **The City of Miami needs designated economic development staff:** While we have made considerable progress in working toward shared goals across sustainability and resilience, with green infrastructure investment being a clear focus, City economic and workforce development efforts related to green jobs appear fragmented. The same is true of the region's economic development actors. The City has limited capacity to engage with emerging green firms to better understand how evolving public sector investments will impact their industries and future job creation. The lack of a city-level economic development arm was noted as a specific concern, alongside the need for more deliberate strategies that leverage City procurement rules to accelerate green opportunities.
- **The City of Miami should prioritize equity and climate action in economic development, especially with COVID-19 recovery dollars:** Although the COVID-19 pandemic and economic recession are beginning to wane, the pandemic

has consequentially impacted Miami's economy with many still out of employment, particularly among low-income Black and non-white Hispanic residents. In response, City leaders have the opportunity to leverage federal and state resources to explicitly support job creation in industries best positioned to create living wage jobs, long-term economic opportunity, and address longstanding socioeconomic inequities over the next 10 to 20 years, which includes industries across the green sectors. The decisions made today about economic recovery will shape our community, economy, and environment in the decades to come.

The COVID-19 pandemic has taught us the importance of resilience, equity, and modernization. Now, it is critical that we take decisive action to ensure our economic recovery efforts reflect these tenets. As immediate next steps, the City of Miami will focus on foundational actions that will support the expansion of this new economic sector. To enable this, the City needs to identify full-time equivalent staff time to focus on and begin work on City-specific actions. Beyond the City, key regional stakeholders including neighbor cities, Miami-Dade County, Beacon Council, workforce development intermediaries, green businesses, climate advocacy groups, and educational institutions, need to come together and collectively identify a regional green economy champion. A green economy champion is needed to lead on collaborating with public and private sector leaders; providing leadership and vision related to green economy goals; supporting start-up, retention, and expansion efforts; and taking ownership of green economy metrics (e.g., jobs, recruitment, wages, companies, and opportunities). This "champion", which may be a person, office, entity, or a coalition, will need to have long-term staying power, credibility with a broad audience of stakeholders, institutions, and businesses, an intense focus on the green economy and climate justice, and access to operational funding.

With a regional green economy champion in place, the proposed actions for growing the green economy can begin to take form. As the City updates its GHG Plan, we will maintain open channels of communication with workers, businesses, educational institutions, community organizations, public agencies, and residents to collaborate and report on the positive economic impacts of the GHG Plan and related climate actions.

## Chapter 1: Introduction

Miami Forever Carbon Neutral is the City's Greenhouse Gas Reduction Plan (GHG Plan) and serves as a roadmap for Miami to achieve carbon neutrality in the community by 2050, strengthen the local economy, and work towards climate justice. This Green Economy Plan serves as a primer on how implementation of the GHG plan will transform the South Florida economy and workforce based on existing economic conditions and trends. The primary focus of the Green Economy Plan is to uncover Miami's existing green economy ecosystem, including the industries, institutions, and policies that are currently supporting its growth, and identify key characteristics of Miami's green workforce so that the City and its partners can support green economic growth in a way that intentionally supports the creation of living wage and economically resilient career pathways for underserved communities. The Green Economy Plan concludes with actions for both the City and the broader Miami community to strengthen the local green economy ecosystem and workforce. The City-led actions at the conclusion of the Green Economy Plan are subgoals to the GHG Plan and are designed to complement the GREEN goals. The success of Miami's green economy, however, will depend on a broad range of economic development, workforce training, and climate justice actors working together towards a shared vision. To that end, the green economy plan goals are accompanied by proposed actions to be led by partners. These goals and actions are discussed in detail in Chapter 6.

Pursuing both goals in tandem will result in economic progress that is sustainable, resilient, inclusive, and equitable – delivering a green and just recovery from the COVID-19 crisis (Garcetti, et al., 2020).

### *GHG Plan goals to transition to a GREEN Miami:*

- **G – Getting Around Miami**
- **R – Renewable Energy**
- **E – Electric Vehicles**
- **E – Energy Efficiency**
- **N – New Economy**

### *Green Economy Plan goals to support the new green economy:*

- **G – Grow the Green Economy Ecosystem**
- **R – Recruit and Retain a Green Workforce**
- **O – Open Occupational Pathways**
- **W – Welcome and Support Green Industry**

## Miami's Greenhouse Gas Reduction Commitments & the New Green Economy

Seventy percent of global carbon dioxide emissions (the primary human-caused GHG emissions) originate from cities, which means local governments must be leaders in their commitment to ambitious actions that drastically reduce emissions to avoid the worst impacts of climate change. And, as described in Resilient305 and Miami Forever Climate Ready, Miami is particularly vulnerable to the impacts of climate change, making it all the more critical that we do our part in reducing GHG emissions while adapting to the changing climate. The City's climate vulnerability must be viewed in the context of existing socioeconomic inequities, such as wage disparity and higher unemployment rates among Black or non-white Hispanic

residents, which were negatively impacted by the COVID-19 pandemic and will continue to be exacerbated by the impacts of climate change.

Achieving our target of 60% reduction in GHG emissions by 2035 and 100% reduction by 2050, coupled with adapting to the increasing intensity and severity of sea level rise and weather events, will require a substantive transformation of the local economy. To support the GHG Plan's Electric Vehicle goals, for example, the local economy will need to increase access to EV charging infrastructure, EV support services (e.g., technicians), and EV dealerships. Likewise, pursuit of the GHG Plan's Energy Efficiency goals will increase demand in the local economy for energy efficient products, such as HVAC and kitchen systems and windows, and related services, such as building design, specialty contractors, and retrofit specialists. Indeed, each of the GREEN goals will lead to increased demand for green goods and services, which will have the effect of growing market share of Pure Green industries, increasing sales of green goods and services in the Partially Green industries, and pushing Potentially Green industries to adopt green practices. In turn, the local economy is likely to see a decline in demand and market share of non-green goods and services. Businesses and employees in these non-green industries are ideal candidates for economic development support services and reskilling opportunities.

**The greening of our economy through the realization of our carbon mitigation and climate adaptation commitments is directly aligned with our goals to reduce socioeconomic disparities and increase economic resilience.** This new green economy will diversify the regional economy, increase economic resilience, and create demand for living-wage jobs that are less susceptible to the economic shocks of weather events and global pandemics. Ensuring that these new, green living wage jobs benefit communities that have been historically disinvested is a critical part of our collective climate justice goals.

The scale of climate change impacts facing the City and the mitigation actions needed to transition to a healthy, climate resilient future and a more sustainable, inclusive economy is far too great for any one sector to undertake alone. As such, the public and private sectors each play key roles in positioning the local economy to be responsive to these structural changes and ensuring that the local workforce is prepared for the evolving work required by green jobs.

## Climate Justice & the Green Economy

Climate justice begins with recognizing which groups are disproportionately impacted by the environmental and economic consequences of climate change and that climate impacts can exacerbate inequitable social conditions. Typically, those groups tend to be responsible for a relatively low volume of greenhouse gas emissions.

In Miami, climate justice communities are historically underinvested neighborhoods (which tend to be inland), populated by individuals that are low-income, predominantly Black, and recent immigrants. These neighborhoods tend to be viewed as less physically vulnerable to climate change since flooding is less common, but they are still vulnerable to climate impacts (hurricanes, extreme heat, flooding, pandemic, economic recession) and their residents are relatively more socially vulnerable than other parts of the City.

Inequities experienced by residents of climate justice communities include:

- Utility burden
- Low car ownership rates
- Renters being pushed out of homes due to increasing rent prices
- Being uninsured or underinsured
- Prolonged exposure to hazardous conditions such as extreme heat and pollution in homes and worksites
- Lack of access to reliable and consistent public transportation
- Living paycheck to paycheck and being unable to afford hurricane supplies or evacuate due to flooding
- Living more than three miles from the closest grocery store

The GHG Plan and the City's ongoing climate adaptation efforts offer opportunities to begin to address some of these inequities by creating job opportunities and career pathways that are economically resilient, offer living wages, and are specifically targeted for underserved climate justice communities. This holistic view of climate action is vital in carrying out the City's vision to create a more resilient, safe, and vibrant Miami for all.

## Defining the Green Economy

The concept of the "green" or "clean" economy has been evolving for almost 20 years, with initial progress linked to strategies advanced by the Organization for Economic Cooperation and Development (OECD) to encourage job growth in sectors that preserve and/or restore the environment through energy efficiency, resource consumption, decarbonization, and waste diversion. Domestic efforts to define "green jobs" expanded after the Great Recession (2008) as the Federal

government's efforts to re-start the economy prioritized green investments (including public transit, clean vehicles, and ecosystem restoration) within the American Recovery and Reinvestment Act (ARRA). This Green Economy Plan builds on this research to advance a refined view of the now emerging green economy across the City of Miami and South Florida.

The **green economy** is broadly defined as any group of businesses and organizations that use practices that reduce the negative impact of human activity on the environment, including those that mitigate or adapt to the impacts of climate change. Miami's new green economy is defined as the businesses and organizations that are supporting the realization of our climate action goals by facilitating access to the goods and services that are essential to reducing the negative impact of human activity on the environment (C40 Cities, 2019). Participants in the green economy can be categorized into two groups:

- **Producers of green goods and services**, such as renewable energy, climate adaptation services (e.g., environmental or engineering professionals that design habitat protection or flood management projects), electric vehicles, or mass transit; and
- **Consumers of green goods and services**, whether they be local government agencies hiring contractors to rebuild infrastructure that can withstand severe weather events, hospitals adopting more efficient energy systems, or private households purchasing electric vehicles.

For the purposes of this report, businesses that produce green goods or services are organized into industries and sectors based on their product or output. For example, in this analysis, the transportation sector incorporates industries associated with the movement of goods and people, such as public transportation and electric vehicles.

Each green sector includes a range of industries that are: 1) **Pure Green Industries**, or industries that are actively producing or providing green outputs; 2) **Partially Green Industries**, or industries that are not yet producing or consuming 100% green goods or services, but a growing portion of outputs or portions are green; and 3) **Potentially Green Industries**, or industries that have the potential to produce or consume green goods and services in the near future. For example, certain industries, such as fossil fuel reliant transportation services, do not currently provide any green outputs since they contribute GHG emissions. However, as technology advances (such as the creation of synthetic fuel or the adoption of zero-emission electric vehicles), market forces and new policies can push these industries to adopt green practices, i.e., they have the *potential* to become green over time. The spectrum of green industries – Potentially Green to Pure Green – are illustrated in Figure 1 below.

**Figure 1. The Spectrum of Green Industries**



This Green Economy Plan specifically quantifies the number of green jobs within the Partially Green and Pure Green industries, but also takes stock of the number of jobs in the Potentially Green industries as they too will be impacted by a transition to a greener economy. The methodology for this analysis can be found in the appendix.

## Chapter 2: Miami's Economy

### Miami's Current Overall Economy

As of 2019, the City of Miami's total economy (which encompasses jobs and firms within the geographic boundary of the City of Miami)<sup>1</sup> supported 300,000 jobs and generated over \$67 billion in gross regional product (GRP). Most of those jobs and economic output exist within the sectors of Health & Education, Professional Services, and Leisure/Tourism. While the Professional Services sector has grown in Miami since 2015 and has added around 3,800 jobs despite the 2020 recession, both Health & Education and the Leisure/Tourism sectors lost jobs between 2015 and 2020. Leisure/Tourism lost almost 4,000 jobs from 2019 to 2020 alone, due largely to pandemic closures. However, the main sectors that contribute to the green economy – Transportation, Building Construction & Materials, and Energy – experienced net growth of over 1,000 jobs between 2015 and 2020.

While the City of Miami's economy has experienced net growth since 2015, it faces vast inequities with regards to income and job quality. Median household income estimates alone depict stark wealth disparity in terms of a householder's race. According to 2019 American Community Survey (ACS) 5-year estimates, the median white household earned an income of \$97,271, whereas the median Latino/Hispanic household earned \$40,925 and Black household earned \$29,462 (US Census

<sup>1</sup> Throughout this report, reference to "Miami" aligns with the "City of Miami" geography, not Miami-Dade County nor other municipalities within Miami-Dade County.

Bureau, 2019). Overall, 41% of Miami's workers are employed in occupations with median hourly wages that are below the living wage for the region (Emsi, 2021; MIT, 2021).<sup>2</sup>

There are also a substantial number of Miamians who operate within the informal, or "gig", economy, meaning they are not employed by one formal employer. These jobs are harder to quantify as workers in the informal economy are either self-employed or hold multiple, often temporary, jobs, but it has been estimated that around 16% of workers in the Miami metro area are in "non-employer relationships." Miami ranks as the metro area with the highest number of gig workers per capita (Tuohey, Zea, Parker, & Tuttle, 2021). While some of these workers are benefiting from a growing gig economy with more access to opportunities and flexible work schedules, others are likely immigrants who lack access to resources, institutions, and bank accounts that support economic growth (Hall, 2020).

As Miami begins to reduce its GHG emissions, which totaled 3.3 million metric tons of carbon dioxide (MT CO<sub>2</sub>e) in 2018, its economy will fundamentally shift and expand to favor goods and services that are better for the environment. As the economy shifts, its jobs and workforce will need to adapt along with it. It is this shift, and expansion, that creates opportunity for Miami to address longstanding socio-economic inequalities.

## Miami's Workforce Today

As of January 2021, Miami's workforce (meaning those who live in the City of Miami and are employed or looking for work) was estimated consist of 221,000 people (US Bureau of Labor Statistics, 2021). Meanwhile there are over 300,000 jobs located within the City. The City of Miami's population comprises about 17% of Miami-Dade County, whereas its 300,000 jobs make up 23% of all jobs within the county. Despite there being enough jobs in Miami to employ every resident in its workforce, 67% leave the City for employment, primarily to other cities in Miami-Dade County such as Miami Beach and Coral Gables.<sup>3</sup> Of the 300,000 jobs in the City, only 19% are held by people who also live in the City (56,800 people) while 81% of jobs are held by those who live elsewhere in the region (US Census Bureau, 2019). This employment and commute pattern underscores that the City of Miami is just one actor and one geography within a larger regional economy – and supports the need for efficient, low-emissions public transit systems.

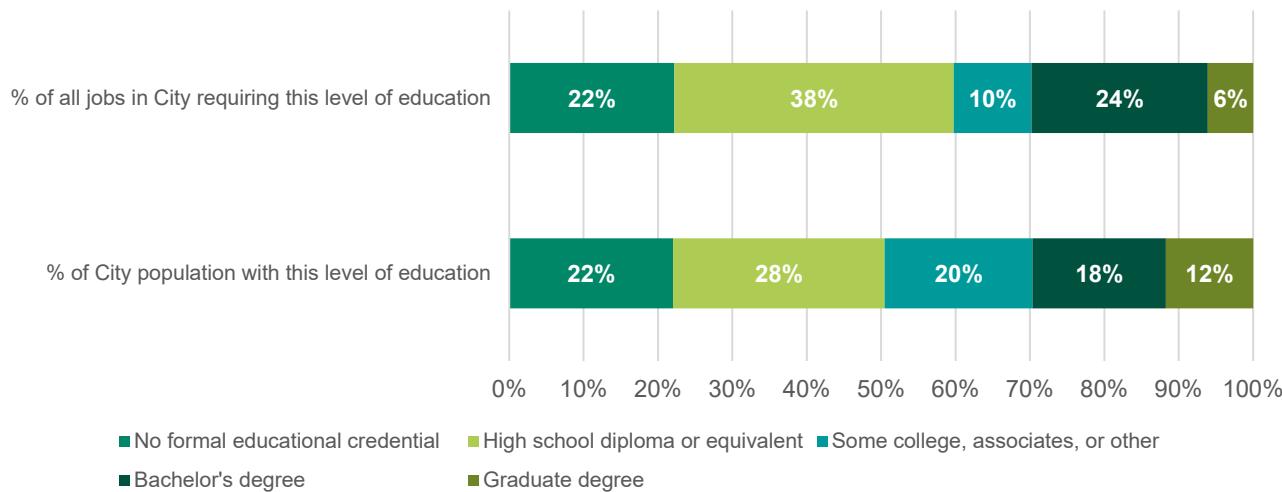
While many factors contribute to residents' employment outside of Miami, one important factor is the skills and education mismatch between the local workforce and available occupations. Currently, based on the typical level of education required for entry into an occupation, 60% of jobs located in the City of Miami require only a high school degree or no formal education. Many of these are lower-wage occupations that offer little to no path for upward mobility. Put differently, there are more low-skilled and lower-paying jobs in Miami than there are higher skilled and better paying jobs. Meanwhile, only 10% (30,000) of Miami's jobs are considered middle-skill – requiring less than a bachelor's degree but more than a high school diploma for entry into the occupation – which are often well-paid entry point jobs for those without a full college degree.<sup>4</sup> Focusing economic development opportunities within the City of Miami that match the local workforce's skillset, along with increasing living wage job opportunities, has the dual benefit of reducing commuter travel and, in turn, reducing emissions. A full breakdown of education level requirements for existing jobs and the educational attainment of City of Miami residents is shown in Figure 2.

<sup>2</sup> The living wage is defined as the wage needed to pay for non-discretionary expenses, including housing, food, transportation, and childcare. This analysis considers the living wage for Miami-Dade County based on MIT's Living Wage Calculator. The living wage is \$16 per hour for one adult with no children and \$21.50 per hour per adult for a family of two adults supporting two children.

<sup>3</sup> As most employment data is based on the location of an employer as opposed to employees' residents, jobs and occupation data refer to the location of the employer. Data sources such as the Longitudinal Employer-Household Dynamics (LEHD) Survey provide insight into the relationship between the residential labor force and employment within the City.

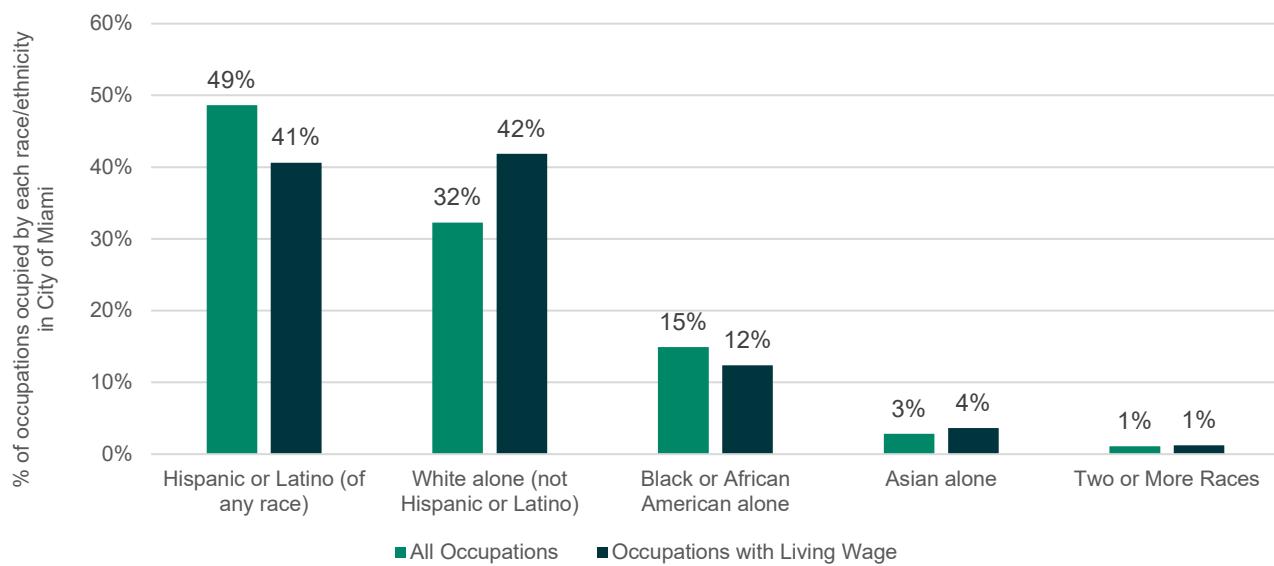
<sup>4</sup> Typical education level for entry to an occupation is reported by BLS at the national level, so alternate paths to employment may exist at a regional level.

**Figure 2. While 50% of the Miami population has some college education or higher, only 40% of jobs require this level of education**



Among the approximately 300,000 workers employed in Miami, 47% work in occupations that have a median hourly wage below living wage (\$17.90) (MIT, 2021).<sup>5</sup> These jobs are more likely to be held by non-white workers, further perpetuating racial disparities in economic opportunity. Unequal access to well-paying jobs has been a longstanding issue in Miami, with non-white workers facing higher unemployment rates and lower educational attainment (Miami-Dade Beacon Council, 2021). Figure 3 shows the Miami workforce by race, for all occupations and for occupations that pay a living wage. While white workers hold 32% of all jobs in Miami, they are disproportionately likely to be employed in occupations that pay a living wage. The same is true for male workers: 40% of men work in living wage jobs compared to just 35% of women. For this data, Hispanic or Latino refers to individuals of any race of Hispanic or Latino ethnicity, while white includes those of non-Hispanic or Latino origin, whereas Black or African American and Asian may overlap with those in the Hispanic or Latino group (US Census Bureau, 2020).

**Figure 3. 47% of occupations in the City of Miami offer less than a living wage and Black and non-white Hispanic/Latino workers are more likely to be in occupations that earn less than a living wage<sup>6</sup>**

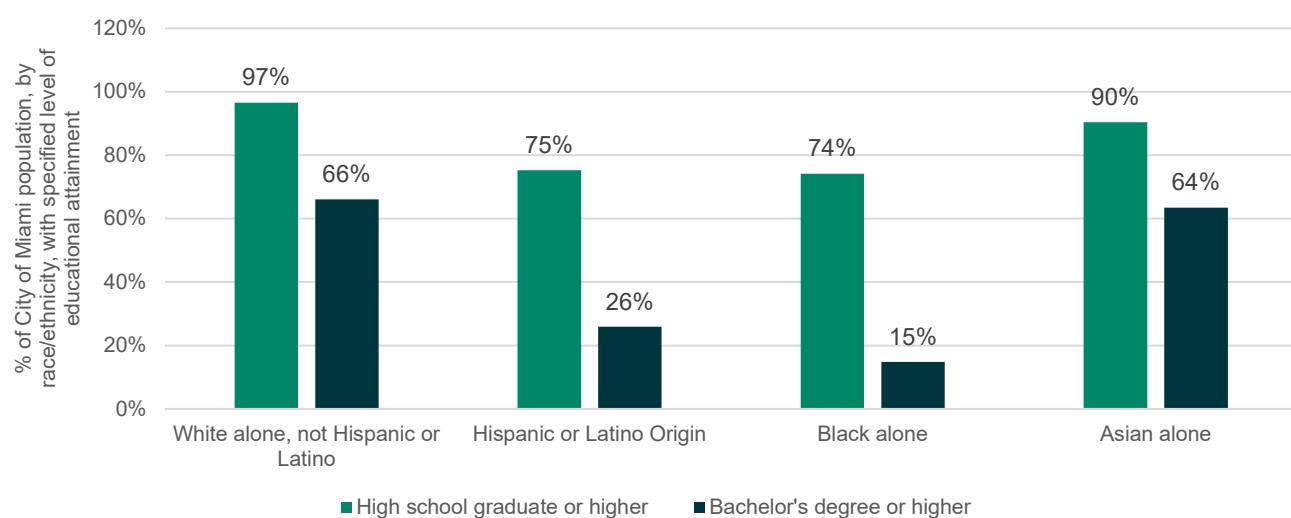


<sup>5</sup> Estimated living wage for two working adults with one child in Miami, FL based on MIT's Living Wage Calculator, which is the same baseline used in JP Morgan's "Trading on Innovation to Expand Opportunity" report.

<sup>6</sup> Emsi occupation demographic data treats 'Hispanic' as an additional race category, removing Hispanic population from other race categories.

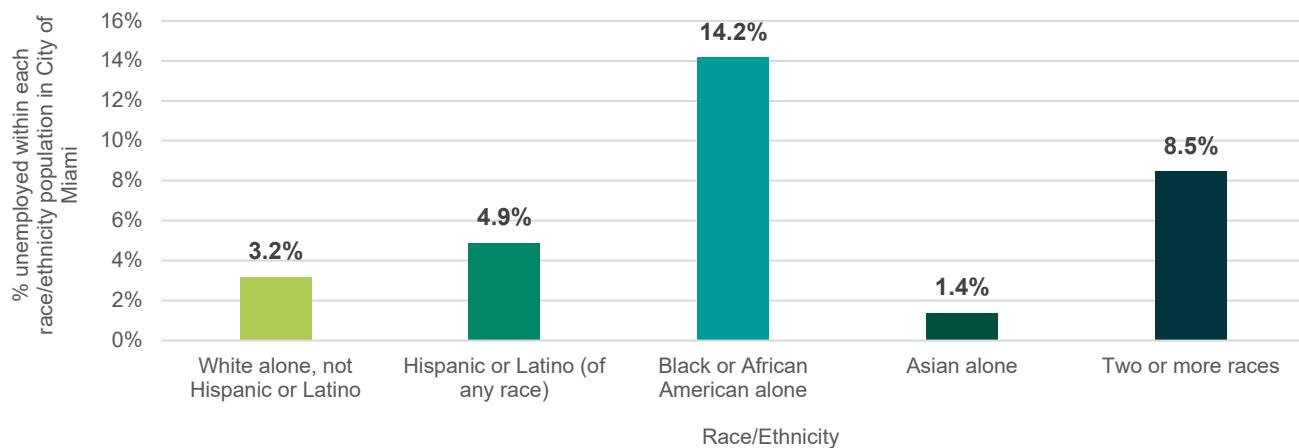
Inequitable access to stable, well-paying occupations is evidenced by the distribution of educational attainment among different racial and ethnic groups, as summarized in Figure 4. White non-Hispanic residents are more likely than Hispanic or Latino and Black Miamians to have graduated high school and obtained a bachelor's degree. Black and Hispanic or Latino residents also face higher rates of unemployment compared to other demographic groups. Figure 5 shows unemployment estimates for 2019, with a rate of 14.2% for Black residents and 3.2% for white residents (US Census Bureau, 2019).<sup>7</sup>

**Figure 4. White Miamians are twice as likely to have a college degree than non-white Hispanic/Latino Miamians and five times more likely than Black Miamians<sup>8</sup>**



Source: ACS 2019 5-Year Estimates

**Figure 5. Black Miamians are three times more likely to be unemployed than non-white Hispanic/Latino Miamians**



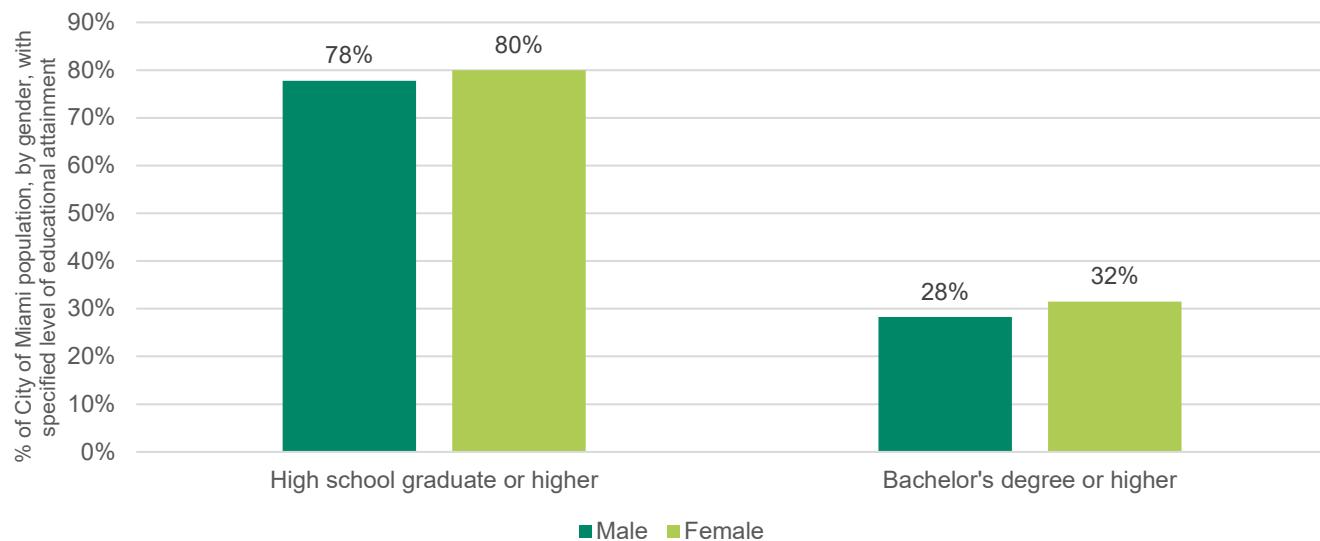
Source: ACS 2019 5-Year Estimates

Female residents in the City of Miami have slightly higher levels of educational attainment, as shown in Figure 6. Although women tend to have higher levels of educational attainment, this lead does not translate to employment gains: women face equal levels of unemployment, as shown in Figure 7, and are less likely to work in living wage jobs. Importantly, women face higher rates of unemployment despite being nearly three times as likely to be single heads of households than men. Meanwhile, Black women are nearly four times as likely to be single heads of households, and out of the labor force compared to white women (US Census Bureau, 2019). Women, particularly Black women, are more likely than men to be unemployed while simultaneously responsible for feeding and housing their families.

<sup>7</sup> Unemployment data were collected prior to the COVID-19 pandemic, which severely impacted employment in 2020 and exacerbated existing inequalities. Preliminary estimates for unemployment in January 2021 in Miami were over 8%. Unemployment disproportionately impacted people in service jobs and Black and non-white Hispanic workers (US Bureau of Labor Statistics, 2020). These numbers further underline the need for economic initiatives that are intended to address racial inequities.

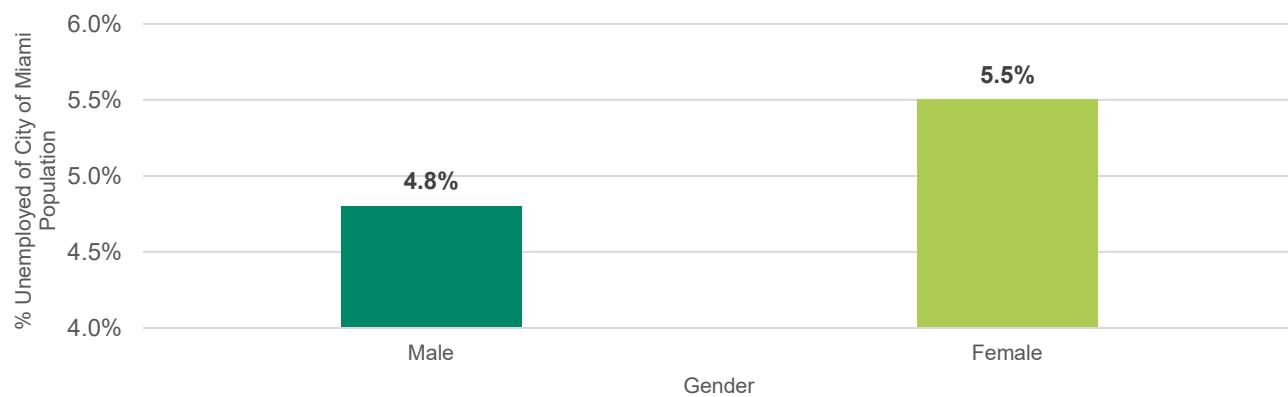
<sup>8</sup> "White" race category refers to white non-Hispanic population.

**Figure 6. On average, women in Miami are slightly more likely to have a high school diploma or higher than men**



Source: ACS 2019 5-Year Estimates

**Figure 7. Despite higher levels of educational attainment, women face similar unemployment rates as men**



Source: ACS 2019 5-Year Estimates

The existing inequities in Miami's economy were exacerbated during the COVID-19 pandemic, underscoring the need for new educational and employment opportunities that offer stable, living wage work, particularly for Black and Brown residents, which can both reduce these socioeconomic inequities and improve the overall resilience of the local economy. Analysis of Miami's green economy today indicates that further investment in the new green economy has a strong potential to address these longstanding inequities.

## Chapter 3: Miami's Green Economy

The idea of a national green economy first gained momentum following the 2008 financial crisis when the American Recovery and Reinvestment Act (ARRA) dedicated about 17% of all direct government spending to green investments. Interest in the green economy and its potential for job creation has re-emerged in recent months given proposed federal legislation to help fund economic recovery and infrastructure investment while simultaneously addressing the climate crisis. Although the U.S. lacks a national standard method for tracking the size of the green economy and its growth, a 2019 study estimated that the green economy produced \$1.3 trillion in output while employing over 4% of the working age population in 2016 and that employment in the green economy grew by over 20% between 2013 and 2016 (Georgeson & Maslin, 2019).

## Industries Driving Miami's Green Economy

Industries driving a local green economy are different in each metropolitan area due to geographic context, environmental challenges, state and local policies, and regional economies. This Green Economy Plan focuses on industries that currently play a role in the City of Miami's green economy and industries that will be impacted by implementation of the GHG Plan and Miami Forever Bond, including Transportation, Energy, Buildings, Waste Management, and Climate Resilient Infrastructure. This Green Economy Plan also evaluates green industries that are not specifically represented in the GHG Plan but have an active and growing presence in the City and region's climate action efforts. These additional green industries include Sensors, Instruments, and R&D, and Regulation and Advocacy. The players in Miami's green economy can be organized into sectors, or groups of industries, that are connected by a shared green output or service. Based on these factors, the City of Miami's green sectors and their associated industries are outlined in Table 1.<sup>9</sup>

---

<sup>9</sup> While this Green Economy Plan focuses on these dominant sectors, there are many small or emerging industries that are not included in the quantitative analysis of Miami's green economy due to the small size of this industry within city limits. These industries include urban agriculture and food sources, green business development and marketing, and disaster-recovery. However, these small and emerging industries are still a relevant and important, even if small, component of the green economy.

**Table 1. Miami's Green Economy Sectors and Example Green Industries and Occupations<sup>10,11</sup>**

<b>Transportation</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Industries involved in passenger and freight transportation as well as jobs related to the selling, manufacturing, and maintenance of mass public transit and electric vehicles.</li> <li><b>Related Climate Action Goals:</b> 15% reduction in personal vehicle trips, 40% of registered passenger vehicles are electric (GHG Plan), Create Mobility Options (R305)</li> <li><b>Pure Green Industry Examples:</b> Commuter Rail Systems, Multimodal Transit Systems, Bus and Other Motor Vehicle Transit Systems</li> <li><b>Partially Green Industry Examples:</b> Automobile Manufacturing, General Automotive Repair, Freight Transportation, Deep Sea Freight Transportation</li> <li><b>Example Occupations:</b> Transportation inspectors, operating engineers, bus and truck mechanics, logisticians, engineers, general and operations managers, sales representatives, electronics engineers, industrial engineers, and public relations specialists</li> </ul>
<b>Energy</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Industries involved in the generation and transmission of carbon-free energy.</li> <li><b>Related Climate Action Goals:</b> 100% carbon-free electricity, 35% reduction in natural gas emissions (GHG Plan), Increase Energy Efficiencies (R305)</li> <li><b>Pure Green Industry Examples:</b> Solar Electric Power Generation</li> <li><b>Partially Green Industry Examples:</b> Electric Power Distribution, Electric Bulk Power Transmission and Control, Power and Communication Line and Related Structures Construction</li> <li><b>Example Occupations:</b> Electrical power line installers, power plant operators, electrical engineers, mechanical engineers, industrial engineers, compliance officers, construction and building inspectors, environmental scientists, economists, and production and operating workers</li> </ul>
<b>Buildings</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Industries participating in the design, construction, and engineering of energy and resource efficient buildings.</li> <li><b>Related Climate Action Goals:</b> Improve energy efficiency and decrease energy consumptions (GHG Plan), Increase Energy Efficiencies (R305), Promote adaptive neighborhoods and buildings (Miami Forever Climate Ready)</li> <li><b>Pure Green Industry Examples:</b> No current Pure Green industries in Miami</li> <li><b>Partially Green Industry Examples:</b> Commercial and Institutional Building Construction, Roofing Contractors</li> <li><b>Example Occupations:</b> Construction and building inspectors, general and operations managers, civil engineers, electrical engineers, architects, plant and systems operators, drilling and boring machine operators, logisticians, compliance officers, and solar energy installation managers</li> </ul>
<b>Waste Management</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Includes public and private waste haulers, recycling and composting services, and waste remediation industries.</li> <li><b>Related Climate Action Goals:</b> Reduce solid waste (GHG Plan), Enhance Natural Systems (R305)</li> <li><b>Pure Green Industry Examples:</b> Recyclable Material Merchant Wholesales, Materials Recovery Facilities</li> <li><b>Partially Green Industry Examples:</b> Solid Waste Collection, Other Waste Collection</li> <li><b>Example Occupations:</b> Biofuels processing technician, chemists, industrial engineers, operating workers, environmental scientists, logistics engineers, bus and truck mechanics, operating engineers, power plant operators, and training and development specialists</li> </ul>
<b>Sensors, Instruments, &amp; R&amp;D</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Includes industries related to the manufacturing of devices necessary to monitor temperature, environmental controls, emissions, etc., as well as scientific research industries.</li> <li><b>Related Climate Action Goals:</b> Supports advancement of all climate action goals, particularly as they relate to technology and engineering</li> <li><b>Pure Green Industry Examples:</b> Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use</li> <li><b>Partially Green Industry Examples:</b> Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)</li> <li><b>Example Occupations:</b> Geoscientists, electrical engineers, civil engineers, logistics engineers, mechanical engineers, technologists and technicians, energy engineers, chemists, industrial designers, and public relations specialists</li> </ul>
<b>Regulation, Education, &amp; Advocacy</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Includes all industries involved in environmental regulation, conservation, restoration, and compliance, as well environmental education, justice and advocacy.</li> <li><b>Related Climate Action Goals:</b> Enhance Natural Systems, Communicate the Concept of Resilience (R305), Protect and enhance our waterfront, Inform, prepare, and engage our residents and businesses (Miami Forever Climate Ready)</li> <li><b>Pure Green Industry Examples:</b> Environment, Conservation and Wildlife Organizations, Nature Parks and Other Similar Institutions</li> <li><b>Partially Green Industry Examples:</b> Grant-making Foundations, Law Firms, Professional Associations (such as Urban Land Institute), Government</li> <li><b>Example Occupations:</b> Water resource specialists, urban and regional planners, environmental compliance inspectors, environmental scientists, educators, hazardous materials removal workers, environmental economists, lawyers, public relations specialists, marketing managers</li> </ul>
<b>Climate Resilient Infrastructure</b>
<ul style="list-style-type: none"> <li><b>Description:</b> Comprises industries involved in Miami's extensive adaptation and resiliency projects to curb future threats of sea-level rise and coastal storms.</li> <li><b>Related Climate Action Goals:</b> Safeguard Urban Systems (R305), Invest in resilient and smart infrastructure (Miami Forever Climate Ready)</li> <li><b>Pure Green Industry Examples:</b> Water Supply and Irrigation Systems, Water and Sewer Line and Related Structures Construction</li> <li><b>Partially Green Industry Examples:</b> Landscaping Services, Highway, Street, and Bridge Construction</li> <li><b>Example Occupations:</b> Hydrologists, environmental engineers, civil engineers, power plant operators, urban and regional planners, construction inspectors, landscape architects, architects, construction equipment operators, and transportation planners</li> </ul>

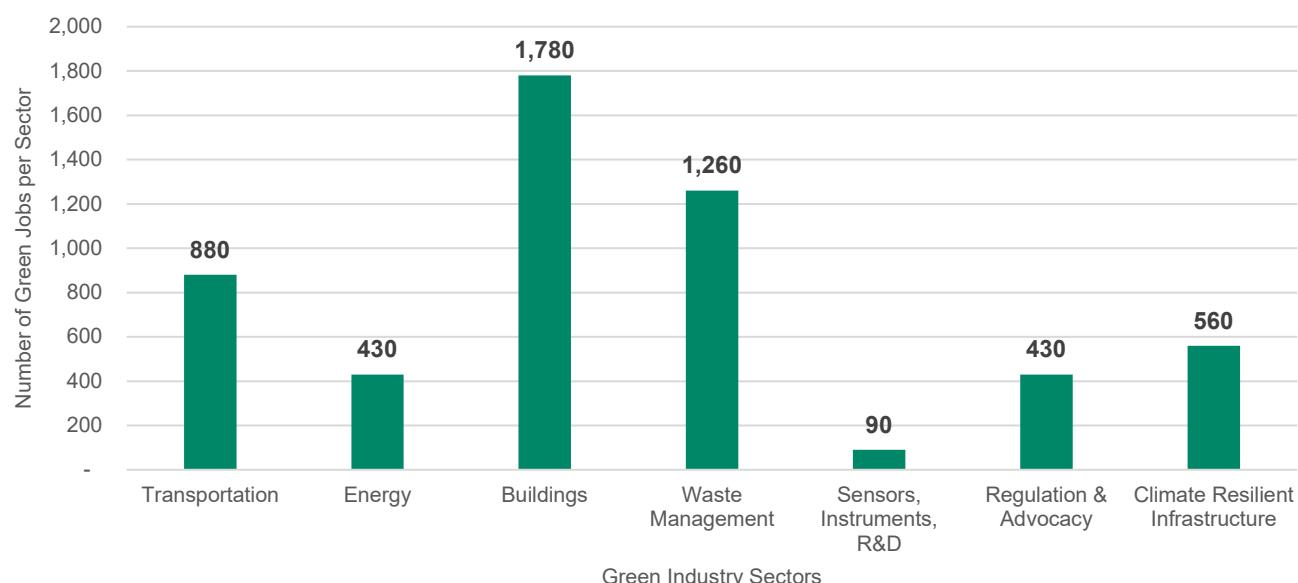
### Protection and restoration of South Florida's environment is a core component of Miami's green economy.

Miami's network of environmental regulators, management services, and advocacy groups, spurred by the adjacency of high-value natural environments, including Biscayne Bay, the Everglades, the Great Florida Reef, and beaches and ocean, is also a key component of the city's burgeoning green economy. This nature adjacency has fostered a small but notable environmental technology industry that includes technological advancements that track ocean pollution and stormwater management. Concern and appreciation for protecting these natural assets drives policy that further creates demand for green goods and services. Local, state, and federal regulatory agencies have issued requirements and incentives, for both the public and private sectors, to reduce environmental impacts and restore natural habitats. This is evidenced by various regulations impacting the County's Water and Sewer Department (WASD), including the state's requirement to treat wastewater for reuse rather than deep well injections and the Environmental Protection Agency's (EPA) consent decree requiring WASD to amend its ocean outfall system, which is leading to multi-billion-dollar capital investments, many of which require specialized contractors to design and execute.

## Jobs Within Miami's Current Green Economy

Green jobs within the City of Miami today are concentrated in the Transportation, Buildings, and Waste Management sectors, as illustrated in Figure 8 . Roughly 5,000 jobs (about 1.5% of all jobs within the City of Miami) and about \$1 billion in GRP (about 2% of the GRP) contribute directly to the City's green economy.<sup>12</sup> These job numbers are calculated by totaling Pure Green industry jobs with estimates of the number of green jobs within Partially Green industries (a more detailed methodology in the appendix describes the process for determining the concentration of green jobs within Partially Green Industries).<sup>13</sup> As demand for green goods and services grows and the market share of green industries grows, demand for these occupations will also grow. To ensure that local Miamians benefit from green economic growth, regional workforce training actors will need to adapt and expand their curricula to prepare students and workers for green jobs. Further analysis of green occupations is included in Chapter 4.

**Figure 8. The Buildings, Transportation, and Waste Management Sectors are the Sectors with the Most Green Jobs in Miami's Current Green Economy**



Source: AECOM Analysis, Emsi 2019 Industry Data

<sup>10</sup> The electrical contractors' industry, which likely captures charging station installation jobs, is included in the green buildings clusters.

<sup>11</sup> While some of these industries are currently lacking green practices, they are an important part of Miami's local economy and have high potential to become greener in the future. For these reasons, they have been captured as part of the green economy analysis.

<sup>12</sup> Emsi employment considers both full time and part time jobs and counts them both equally.

<sup>13</sup> The job numbers and financial values in this Analysis solely include firms operating within the city limits of Miami – not those within greater Miami-Dade County nor neighboring municipalities. However, it is important to acknowledge that Miami's local economy is influenced by regional economic forces within Miami-Dade County and Southeast Florida, and that regional supply and demand also play a role in supporting the City's local green economy.

## Chapter 4: The Potential of the Green Economy

### Green Jobs are Resilient and Poised for Growth

Industries that contribute to the City of Miami's green economy grew at a compounded annual rate of 3.8% from 2015 to 2019, adding 5,600 jobs (although these jobs are dispersed among Pure and Partially Green industries), compared to a 1% annual growth rate for Miami's non-green industries and 1.4% for the overall economy (inclusive of green and non-green industries). Green and traditional sectors, as analyzed in this research, are summarized in Table 2. Importantly, during the COVID-19 recession, the green economy showed little to no job loss while jobs in Miami's traditional industries lost over 6,000 jobs (US Bureau of Labor Statistics, 2021).<sup>14</sup> This comparison is illustrated in Figure 9 and Figure 10.

**Table 2. Categorization of sectors between Miami's green and traditional economies<sup>15</sup>**

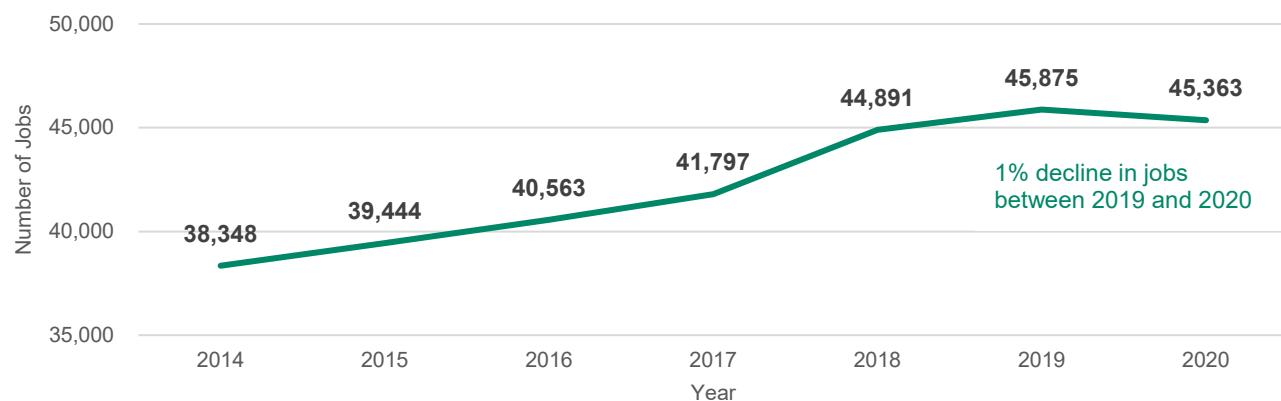
Green Economy Sectors	Traditional Economy Sectors
<ul style="list-style-type: none"> <li>• Transportation</li> <li>• Energy</li> <li>• Buildings</li> <li>• Waste Management</li> <li>• Sensors, Instruments, R&amp;D</li> <li>• Regulation and Advocacy</li> <li>• Climate Resilient Infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Health and Education</li> <li>• Manufacturing</li> <li>• Leisure and Tourism</li> <li>• Federal and State Government</li> <li>• Local Government</li> <li>• Retail/Wholesale/Distribution</li> <li>• Agriculture and Food</li> <li>• Professional Services</li> </ul>

- Transportation
- Energy
- Buildings
- Waste Management
- Sensors, Instruments, R&D
- Regulation and Advocacy
- Climate Resilient Infrastructure

- Health and Education
- Manufacturing
- Leisure and Tourism
- Federal and State Government
- Local Government
- Retail/Wholesale/Distribution
- Agriculture and Food
- Professional Services

Source: AECOM Analysis, Emsi 2019 Industry Data

**Figure 9. Jobs in the City of Miami's green sectors grew by 20% between 2014 and 2019 and dropped by 1% from 2019 to 2020 as the COVID-19 pandemic impacted business sales and operations**

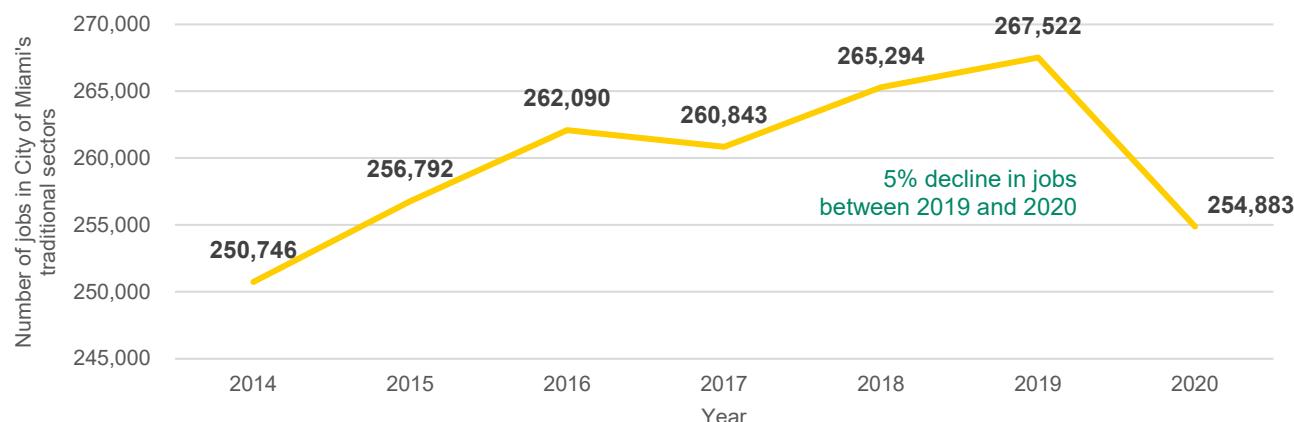


Source: AECOM Analysis, Emsi 2019 Industry Data

<sup>14</sup> Emsi 2020 employment data is based on BLS QCEW data through Q2 (June 2020), so 2020 estimates are subject to change.

<sup>15</sup> Traditional economy sectors were identified as all other sectors that have a presence in Miami that do not have a large component of pure or partially green industries.

**Figure 10. Jobs in the City of Miami's traditional sectors grew by 7% between 2014 and 2019 and dropped by 5% from 2019 to 2020 as the COVID-19 pandemic impacted business sales and operations**



Source: AECOM Analysis, Emsi 2019 Industry Data

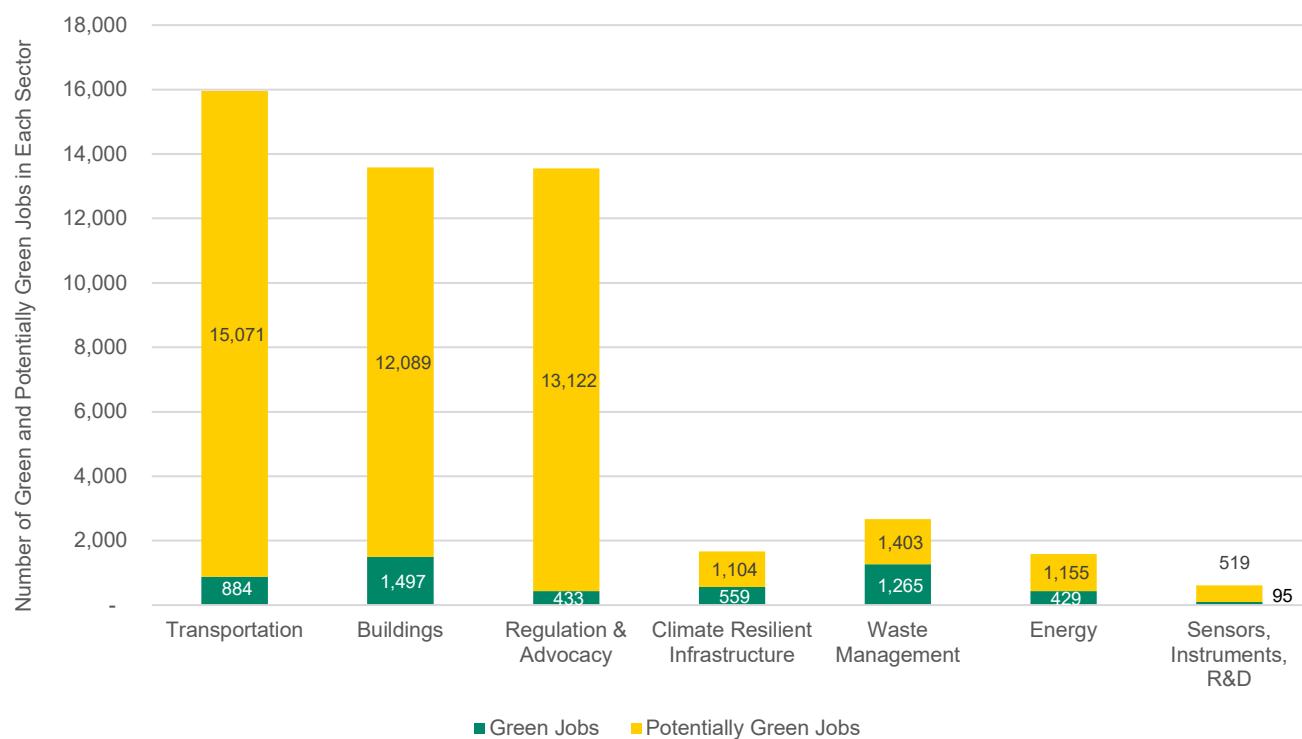
#### **The Impacts of Climate Change Drive Demand for Green Goods and Services**

The impacts of climate change, including sea level rise and hurricanes, have led to increased spending by the private sector as more people are investing in weatherization improvements for private property and using alternative financing mechanisms (such as the PACE program) to pay for these improvements.

When considering industries that participate both directly (e.g., Pure and Partially Green industries) and indirectly (e.g., Potentially Green industries) in the green economy, Miami's green economy comprises 30% of Miami's total economic output (GRP) (Emsi, 2020).<sup>16</sup> The industries in Miami's green sectors (e.g., Transportation, Energy, Building Construction, Technical Services, Waste Management, Regulation, and Infrastructure) are estimated to support upwards of 47,400 jobs. Eleven percent of these jobs are green jobs (or jobs that are either in Pure Green industries or the green components of Partially Green industries) while the remaining 89% of jobs have the potential to become green as demand for green goods and services increases.

<sup>16</sup> This estimate is derived from job numbers for Pure and Partially Green industries, with a green intensity ratios used to estimate how many green jobs could exist within these Partially Green industries (details on the green intensity methodology can be found in Appendix II). All employment data is provided by Emsi.

**Figure 11. 11% of jobs in Miami's green sectors are considered green, while 89% have the potential to become green as demand for green goods and services grow**



Source: AECOM Analysis, Emsi 2019 Industry Data

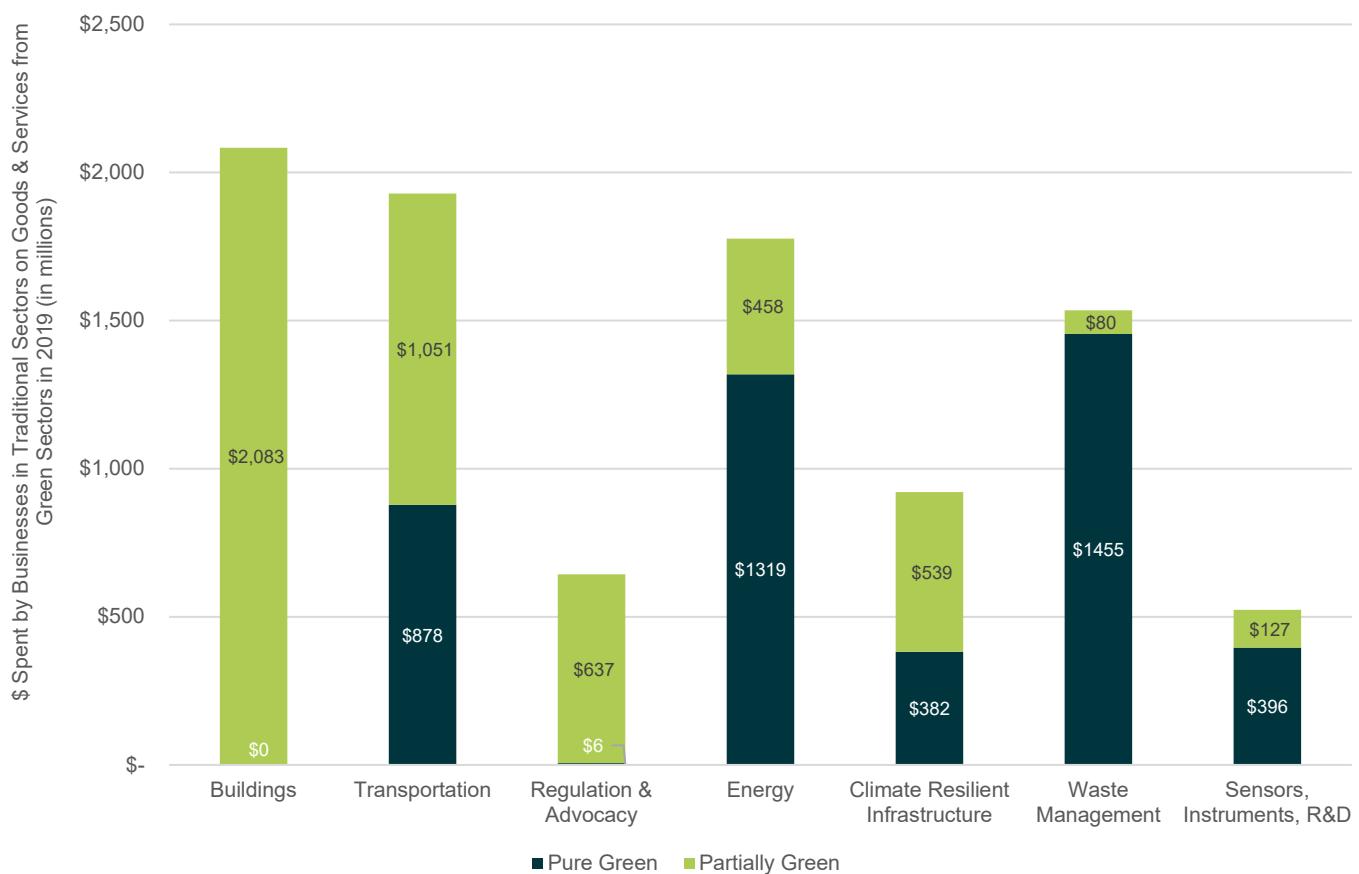
This demonstrates that the City of Miami has strong potential to transition to a green economy, either by transitioning existing jobs to green ones or creating new green jobs, especially as demand for green goods and services increases with the implementation of the GHG Plan and climate adaptation projects.

## Traditional Industries Will Grow the New Green Economy

The sectors that have historically been key drivers of the Miami region's economic success, such as Healthcare, Education, and Tourism, also contribute to the green economy as the consumers of green goods and services. Industry purchase data shows that traditional sectors rely on roughly \$5 billion in goods and services from green sectors annually, which forms a positive feedback loop between emerging green industries and the City of Miami's broader economy. One clear example is building construction, where traditional industries in Miami spend over \$2 billion annually on the construction and renovations of hospitals, offices, apartments, hotels, and commercial buildings. Figure 12 depicts the total amount spent by businesses in traditional, non-green industries on goods and services produced by businesses that participate in the green economy.<sup>17</sup> As traditional sectors adopt greener practices in the future, such as purchasing EVs, investing in solar, or improving energy and water efficiency of buildings, they will rely on firms within Miami's green sectors.

<sup>17</sup> The data should not be interpreted as the amount spent purely on green goods and services, but rather on the overall sectors which encompass evolving green industries. These data illustrate the influence that Miami's traditional economy has had on helping its green businesses grow as it makes decisions on whether and how to make environmentally responsible investments in areas such as green building retrofitting and construction, electrification of buildings and fleets, and sustainable resource management.

**Figure 12. Businesses in Miami's traditional sectors spent \$5 billion on goods and services from businesses participating in Miami's green sectors in 2019**



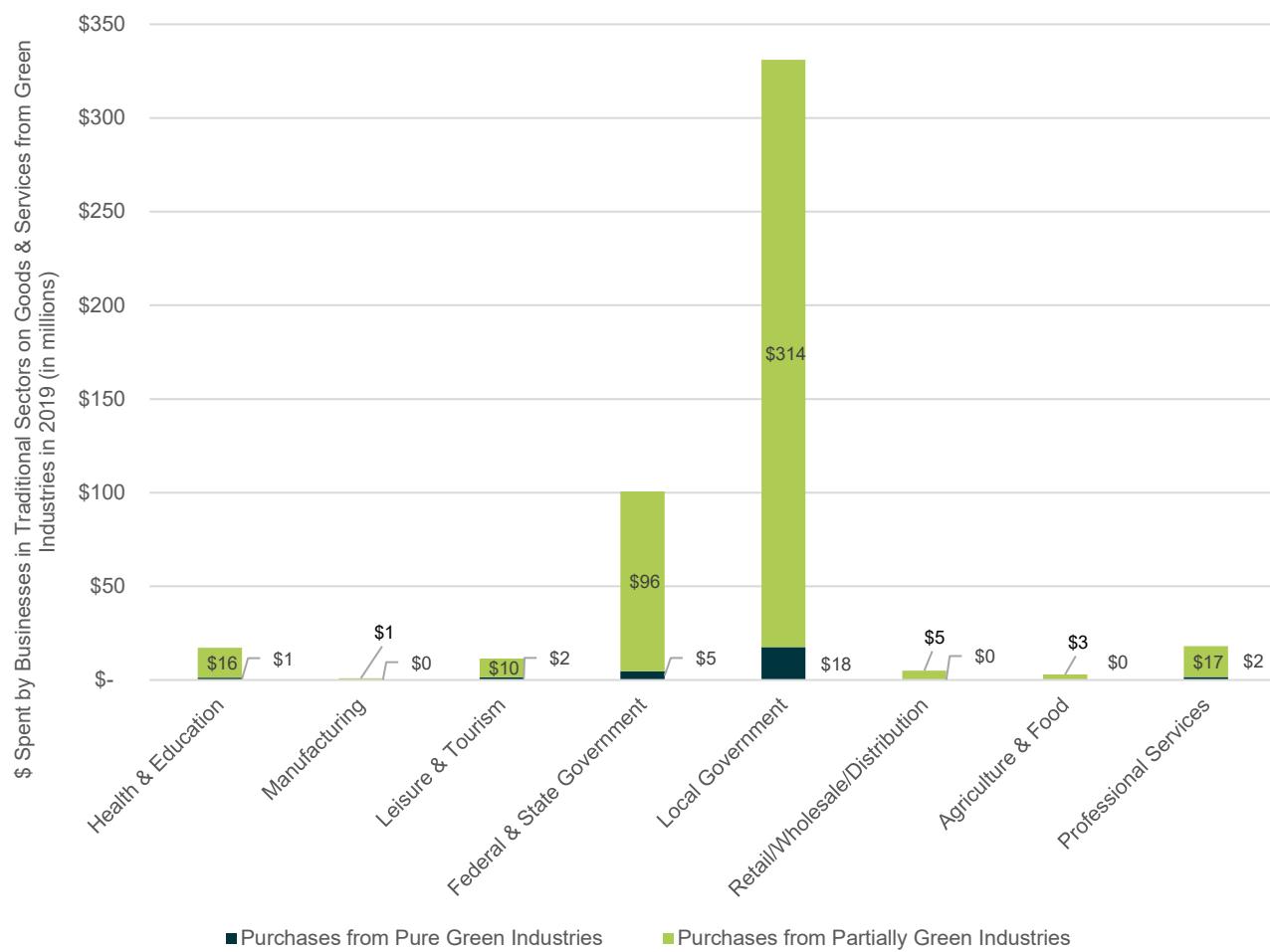
Source: AECOM Analysis, Emsi 2019 Industry Data

Figure 13 shows the average amount spent per industry among traditional sectors on goods and services from either Pure or Partially Green industries. Overall, non-green industries spend about 14% of total purchases in Pure or Partially Green industries. Of these industries, the highest spender is local government, totaling nearly \$330 million in green sector purchases in 2019. While local government's purchases from Pure and Partially Green industries are not *all* green, changes in City policies that lead to more green purchases will have significant influence in "greening" the economy. Spending by traditional industries within the green economy to-date has occurred organically – or, rather, without deliberate economic development or government policies driving demand. Given this, incentives, regulations, and broader market forces have clear opportunity to sway Miami's traditional industries to invest in green goods and services. Given this clear economic linkage between green and non-green industries, public policy efforts that encourage the private sector to make green investments will have ripple effects throughout regional economy, and support pursuit of broader carbon reduction goals.

#### Growth in Renewable Energy Jobs

Today, the renewable energy industry in Miami provides over 400 jobs, which is less than 30% of the total jobs in Miami's energy sector. However, renewable energy jobs have grown by 16% in the past decade. This growth is driven by purchases from Miami's traditional sectors (e.g., government, healthcare, tourism), which amounted to nearly \$600 million in 2019. The actions listed below both support GHG reductions and create opportunity to increase demand for renewable energy, which will in turn lead to increased demand for clean renewable energy jobs.

**Figure 13. Of Miami's traditional sectors, local government was the largest purchaser of goods and services from Pure and Partially Green industries in 2019**



Source: AECOM Analysis, Emsi 2019 Industry Data

#### The City of Miami is Already Shaping the Green Economy

The City has already instituted sustainability-directed policies which are shaping the new green economy, such as requiring buildings over 50,000 square feet to be LEED certified, allocating a fifth of off-street parking spaces to EVs, and allowing solar panels to not contribute to building height maximums. More policies and investments similar to these are anticipated with the implementation of the GHG Plan and other resilience efforts.

## Green Jobs Are Higher Paying and More Accessible

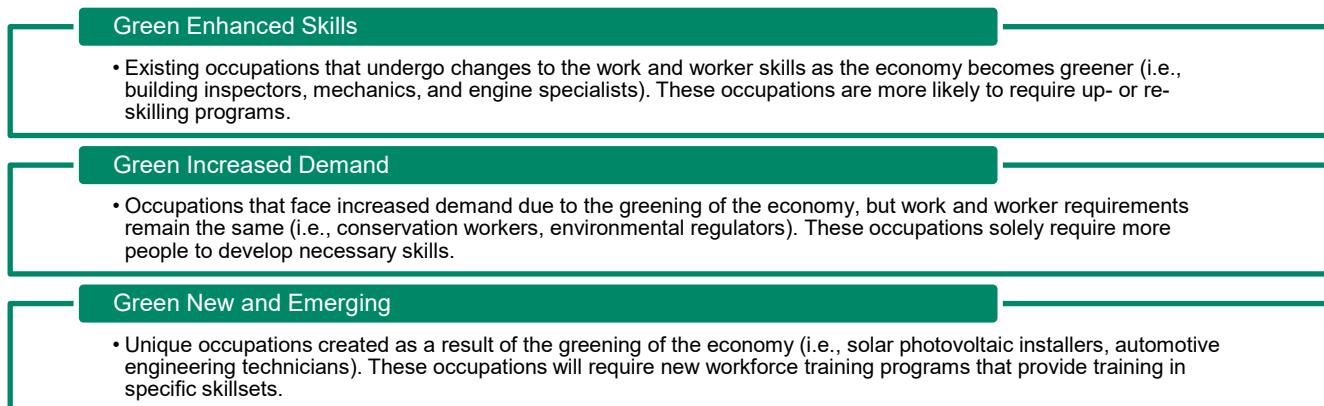
Essential to achieving our broader climate justice agenda is ensuring that underinvested climate justice communities and Black and Brown Miamians have access to living wage career pathways, which the expansion of green industries can provide. Numerous studies confirm that jobs in green industries tend to be higher paying with lower barriers to entry compared to jobs in traditional industries, particularly for renewable energy jobs which tend to require on-the-job training rather than a post-secondary degree (Muro, Tomer, Shivaram, & Kane, 2019). 65% of Miami's green occupations have a median wage that is greater than the local living wage and 60% of them are considered middle skill, which are jobs that require less than a college degree and more than a high school diploma. In comparison, 53% of Miami workers earn a living wage and only 38% of jobs within the broader Miami-Dade County economy are considered middle skill. All green sectors are already expected to grow over the next ten years – even without the implementation of our GHG Plan and broader resilience goals – indicating that growth in the middle-skill, living wage jobs market can be expected.

## Chapter 5: Green Occupations

Preparing Miami's workforce for new, greener jobs requires understanding which jobs will be in demand and their associated skillsets. Preparation will also need to identify the occupations that are most at-risk for decreased demand as the economy transitions to become greener. For example, an increase in EVs in Miami, which is a top GHG reduction goal, will increase demand for electricians and EV technicians while reducing demand for workers related to combustion engine vehicles. While it will require efforts to monitor the changing needs of green or greening employers in Miami, some studies have tried to synthesize more broadly how skills for green jobs vary from those for traditional jobs. Skill and knowledge areas for green occupations tend to require more scientific knowledge and technical expertise (Muro, Rothwell, & Saha, 2011). As many technician occupations do not require a college degree, but rather an associate's degree, vocational education or on-the-job training, many green job-specific training programs could be accessed through existing technical training and educational programs, such as those offered through Florida International University (FIU), Miami-Dade College, and other local colleges and universities. We – the City of Miami, educational institutions, workforce and economic development organizations, and the private sector – must work together to anticipate these changes in demand for occupations and skills and prepare our workforce accordingly.

Green occupations are divided into three skillset categories, as summarized in Figure 14, that inform workforce training curriculum design and recruiting (O\*NET OnLine, 2020).<sup>18</sup> Occupations in the "green enhanced skills" and "green increased demand" categories already have a presence in Miami and are more likely to have existing workforce training and other skills development resources in place, which will need to be expanded or augmented. "Green, new, and emerging" occupations, meanwhile, are less likely to have training resources and career pathways in place, so developing local talent to fill related jobs will require educational partnerships and curricula development. Full lists of Miami green occupations that fall into each of these workforce training categories are available in Table 12, Table 13, and Table 14 in the Appendix. The tables include wage and skill requirement data.

**Figure 14. Green Occupation Workforce Training Categories**



<sup>18</sup> Jobs that are defined as green due to the nature of their work can be defined as "green occupations." An analysis of green occupations provides further detail on the activities, skills and education that will be needed in Miami's growing green economy.

### **Green Buildings & Green Jobs**

The green buildings sector, which includes energy efficiency contractors, electricians, and other specialty contractors, accounts for 35% of Miami's green jobs. Today's green building sector is the result of traditional industries investing in green buildings and retrofits. In 2019, businesses in traditional sectors spent over \$2 billion in Miami's green buildings industry. The buildings sector also offers the opportunity for the most growth in green jobs: green building jobs are currently just 13% of all buildings jobs, leaving 87% of jobs in this industry to become green jobs. As implementation of the GHG Plan takes off and demand for green buildings and retrofits grows, there will be corresponding demand for specialty contractors. Miami's workforce will need to be prepared to fill the increased demand for green buildings jobs or otherwise risk losing them to people outside the region. It will be critical for the City and economic development actors to market green jobs in the buildings industry, particularly to young people, and to develop and expand training pathways tailored to these jobs. New or expanded green workforce development opportunities will need to offer training to people entering the workforce and to re-skilling those already within the buildings and construction industry. Since these jobs tend to pay at or above the living wage, special attention should be given to recruiting and training potential employees from historically underinvested and climate justice communities.

There are hundreds of green occupations across Miami's core green sectors, all of them with varying growth potential, which can make workforce training prioritization challenging, especially in a context of limited resources. Many occupations, however, are prevalent across multiple green sectors, which makes them ideal targets for workforce training programs. Programs that provide the skills and educational training for multi-industry occupations are more likely to see students match with relevant jobs. Miami's green occupations with the highest "frequencies" across green sectors are summarized in Table 3.

**Table 3. High frequency green occupations**

Occupation	Compound Annual Job Growth (2015 – 2019)	Median Hourly Earnings	Work Experience Required	Typical Entry Level Education
Construction Laborers	10%	\$14.08	None	No formal credential
Laborers and Freight, Stock, and Material Movers	12%	\$12.92	None	No formal credential
Electricians	5%	\$20.04	None	High school diploma or equivalent
General and Operations Managers	16%	\$42.72	5 years or more	Bachelor's degree
First-Line Supervisors of Construction Trades and Extraction Workers	8%	\$26.92	5 years or more	High school diploma or equivalent
First-Line Supervisors of Mechanics, Installers, and Repairers	2%	\$28.42	Less than 5 years	High school diploma or equivalent
Cargo and Freight Agents	9%	\$17.97	None	High school diploma or equivalent
Maintenance and Repair Workers, General	8%	\$17.01	None	High school diploma or equivalent
Operating Engineers and Other Construction Equipment Operators	11%	\$20.97	None	High school diploma or equivalent
Cement Masons and Concrete Finishers	8%	\$19.21	None	No formal credential
Civil Engineers	2%	\$39.00	None	Bachelor's degree
Roofers	14%	\$14.45	None	No formal credential
Bus and Truck Mechanics and Diesel Engine Specialists	4%	\$23.49	None	High school diploma or equivalent
Industrial Truck and Tractor Operators	6%	\$15.70	None	No formal credential
Sheet Metal Workers	-8%	\$19.53	None	High school diploma or equivalent
Architects, Except Landscape and Naval	3%	\$31.17	None	Bachelor's degree
Helpers--Installation, Maintenance, and Repair Workers	1%	\$12.87	None	High school diploma or equivalent
Industrial Machinery Mechanics	4%	\$20.01	None	High school diploma or equivalent
Inspectors, Testers, Sorters, Samplers, and Weighers	8%	\$17.10	None	High school diploma or equivalent
Production, Planning, and Expediting Clerks	22%	\$17.98	None	High school diploma or equivalent

Source: AECOM analysis of Emsi occupation data based on O\*NET green occupation classifications

### The Promise of Electric

Critical to accelerating EV adoption will be the availability of charging station infrastructure, electricians to support charging station infrastructure, and technicians to support EV maintenance. With more EVs scheduled to arrive in the market within the next year and car companies transitioning to all-electric vehicle stocks, demand for EV mechanics is already expected to grow in the coming years, and the actions presented in the GHG Plan will further catalyze this demand. Mechanics, particularly bus and truck mechanics, make well above the living wage (\$24 per hour compared to the living wage of \$18 per hour), so increased demand for these jobs will create important opportunities for Miami's workforce. While Miami-Dade College already offers an EV mechanic training program, additional training programs could be offered, along with targeted marketing and recruitment strategies. Likewise, increasing awareness of the opportunities and benefits of the electrical trade, and specifically the EV charging station certification, including the trade's wage and growth benefits, will ensure that Miami has a workforce that is able to support widespread EV adoption.

## Chapter 6: Opportunities and Barriers to Growing Miami's New Green Economy

Regional economies are not only comprised of individual companies producing and selling goods and services to customers but also of entire networks of actors – including the public sector, educational institutions, funders, civic leaders, and non-governmental organizations (NGOs) – that contribute to the conditions required to support economic growth. Understanding Miami's existing green economy not only requires identifying green industries and measuring its GRP and living wage jobs, but also understanding which parts of the local and regional ecosystem are supporting (or hindering) sustained green economic growth.

The following summary draws from over 20 interviews with local stakeholders representing public, private, and nonprofit sectors and civic institutions. The summary identifies both facilitators of the green economy and factors that are otherwise inhibiting sustained green economic growth across Miami's growing green economy ecosystem.

### Opportunities

- **Local government prioritization of resilience is central to the Miami green economy.** Expected growth in Miami's green economy will, in large part, be driven by the City's planned infrastructure investments under the \$400 million Miami Forever Bond and stormwater master plan update and the County's Water and Sewer Department (WASD) capital upgrades related to environmental protection and climate adaptation, among other notable capital investments.
- **Implementation of our GHG Plan will lead to increased green growth in the Buildings, Transportation, and Energy sectors.** The actions that are expected to directly lead to economic growth, including the creation of new jobs, are summarized below:

#### **Goal 1: GETTING AROUND MIAMI**

- G-2: Collaborate with Miami-Dade County and local advocacy groups to increase utilization of biking as a transit method by implementing the Bicycle Master Plan and expanding the number of protected, green bikeways.
- G-3: Expand micromobility options throughout the entire city including Citi Bikes, scooters, and electric bikes.
- G-4: Develop a Trolley Master Plan including a long-term vision for the program and route updates.
- G-8: Work with partner entities to create bus lanes in strategic, key corridors.
- G-10: Improve pedestrian experience and safety through investments in sidewalks such as ADA compliance measures and increasing number of crosswalks, especially in low-medium income areas.

#### **Goal 2: RENEWABLE ENERGY**

- R-4: Provide additional policy and financial incentives to encourage private solar installations and identify incentives that would appeal to owners of affordable housing.
- R-6: Partner with community organizations such as local nonprofits, trade organizations, and electric and gas utilities, to develop a building electrification education program to provide information and technical assistance.

#### **Goal 3: ELECTRIC VEHICLES**

- EV-3: Partner with major employers and multifamily building owners to install EV chargers in parking lots/garages.
- EV-4: Build on EV Capability Ordinance to require EV charger installations in new developments starting in 2025.

#### **Goal 4: ENERGY EFFICIENCY**

- E-1: Implement Building Efficiency 305 (BE305) program requiring energy benchmarking and disclosure for commercial, multi-family residential, and City of Miami municipal buildings over 20,000 sq. ft.
- E-4: Adopt a residential, single-family home energy rating and disclosure ordinance.
- E-5: Adopt building performance standard for commercial, multi-family residential, and City of Miami municipal buildings over 20,000 sq. ft.
- E-6: Establish residential, single-family home energy conservation requirements.

#### **Additional Enabling Actions**

- **Miami's colleges, universities, and educational institutions are a critical pillar to the city's overall economic strength and to the local green economy, both in terms of workforce training and research and development.** Today, Miami colleges and universities offer courses that directly support many of its green economy sectors, including environmental engineering and protection (University of Miami, Florida International University), sustainable management (University of Miami, Florida International University), building efficiency (University of Miami) and construction trade programs (Florida International University), and EV-related technical skills (Miami Dade College's advanced automotive service technology certificate). Several of these institutions also serve as workforce intermediaries, providing direct access to technical skills training and employment opportunities. Miami-Dade College and Miami-Dade Unified School District also have a track record of working with construction and development companies to attract students to the construction industry, an industry that, on average, offers living wage jobs and job security. Likewise, Florida International University (FIU) has partnered with JP Morgan Chase and local employers to offer Urban Potential Laboratories (UP Labs) which specifically prepares students for middle-skill jobs in high-demand industries. It is this strong foundation of educational assets, which will need to grow and expand in anticipation of increased demand, that will enable Miami to flourish as a green workforce hub.
- **Small but growing green finance and risk management industries are developing in the South Florida region.** The finance and risk sectors have an important role to play in providing capital to Miami's climate adaptation projects and providing funding for growing green industries. Miami already has a strong presence of banks and financial institutions and the the South Florida economy – and climate – is an ideal setting for testing financial instruments and expanding green investment portfolios. Combined, the Miami Forever Bond, GHG Plan, and Venture Miami signal to investors and financial institutions that there is a growing market for green finance and risk management services. There is also potential to grow existing financial institutions and resources, like the Climate First Bank or Solar and Energy Logan Fund (SELF), and attract green businesses accelerators or venture capital firms that provide seed funding.
- **Growing demand – both nationally and locally – for sustainable, renewable, and green goods and services has led to economies of scale and, thereafter, declining costs, creating a virtuous cycle in which “green” is becoming more and more affordable.** This is also evidenced by FPL's growing investment in solar energy, demand for solar panels on private residences, demand for EVs and charging infrastructure, and the airport's energy efficiency overhauls. The expectation is that costs will continue to decline as demand, in Miami and beyond, leads to increased innovation and reaches higher quantities of scale.

## **Barriers**

- **While there is regional consensus about the importance and potential of Miami's new green economy, there is no champion to focus energy on growing the green economy.** A leader is needed to ensure that a functioning ecosystem is in place to support future job creation, to facilitate creation and access to living wage jobs to our Black and Brown populations, and to develop partnerships with local workforce intermediaries and universities. The pockets of the green economy that are particularly active and visible, such as in the Transportation, Buildings, Energy, and Climate Resilient Infrastructure, are mostly operating independently of one another. The actors within these sectors, including private enterprises, nonprofits, civic organizations, and educational institutions would benefit from stronger connections and alignment of goals and resources.
- **While the City of Miami has made considerable progress in working toward shared goals across sustainability and resilience, City economic and workforce development efforts related to green jobs are fragmented.** The City has limited capacity to engage with emerging green firms to better understand how evolving public sector investments (GHG Plan) will impact their industries and future job creation. The lack of a city-level economic development arm was noted as a specific concern, alongside need for more deliberate strategies to leverage city procurement rules to accelerate green opportunities.
- **Although the COVID-19 pandemic and economic recession are beginning to wane, the pandemic has had consequential impact on Miami's economy with many Miamians still out of employment, particularly low-income Black and non-white Hispanic residents.** In response, City leaders have the opportunity to leverage federal and state resources to explicitly support job creation in sectors best positioned to drive growth and creation of good jobs

over the next 10-20 years, which includes the industries across the green sectors. The decisions made today about economic recovery will have shape the economy, community, and the environment today and in the decades to come.

- **Workforce development programs, middle-skill employers, and Miami's public-school system require partnerships, resources, and clear direction on how to prepare the local workforce for the green economy.** To ensure that Miami has the workforce to support the growth of the green economy, it will need to ensure that its workforce is trained for green occupations. Presently, employers across industries, including Transportation, Buildings, and Technology sectors, hypothesize that the region's skilled talent supply is insufficient to meet current and future demand (JPMorgan Chase & Co., 2015). Meanwhile, lower-skilled younger residents and adults report that it is difficult to access high-demand occupations for a variety of reasons, including skill and education requirements and visibility of opportunities. Indeed, many lower-income residents, particularly Black and non-white Hispanic residents, are most often in need of middle-skill jobs, lack high school diplomas, GEDs, and/or English language proficiency and are thus not necessarily positioned to pursue these opportunities (JPMorgan Chase & Co., 2015).

## Chapter 7: Actions that will Catalyze and Support the Growth of a New Green Economy

Today, Miami's green economy ecosystem includes many actors that are operating, for the most part, independently of one another. These actors lack a supportive ecosystem to help them grow, hire, increase their impacts on the local economy, and provide equitable opportunities. Our goal is to ensure that green industries have a pathway for growth and that the City plays an active role in paving the way for new green economic growth and employment. This includes preparing underemployed workers for new green opportunities, engaging with the current and potential green job holders, fostering connections between stakeholders, and building business and workforce training capacity and synergies across the entire ecosystem. While the City has an important role to play in the new green economy, growing an equitable New Green Economy will require partnerships and actors from all sectors of Miami's economic ecosystem. The City-led actions are intended to encourage broader, collective actions from the City's economic development, workforce development, and climate justice stakeholders.

### City Authority

As discussed in the GHG Plan, the City of Miami faces practical constraints on its ability to influence all GHG emissions. The same is true for the City's ability to direct and influence the local economy – we can directly make change through just a few select channels. We can play an impactful role in creating demand for green goods and services by purchasing those items, making requirements through permitting and contracting, and leading by example and through partnerships. The City-led New Economy actions leverage the City's existing resources (e.g., staff), programs (e.g., Summer Youth Connect program, Opportunity Center), authority (e.g., zoning and procurement), and regional leadership to influence Miami's economy.

#### State of Illinois' Climate and Equitable Jobs Act

In September 2021, Illinois Governor J.B. Pritzker signed the Climate and Equitable Jobs Act, setting the state on a course to phase out fossil fuels in the power sector by 2045. The act more than doubles renewable energy funding, expands energy efficiency programs, and invests \$115 million per year for green job creation in disadvantaged communities. The bill includes a comprehensive effort to transition workers and municipalities away from fossil fuels, establishing a "displaced worker bill of rights" to provide training and benefits to transitioning workers, replacing lost local property tax revenue from energy sources, and investing in job training, an incubator program for clean energy firms, and a clean jobs workforce network for "equity-focused populations."

#### Vancouver's Greenest City Action Plan

Vancouver's Greenest City Action Plan included a major effort to increase the number of green jobs and businesses engaging in greening their operations. This plan included two green economy targets: the first to double the number of green jobs from 18,250 in 2010 by 2020, and the second to double the number of companies actively greening their operations, from the 5% who were in 2011. The effort, still ongoing, significantly increased the number of jobs in green building construction, local food production, and green transportation-related industries.

#### Toronto's Green Jobs Metrics

The City government of Toronto actively tracks and develops its green jobs and workforce, which it estimated in 2019 to include about 60,000 workers. The City has commissioned research on developing and managing regional economic clusters, emphasizing a firm-neutral, collaborative approach to economic development at the industry level. The City has rolled out a Green Market Acceleration Program (GMAP) to coordinate between green firms, investors, and City officials. Toronto accommodates GMAP participants by lending them use of City-owned infrastructure for research, pilots, and demonstrations.

## Community Leadership and Regional Action

The green economy is bigger than just the City of Miami and its borders – it extends across the entire South Florida region and beyond. Efforts to grow the green economy need to involve the Greater Miami region and its economic and workforce development institutions, including the Beacon Council, the Chamber of Commerce, plus a deep bench of colleges, universities, and foundations. All these actors are already active in Miami's green economy ecosystem in some sort of capacity, either by supporting workforce and educational development, recruiting green industries, or funding community needs. The proposed partner led actions, detailed in Table 4 along with the City-led actions, could be led by a regional green economy champion or could be dispersed across various entities working together to grow the green economy.

### Los Angeles' Green New Deal & Green Jobs Target

The City of Los Angeles followed up on its 2015 Sustainable City pLAn with its 2019 Green New Deal, setting more aggressive GHG emissions reduction goals and a more ambitious economic agenda. The plan aims for City carbon neutrality by 2050. Among its targets are creating 300,000 green jobs in the City by 2035 and 400,000 by 2050, increasing green sector investment by \$2 billion by 2035, and eliminating the gap between City and county unemployment. Initiatives to achieve these goals will include developing green jobs pipelines at community colleges and technical schools, creating private sector partnerships to boost apprenticeships, and offer job retraining for those displaced by the green energy transition and automation. The City also plans to offer more tax incentives, subsidized loans, and regulatory assistance for green investment (City of Los Angeles, 2019).

### Colorado Community College System's Career Pathways Website

The Colorado Community College System developed an extensive website focused on careers in advanced manufacturing (Colorado Community College System, 2021). Their effort provides unique industry maps to highlight occupations positioned for near term growth, placed in context with career pathways that provide clarity regarding how to get from lower wage opportunities to higher wage opportunities.

## New Green Economy Actions

All of these actions will require continuous engagement with impacted workers, particularly those from waning industries and those who are un- and under-employed, green job holders, and Pure, Partially, and Potentially Green industries. Sustained engagement and collaboration will ensure that the new green economy is working for Miamians.

The objectives of the New Green Economy report spell out GROW. The breakdown of the GROW framework is as follows:

- G – Grow the Green Economy Ecosystem
  - Strong regional economies are underpinned by an ecosystem of actors that each play important roles in facilitating economic growth. To grow Miami's green economy, we must consider all factors that support a growing economic ecosystem, including local leadership and business and industry networks.
- R – Recruit and Retain a Green Workforce
  - A critical component of Miami's economy is its workforce. A workforce that is prepared to capitalize on new and expanded green job opportunities will be attractive to green industries. Likewise, a key driver of this Green Economy Plan is ensuring that our workforce has opportunity to access resilient, living-wage jobs.
- O – Open Occupational Pathways
  - We – the City of Miami, educational institutions, workforce and economic development organizations, and the private sector – must work together to create green occupational pathways – from education to job placement - that allow more Miamians to access living wage jobs.
- W – Welcome and Support Green Industry
  - Inviting and attracting green industries to invest, hire, and grow their businesses here is, ultimately, the goal of this Green Economy Plan. These green industries will not only bring jobs and economic diversity to Miami but will also ease the transition to a carbon-free future. These actions are intended to invite and support green industry in Miami.

**Table 4. New Green Economy Actions for City of Miami**

<b>Grow the Green Economy Ecosystem</b>		
<b>Phase 1 (1-3 years)</b>		
<b>Action</b>	<b>Action Details</b>	<b>Resilient 305 &amp; Miami Forever Climate Ready Alignment</b>
NE-1: Work with regional partners to identify a regional green economy champion and align resilience and adaptation goals.	While ecosystems are not created overnight, coalition building with regional partners, including Miami-Dade County, Beacon Council, the Chamber of Commerce, CareerSource, and non-governmental organizations (NGOs), to identify a green economy champion and align resilience and adaptation goals from Resilient305, Miami Forever Climate Ready, and Miami Forever Carbon Neutral to intentionally foster creation of a functioning, inclusive ecosystem which advances equity and opportunity through innovation. This “champion” will need to have long-term staying power, credibility with a broad array of stakeholder groups, an intense focus on the green economy and climate justice, and access to operational funding.	R305: Action 20: Build an Inclusive Economy, Action 21: Train for Construction, & Action 27: Expand Youth Career Opportunities  MFCR: Goal 1: Ensure decisions are data-driven and human centered Goal 2: Inform, prepare, and engage our residents and businesses
NE-2: Dedicate staff to support green economic development goals and implementation of the GHG Plan.	Dedicate additional full-time equivalent (FTE) employee capacity within existing City departments (planning, resiliency, housing & community development) to support the green economy champion and to lead the City's role in growing the green economy ecosystem (which includes the actions detailed in this table).	
NE-3: Develop a plan for expanded, permanent economic development capacity.	Develop business model for expanded City-level economic development capacity, either as a city department or as a public private partnership, to sustain development of a functioning green economy ecosystem, including economic development incentives and workforce development resources to support career and training pathways. This would build upon Venture Miami efforts.	
NE-4: Develop green economy performance metrics.	Performance metrics are essential in placing climate investments and associated job creation in a broader economic, social, and environmental context, and documenting progress toward future goals. The metrics identified in the GHG Plan (e.g., the number of Electric Vehicles in use) will serve as a proxy for measuring the new green economy. The City will develop separate metrics for tracking equity goals, including demographic makeup of industries and occupations, workforce training recruitment and participation, and employment retention.	
<b>Recruit and Retain a Green Workforce</b>		
<b>Phase 1 (1-3 years)</b>		
<b>Action</b>	<b>Action Details</b>	<b>R305 &amp; Miami Forever Climate Ready Alignment</b>
NE-5: Offer relevant job trainings through the Opportunity Center and connect job seekers to local employers.	The City's Opportunity Center and other training entities can partner with local green businesses to surface job orders, locate trainings in the City, and prioritize recruiting displaced, underemployed, or unemployed workers from climate justice communities. Through this process the City will gain a better understanding of barriers to employment in the green economy and build relationships with workforce	R305: Action 20: Build an Inclusive Economy, Action 21: Train for Construction  MFCR: Goal 1: Ensure decisions are data-driven and human-centered, Goal 2:

	and education partners to develop programming to bridge the identified gaps.	Inform, prepare, and engage our residents and businesses
<b>Open Occupational Pathways</b>		
<b>Phase 1 (1-3 years)</b>		
Action	Action Details	R305 & Miami Forever Climate Ready Alignment
NE-6: Expand the Miami Summer Jobs Connect program to include internships that align with the new green economy.	Introducing Miami youth to green jobs, particularly jobs that offer living wages and long-term growth opportunities, early in their career can ensure that Miami has a supply of qualified workers to support green economic growth and climate action goals.	Action 27: Expand Youth Career Opportunities
<b>Welcome and Support Green Industry</b>		
<b>Phase 2 (4-6 years)</b>		
Action	Action Details	R305 & Miami Forever Climate Ready Alignment
NE-7: Strengthen the City's procurement requirements so that green and sustainable are not only the preferred option, but the required option.	Update the language in Chapter 22.5 of the City Code, Articles I and III, to require City departments to purchase green goods and services rather than consider them.	R305: Action 20: Build an Inclusive Economy, Action 57: Leverage the Power of Purchasing  MFCR: Goal 2: Inform, prepare, and engage our residents and businesses
NE-8: Facilitate expedited design and permitting review of projects that will achieve Miami's GHG and resilience goals.	Expedited review will reduce costs and encourage developers, contractors, and related businesses to pursue sustainable opportunities.	
NE-9: Preserve or enhance zoning that supports green industries.	Growth of Miami's green economy will also change land use needs. It will be important for the City to identify changes in land-use needs and preserve or create zoning that supports green industry needs. Zoning that supports green industries will also facilitate location-based economic development strategies. Formalize resilience and green economy priorities in the City's comprehensive plan.	

**Table 5. Proposed New Green Economy Actions for Partners**

Grow the Green Economy Ecosystem		
Phase 1 (1-3 years)		
Action	Action Details	R305 & Miami Forever Climate Ready Alignment
Work with the City of Miami and other regional partners to identify a regional green economy champion and align sustainability and adaptation goals.	While ecosystems are not created overnight, coalition building with regional partners, including Miami-Dade County, Beacon Council, the Chamber of Commerce, CareerSource, and non-governmental organizations (NGOs), to identify a green economy champion can happen within the near-term. This coalition building can include work to align sustainability and adaptation goals from Resilient305, Miami Forever Climate Ready, and Miami Forever Carbon Neutral, which will help to foster a functioning, inclusive ecosystem that advances equity and opportunity through innovation. The green economy “champion” will need to have long-term staying power, credibility with a broad array of stakeholder groups, an intense focus on the green economy and climate justice, and access to operational funding.	R305: Action 20: Build an Inclusive Economy, Action 21: Train for Construction, & Action 27: Expand Youth Career Opportunities  MFCR: Goal 2: Inform, prepare, and engage residents and businesses
Identify and grow green financing opportunities.	Access to capital is essential for businesses to grow and hire and to facilitate large-scale public investments. The new green economy champion and/or supporting partners will need to build out the green economy ecosystem by identifying and growing green financing opportunities, either through recruitment of financial firms to the Miami market or expansion of offerings from existing financial organizations.	
Recruit and Retain a Green Workforce		
Phase 1 (1-3 years)		
Action	Action Details	R305 & Miami Forever Climate Ready Alignment
Develop a resource that highlights green career pathways.	Building off The Miami Foundation's Labor Miami website, creating a resource that outlines various green career pathways, which will help people understand the benefits of a green career and how to start their green career. This resource could highlight educational and skill requirements, transferable skill mapping, and career pathways including steps and skills needed to advance to higher-wage careers.	R305: Action 20: Build an Inclusive Economy  MFCR: Goal 2: Inform, prepare, and engage our residents and businesses
Phase 2 (4-6 years)		
Develop a recruitment strategy and marketing campaign to showcase the benefits of green jobs and recruit young people to living wage career pathways.	A recruitment strategy and marketing campaign will aim to match climate justice communities and underserved residents with living wage jobs in the green economy.	R305: Action 20: Build an Inclusive Economy, Action 21: Train for Construction, & Action 27: Expand Youth Career Opportunities
Locate green workforce trainings in climate justice communities.	In support of the recruitment strategy to match residents with living wage jobs, green workforce trainings and supportive assets, including certification programs, should have a sustained presence in climate justice communities.	MFCR: Goal 2: Inform, prepare, and engage our residents and businesses
Open Occupational Pathways		
Phase 1 (1-3 years)		
Action	Action Details	R305 & Miami Forever Climate Ready Alignment

Create a green jobs consortium tasked with ensuring that Miami's workforce is prepared for the green economy.	In collaboration with the green economy regional champion, this consortium should include representatives from local colleges and universities, (existing) green businesses, trade organizations, local government, economic development organizations, and community groups, particularly those that represent climate justice communities. Work could include updating school programs, training, and apprenticeship curricula meet the needs of green employers, expanding green job-related training opportunities (and reducing barriers to access those opportunities), matching resource needs with resources, connecting employers with potential employees, and standardizing job requirements.	R305: Action 20: Build an Inclusive Economy, Action 21: Train for Construction, & Action 27: Expand Youth Career Opportunities  MFCR: Goal 1: Ensure decisions are data-driven and human-centered, Goal 2: Inform, prepare, and engage our residents and businesses
Identify industries and occupations that have the highest projected job growth or are at greatest risk for near-term transition due to climate action efforts.	Identify the green industries and occupations that are expected to see the most job growth in the next decade and identify the non-green industries and occupations that are exacerbating climate change and/or are expected to wane as the national and global market becomes greener. Develop workforce transition pathways that match skills from the declining occupations to skills in green occupations, particularly those that are expected to grow.	
Expand green workforce training programs at colleges, universities, trade associations, and MDUSD, and establish paid green apprenticeship programs.	The green jobs consortium should endeavor to expand the capacity of existing green workforce programs, including Miami Dade College's EV technician certification and University of Miami's green business programs, <i>and</i> increase the variety of green training offerings. Encourage partnerships with high schools and community colleges to ensure that high-growth green pathways have a backlog of students and employees. Support the creation of paid apprenticeship programs, similar to WASCO's program, to ease access to green jobs.	

### Welcome and Support Green Industry

#### Phase 1 (1-3 years)

Action	Action Details	R305 & Miami Forever Climate Ready Alignment
Engage with local businesses, property owners, and large employers to encourage the development and implementation of green procurement policies.	Businesses in Miami's traditional sectors spent \$5 billion on goods and services from businesses participating in Miami's green sectors in 2019; Yet just 6% of those purchases were from Pure Green industries while 94% (\$4.6 billion) of these purchases were from Partially Green industries. Encouraging businesses in Miami's traditional sectors to adopt green procurement policies could have a \$4.6 billion impact on greening the economy. This effort should include working with the South Florida Anchor Alliance to integrate GHG mitigation and climate resilience into their equity-focused procurement practices.	R305: Action 57: Leverage the Power of Purchasing
Engage with local businesses to design incentives to support "greening."	Miami has a robust, vibrant local business community that, collectively, are major providers and purchasers of goods and services and major employers. Greening local businesses will be important for achieving GHG mitigation and climate justice goals. To support this transition, we will need to understand what type of support will be helpful for either purchasing green goods or services or to transition to offer green goods or services.	R305: Action 20: Build an Inclusive Economy  MFCR: Goal 1: Ensure decisions are data-driven and human centered, Goal 2: Inform, prepare, and engage our residents and businesses

#### Phase 2 (4-6 years)

Create a green incubation hub.	Work with Venture Miami to create a mechanism for businesses and entrepreneurs to pitch climate action initiatives related to business and tech solutions and secure funding, startup resources, and use of City assets for testing products and ideas. This concept inspired by Toronto's Green Market Acceleration Program)	
--------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

## Next Steps

The COVID-19 pandemic has taught us the importance of resilience, equity, and modernization. Now, it is critical that we take decisive action to ensure our economic recovery efforts reflect these tenets. As immediate next steps, the City of Miami will focus on foundational actions that will support the expansion of this new economic sector. To enable this, the City needs to identify full-time equivalent staff time to focus on and begin work on City-specific actions. Beyond the City, key regional stakeholders including neighbor cities, Miami-Dade County, Beacon Council, workforce development intermediaries, green businesses, climate advocacy groups, and educational institutions, need to come together and collectively identify a regional green economy champion. A green economy champion is needed to lead on collaborating with public and private sector leaders; providing leadership and vision related to green economy goals; supporting start-up, retention, and expansion efforts; and taking ownership of green economy metrics (e.g., jobs, recruitment, wages, companies, and opportunities). This "champion", which may be a person, office, entity, or a coalition, will need to have long-term staying power, credibility with a broad audience of stakeholders, institutions, and businesses, an intense focus on the green economy and climate justice, and access to operational funding.

With a regional green economy champion in place, the proposed actions for growing the green economy can begin to take form. As the City updates its GHG Plan, we will maintain open channels of communication with workers, businesses, educational institutions, community organizations, public agencies, and residents to collaborate and report on the positive economic impacts of the GHG Plan and related climate actions.

## Bibliography

- Alliance for Automotive Innovation. (2021). *US Light-Duty Advanced Technology Vehicle (ATV) Sales (2011-2021)*. Retrieved from <https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard>
- C40 Cities. (2015). *Cities100: Toronto - Promoting Efficiency in New Developments*. Retrieved from C40 Cities: [https://www.c40.org/case\\_studies/cities100-toronto-promoting-efficiency-in-new-developments](https://www.c40.org/case_studies/cities100-toronto-promoting-efficiency-in-new-developments)
- C40 Cities. (2019). C40 Green Economy & Innovation Forum Webinar on Measuring Green Jobs in Cities. Retrieved from <https://www.c40.org/programmes/green-economy-innovation-forum>
- C40 Cities. (2021). *Why Cities?* Retrieved from [https://www.c40.org/why\\_cities](https://www.c40.org/why_cities)
- Calgary Economic Development. (2016). *Calgary Region's Green Energy Economy*. Retrieved from <https://delphi.ca/wp-content/uploads/2019/09/135.pdf>
- City of Edmonton. (2018). *Edmonton's Green Energy Economy*. Retrieved from [https://delphi.ca/wp-content/uploads/2019/09/Edmonton\\_Green\\_Energy\\_Economy\\_Report\\_Web\\_Version\\_2018.pdf](https://delphi.ca/wp-content/uploads/2019/09/Edmonton_Green_Energy_Economy_Report_Web_Version_2018.pdf)
- City of Los Angeles. (2019). *L.A.'s Green New Deal: Sustainable City pLAn*. Retrieved from [https://plan.lamayor.org/sites/default/files/pLAn\\_2019\\_final.pdf](https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf)
- City of Miami. (2021). *Proposed Capital Budget Fiscal Year 2020-21*. Retrieved from <http://archive.miamigov.com/Budget/docs/FY21/FY%202020-21%20Proposed%20Capital%20Plan%20-20Web%20Version.pdf>
- Colorado Community College System. (2021). *Advanced Manufacturing*. Retrieved from Colorado's Advanced Manufacturing Industry: <https://cocareeractiontools.com/>
- Emsi. (2020). *Occupational Data*. Retrieved from Emsi: <https://economicmodeling.com/2020/06/17/occupation-data/>
- Florida Agency for Workforce Innovation. (2010). *Green Jobs Survey Report*. State of Florida. Retrieved from <https://docplayer.net/6899892-Reen-jobs-survey-report-state-of-florida.html>
- FPL. (2020). *Reliable Power: In the Air and Underground*. Retrieved from <https://www.fpl.com/content/dam/fpl/us/en/news/pdf/energy-news-q2-2020.pdf>
- Garcetti, E., Sala, G., Aboutaleb, A., Aki-Sawyerr, Y., Cantrell, L., Capp, S., . . . Won-soon, P. (2020). *C40 Mayors' Agenda For a Green and Just Recovery*. Retrieved from [https://c40-production-images.s3.amazonaws.com/other\\_uploads/images/2093\\_C40\\_Cities\\_%282020%29\\_Mayors\\_Agenda\\_for\\_a\\_Green\\_and\\_Just\\_Recovery.original.pdf?1594824518](https://c40-production-images.s3.amazonaws.com/other_uploads/images/2093_C40_Cities_%282020%29_Mayors_Agenda_for_a_Green_and_Just_Recovery.original.pdf?1594824518)
- Georgeson, L., & Maslin, M. (2019). Estimating the Scale of the US Green Economy Within the Global Context. *Palgrave Communications*, 5(121). doi:10.1057/s41599-019-0329-3
- Hall, K. G. (2020, April 6). *For Miami's unbanked, stimulus checks come with hurdles*. Retrieved from Miami Herald: <https://www.miamiherald.com/latest-news/article241805346.html>
- International labour Organization. (2016, April 13). *What is a Green Job?* Retrieved from International labour Organization: [https://www.ilo.org/global/topics/green-jobs/news/WCMS\\_220248/lang--en/index.htm](https://www.ilo.org/global/topics/green-jobs/news/WCMS_220248/lang--en/index.htm)
- JPMorgan Chase & Co. (2015). *Trading on Innovation to Expand Opportunity*. Retrieved from <https://www.jpmorganchase.com/content/dam/jpmc/jpmorgan-chase-and-co/documents/54841-jpmc-gap-miami-online-aw4-v1.pdf>
- Martindale. (2021). *Martindale*. Retrieved from Environmental Lawyers: <https://www.martindale.com/>
- Miami-Dade Beacon Council. (2021). *Miami-Dade Beacon Council 2019-2020 Annual Report*. Retrieved from [https://www.beaconcouncil.com/wp-content/uploads/2020/06/BEA\\_ANNUAL-REPORT-2021\\_FINAL.pdf](https://www.beaconcouncil.com/wp-content/uploads/2020/06/BEA_ANNUAL-REPORT-2021_FINAL.pdf)
- MIT. (2021). *Living Wage Calculator*. Retrieved from <https://livingwage.mit.edu/counties/12086>
- Muro, M., Rothwell, J., & Saha, D. (2011). *Sizing the Clean Economy: A National and Regional Green Jobs Assessment*. Brookings Institution. Retrieved from <https://www.brookings.edu/research/sizing-the-clean-economy-a-national-and-regional-green-jobs-assessment/>
- Muro, M., Tomer, A., Shivaram, R., & Kane, J. (2019). *Advancing Inclusion Through Clean Energy Jobs*. Brookings Institution. Retrieved from <https://www.brookings.edu/research/advancing-inclusion-through-clean-energy-jobs/>
- O\*NET OnLine. (2020). *Occupation Search*. Retrieved from O\*NET OnLine: <https://www.onetonline.org/>
- OECD. (2012). *Sustainable Development, Green Growth, and Quality Employment*. Retrieved from <https://www.oecd.org/employment/emp/50318559.pdf>
- Popp, D., Vona, F., Marin, G., & Chen, Z. (2020). The Employment Impact of Green Fiscal Push: Evidence from the American Recovery Act. *National Bureau of Economic Research*, 1-65. Retrieved from [https://www.nber.org/system/files/working\\_papers/w27321/w27321.pdf](https://www.nber.org/system/files/working_papers/w27321/w27321.pdf)
- Puget Sound Regional Council. (2009). *Clean Tech Cluster Analysis Update for the Puget Sound Region*. Retrieved from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.643.4102&rep=rep1&type=pdf>

- Quintana, A. (2018, December 19). *A Tale Of Too Much 'Wishcycling': A Look At Miami-Dade's Low Recycle Rate*. Retrieved from WLRN: <https://www.wlrn.org/news/2018-12-19/a-tale-of-too-much-wishcycling-a-look-at-miami-dades-low-recycle-rate>
- Stoevska, V., & Hunter, D. (2012). *Proposals for the Statistical Definition and Measurement of Green Jobs*. Retrieved from <http://ina.bnu.edu.cn/docs/20140604145534115744.pdf>
- The Miami Foundation. (2020). *Give Miami Day*. Retrieved from Give Miami Day 2020 Registered Organizations: <https://www.givemiamiday.org/>
- Tuohey, P., Zea, L., Parker, O., & Tuttle, S. (2021). *Communities and the Gig Economy*. Retrieved from <https://better-cities.org/wp-content/uploads/2021/04/Gig-Economy-Better-Cities-Project.pdf>
- UN Development Programme. (2012). *Green Economy in Action: Articles and Excerpts that Illustrate Green Economy and Sustainable Development Efforts*. Retrieved from [https://www.un.org/waterforlifedecade/pdf/green\\_economy\\_in\\_action\\_eng.pdf](https://www.un.org/waterforlifedecade/pdf/green_economy_in_action_eng.pdf)
- UN Environmental Program. (2008). *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*. Retrieved from [https://www.ilo.org/wcmsp5/groups/public/---ed\\_emp/---emp\\_ent/documents/publication/wcms\\_158727.pdf](https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_158727.pdf)
- UN Environmental Program. (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Retrieved from [https://sustainabledevelopment.un.org/content/documents/126GER\\_synthesis\\_en.pdf](https://sustainabledevelopment.un.org/content/documents/126GER_synthesis_en.pdf)
- US Bureau of Labor Statistics. (2013). *Measuring Green Jobs*. Retrieved from <https://www.bls.gov/green/home.htm>
- US Bureau of Labor Statistics. (2021). *Local Area Unemployment Statistics*. Retrieved from US Bureau of Labor Statistics: <https://www.bls.gov/lau/>
- US Bureau of Labor Statistics. (2021). *Quarterly Census of Employment and Wages*. Retrieved from US Bureau of Labor Statistics: <https://www.bls.gov/cew/>
- US Census Bureau. (2018). *Longitudinal Employer-Household Dynamics OnTheMap*. Retrieved from <https://onthemap.ces.census.gov/>
- US Census Bureau. (2019). *2019 American Community Survey (ACS) 5-Year Estimates, City of Miami*. Retrieved from US Census Bureau: <https://data.census.gov/cedsci/advanced>
- US Census Bureau. (2020). *Hispanic or Latino Origin*.
- US Department of Education. (2003). *Literacy in Everyday Life: Results from the 2003 National Assessment of Adult Literacy*. National Center of Education Statistics. Retrieved from <https://nces.ed.gov/Pubs2007/2007480.pdf>
- Vancouver Economic Commission. (2018). *State of Vancouver's Green Economy 2018*. Retrieved from [https://storage.googleapis.com/production-vec-uploads/2018/06/State\\_of\\_Vancouver's\\_Green\\_Economy\\_2018\\_Report\\_Vancouver\\_Economic\\_Commission.compressed.pdf](https://storage.googleapis.com/production-vec-uploads/2018/06/State_of_Vancouver's_Green_Economy_2018_Report_Vancouver_Economic_Commission.compressed.pdf)

## Appendix I: Methodology

One of the goals of the Green Economy Plan is to provide a baseline analysis for Miami's green economy as it is today. This involves estimating the current number of jobs within the City of Miami that can be considered "green." Doing so first relies on establishing a clear definition of what green jobs entail. The definitions and methods adopted in this research were adopted from several existing green economy analyses performed by municipal governments and research institutions.

This research takes two approaches in assessing green jobs in Miami. The first is through an industry lens, meaning that green jobs are calculated based on the nature of the firms and whether they provide a green good or service. This framing indicates that any job within that firm, even if it does not directly relate to green tasks and skillsets, is considered green. For example, with this approach an accountant at a renewable energy firm would still be considered "green."

The second approach looks at green occupations, examining a job by the nature of the work itself. The occupation analysis allows a look into the types of jobs that are more likely to emerge as demand for green goods and services grow, informing the City and other stakeholders of the potential changes in required worker skills and knowledge.

### Industry Approach

The primary goal of the industry analysis is to understand the number of jobs supported by Miami's green economy. Most US employment and industry data are derived from the Quarterly Census of Earnings and Wages, which surveys firms to estimate the total number of jobs and employee earnings by their respective industries. The industries these firms are assigned to are defined by the North American Industry Classification System (NAICS). NAICS industry codes, which are most detailed and granular at a 6-digit level, in most cases do not differentiate between green and non-green industries. More recently, 6-digit NAICS industries have been added to account for innovation in fields of green tech and renewable energy. For example, 6-digit NAICS industries now exist for solar as well as wind power generation. However, there is not a distinction between construction industries that provide green building services and those that do not.

#### Industry Selection and Green Sector Definitions

To address this shortcoming of industry classifications, this analysis took on an approach established by the City of Toronto's green economy assessment which assigns NAICS industries to categories of "pure green" or "partially green". These industries were then grouped together into green sectors – or groups of industries that ultimately provided the same final green good or service such as sustainable transportation or green buildings.

The industries selected as pure or partially green were originally adopted from the list of NAICS industries surveyed by the Bureau of Labor Statistics for their 2011 Green Goods and Services Survey.<sup>19</sup> BLS identified 325 6-digit NAICS industries as potential producers of green goods and services (US Bureau of Labor Statistics, 2013). These "potentially" green industries were then assigned either partial or pure green status based on their definition.

The green sectors and sub-sectors were based on BLS green sector definitions as well as the industry categories defined in the Brookings Institution's national and regional green jobs assessment (Muro, Rothwell, & Saha, 2011).

The largest challenge lay in estimating the number of green jobs within a partially green industry. To establish a model for predicting an industry's level of "greenness," the analysis determined green intensity ratios using various proxies for each cluster.

Details on the data sources and methods for each green sub-sectors' intensity ratio is detailed in Appendix II.

### Occupation Approach

Green occupations in this analysis came from O\*NET, the Department of Labor's Occupational Information Network. O\*NET adopts the BLS SOC (Standard Occupational Classification) codes to create their O\*NET-SOC titles which are one level above the BLS detailed SOC Occupations. The green occupations used the 2010 taxonomy of SOC O\*NET occupations. Out of the 1,110 O\*NET SOC occupations, 201 were designated green. Because the current occupation data is collected only at

---

<sup>19</sup> The BLS GGS survey was the first major effort in the US to measure the size of the green economy but was eliminated in 2013 due to funding limitations.

a 5-digit BLS SOC code-level, each green occupation needed to be converted to the appropriate, relevant code from the 2018 BLS taxonomy (O\*NET OnLine, 2020).

In order to match these SOC codes to the most recent 2018 SOC titles, a crosswalk matched 2010 O\*NET SOC titles to 2018 SOC O\*NET titles. Those were then matched to the 2018 BLS occupations. Because the SOC occupations lack the same level of detail as those of O\*NET, the broader occupation group from BLS was designated as “green.” For example, O\*NET SOC taxonomy differentiates Chief Executives (11-1011) from Chief Sustainability Officers (11-1011.03). Chief Sustainability Officers SOC does not exist in the BLS SOC taxonomy, but Chief Executives is still designated as “green” as it overlaps with a sub-occupation that is considered green.

## Data Sources

This analysis primarily relies on Emsi, a proprietary data source that gathers and aggregates employment data from several sources such as the Bureau of Labor Statistics, Bureau for Economic Analysis, as well as state and county level labor offices. Their datasets include detailed past, current and future estimates for employment by industry from the sector to 6-digit NAICS level. Their occupation data includes data related to jobs by occupation (up to the 5-digit SOC code), to median hourly wages, education, and skill-level requirements for occupations. Emsi data is available at the county-level and zip-code level. Because this analysis was primarily focused on establishing a baseline of the green economy within the City of Miami, zip-code level data was aggregated to approximate the jobs by industry and occupation within the city. Given that zip-codes do not align perfectly with the City of Miami's boundaries, this analysis also applied a coverage ratio to zip-codes that were only partially overlapping with the city's boundary. For example, if 50% of a zip-code's area overlapped with the City of Miami, only 50% of its jobs were counted as within the city. This methodology has shortcomings as it assumed an even distribution of jobs per industry throughout a zip-code.

## Appendix II: Intensity Ratios

### Green Intensity Proxy Ratio Methodology

Green intensity ratios are intended to estimate what proportion of an industry's aggregated output is from the provision of a green good or service. As existing industry classification systems (such as NAICS) often do not differentiate industries based on whether they provide a green good or service, most industries must be categorized by their level of greenness. "Pure Green" industries are those which, by nature of their definition, consist of firms providing 100% green output, and therefore have a green intensity ratio of 1. More often, however, green firms are classified within NAICS industries that can only be considered Partially Green industries; these are industries that comprise both green and non-green firms, or firms that provide both green and non-green outputs.

The process of estimating "green intensity" within a partially green industry varies depending on data accessibility. Many green economy studies for other regions or cities have conducted surveys in order to estimate what proportion of firms within an industry should be considered green (C40 Cities, 2015). In the absence of firm survey data, other data that describes the market penetration of activities related to the green economy can be used as a proxy. This method was adopted for green energy economy assessments of Calgary and Edmonton, Canada and Puget Sound in Washington State (Calgary Economic Development, 2016; City of Edmonton, 2018; Puget Sound Regional Council, 2009).

To estimate green jobs and green output within the City of Miami's economy, 6-digit NAICS industries were aggregated to make up specific green clusters. In most cases, these clusters are broken down further into sub-categories that could be associated with a specific data source that provided a green proxy ratio. In other cases, a green proxy ratio was calculated and applied to an entire cluster.

This methodology has limitations as the data used to calculate proxy ratios for green intensity is unlikely to provide full accuracy in the level of greenness of each industry within a cluster. There are also industries that likely host green businesses and jobs but there is not sufficient data available to determine a decent proxy variable.

Each green cluster and the methods and data sources used for calculating proxy ratios are provided below. Additionally, whether these sources include historical data to decipher whether the green intensity in a market has changed over time is included. Finally, a list of limitations and areas for future research accompany each green cluster.

### Green Buildings

The green buildings cluster consists of industries including multi-family residential, commercial, and industrial construction, contractors for retrofitting existing building systems, as well as the manufacturing of materials needed for green buildings. This cluster includes electrical contractors, which is an especially relevant industry for updating building systems. This industry also likely captures jobs involved in the installation of electric vehicle charging stations. Those jobs would thus be counted in this cluster rather than in sustainable transportation. This cluster is divided into three sub-clusters which are aggregations of industries related to building construction, architecture, and engineering, and building systems.

All industries in this cluster are considered partially green, as construction-related industries are still very much involved in the design and construction of non-green buildings. Two proxy variables were calculated using two separate data sources to estimate the level of greenness within these industries: LEED building certification data and permits issued by the City of Miami for solar energy.

**Table 6. Green Buildings Proxy Variables**

Green Sub-Cluster	Proxy Variable Description
<b>Architecture &amp; Engineering</b>	<i>LEED Certifications – 15%</i> Data from CoStar and the LEED Project Directory from the US Green Building Council was used to estimate the percent of existing building square-footage that had LEED certification or was registered in the LEED database. Total building inventory in the City of Miami (including all building types, except for single-family homes) is about 272 million SF, and currently 117 buildings, approximately 26 million SF, are LEED certified which amounts to 9.6% of the total inventory. Many buildings, however, may be constructed with LEED standards and initially register with LEED but do not end up pursuing certification. To account for this, we raise the intensity to 15%.
<b>Construction</b>	

<b>Retrofitting and Maintenance</b>	<i>Miami Building Permits – 0.48%</i> Buildings permits issued by the City of Miami for 2019 for both residential and commercial projects were analyzed to calculate the proportion of projects related to electrical system installation and updates that were for the purpose installing or replacing solar panel systems.
-------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

### Historical Data Availability

Data for LEED building certifications goes back to 2005, and Miami building permits date back to 2012. Based on LEED project data, there has been a decline in LEED certified buildings, as well as building registering to apply for LEED, from 2017-2020, despite a continued upward trend in new building construction in Miami.

### Limitations/Additional Areas for Research

- LEED is only one of several green building certification programs, and it is possible that some buildings achieve LEED standards but do not pursue LEED certification due to costs and processing time.
- Pursuing LEED or other green certification for single-family homes is far less common than for commercial or multi-family construction, suggesting a more thorough or specific analysis of green intensity of the construction industry for single-family homes would provide more accurate picture of how residential construction firms can respond to increased demand for greener, single-family homes.
- Florida Green Buildings (FGB) is another certification program which can provide further insight on the percentage of green construction of Miami, however, their data on single family home certification lacks projects after 2017. FGB's Commercial data is also limited in that it displays only 6 properties in Miami-Dade with certification.

### Sustainable Transportation

The sustainable transportation cluster is broken into five categories – private transit, public transit, electric vehicles (EVs), trucking and package delivery, air transportation and water transportation. Public and private transit are considered pure green, meaning an intensity ratio is not necessary. Industries related to automobiles, trucking, water freight, and passenger transit and air travel, for the most part, consist of firms that are not green and are industries that contribute significantly to GHG emissions.

**Table 7. Proxy Variables for Sustainable Transportation**

Green Sub-Cluster	Proxy Variable Description
<b>Private Transit</b>	<i>Pure green - No IR</i>
<b>Public Transit</b>	<i>Pure green - No IR</i>
<b>Electric Vehicles</b>	<i>Market Share of EVs and Plug-in Hybrid EVs – 1.5%</i> According to the Auto Alliance's Advanced Technology, privately-owned battery electric vehicles and plug-in hybrid electric vehicles made up approximately 1.5% of new car purchases in 2018 for Florida's 27 <sup>th</sup> congressional district (which includes part of Miami) (Alliance for Automotive Innovation, 2021). Jobs related to EV charging station installation would likely be captured in the electrical contractor industry, which is counted in the Green Buildings cluster.
<b>Trucking &amp; Package Delivery</b>	<i>Percent of logistics and shipping companies registered as EPA SmartWay partner – 1%</i> EPA's SmartWay program helps companies advance supply chain sustainability. Partnering companies measure, benchmark and improve logistics operations to improve their environmental footprint. According to Enterprise Florida, the State has about 15,000 logistics and shipping companies. 140 companies are registered as current SmartWay partners, or about 1%.
<b>Water Transportation &amp; Shipping</b>	<i>Percent of logistics and shipping companies registered as EPA SmartWay partner – 1%</i> EPA's SmartWay program helps companies advance supply chain sustainability. Partnering companies measure, benchmark and improve logistics operations to improve their environmental footprint. According to Enterprise Florida, the State has about 15,000 logistics and shipping companies. 140 companies are registered as current SmartWay partners, or about 1%.

### Historical Data Availability

The Auto Alliance maintains an Advanced Technology Vehicle Sales dashboard that tracks state-level data for EV and hybrid sales which shows that market share for EVs and plug-in hybrid EVs has grown over the last several years (Alliance for Automotive Innovation, 2021).

### Limitations/Additional Areas for Research

- This data is only for privately owned vehicles and does not account for the impact of converting government-owned fleets to electric.

- These industries do not capture jobs related active transportation such as biking, walking, e-scooters. Infrastructure updates to accommodate this kind of transportation is hopefully captured in the resilient infrastructure cluster.

## Waste Management

Waste management is comprised of three sub-clusters: waste cleanup and remediation, recycling, and public utilities. All public jobs in Miami related to waste collection are considered pure green thanks to Miami's green waste management practices which keep waste out of landfills. Private companies involved in solid waste collection, however, need a proxy as it is likely that only a percentage of this waste is not landfilled.

**Table 8. Proxy Variables for Waste Management**

Green Sub-Cluster	Proxy Variable Description
<b>Public Utilities</b>	<i>Estimate provided by City</i>
<b>Waste Clean-up &amp; Remediation</b>	<i>Pure green - No IR</i>
<b>Recycling</b>	<i>Percent of county waste that is recycled – 18%</i> This figure comes from 2018 news articles citing a figure calculated by the Florida Department of Environmental Protection (Quintana, 2018).

### Limitations/Additional Areas for Research

- The rate at which waste is recycled or incinerated and not landfilled only captures one aspect of green waste management practices; other aspects involve source reduction and re-use, practices that help to create less waste in the first place.

## Resilient & Green Infrastructure

The resilient infrastructure cluster includes industries necessary for large adaptation or green infrastructure projects such as civil engineering, landscaping, and water/sewer line related construction. A proxy ratio for the percentage of industries' output associated with these types of projects was determined based on Miami's Capital Improvement Plan.

**Table 9. Proxy Variable for Resilient & Green Infrastructure**

Green Sub-Cluster	Proxy Variable Description
<b>Climate Resilient Infrastructure</b>	<i>Percent of Miami's CIP Funding Dedicated to Stormwater Sewer and Park Improvements – 32%</i> As these are industries typically involved in large capital improvement projects, interpreting Miami's CIP spending breakdown can provide an estimate for what proportion of infrastructure spending in City of Miami will be dedicated to projects related to stormwater management, green infrastructure, and parks (City of Miami, 2021).

### Historical Data Availability

Because CIPs involve long-term planning, it is possible to analyze how the City has previously and plans to prioritize major infrastructure projects.

### Limitations/Additional Areas for Research

- Because the CIP is managed by the City, looking into the procurement process for these projects would allow them to further their understanding of what industries and businesses are participating in these types of projects.

## Clean Energy

While NAICS has created industry classifications for the installation and management of renewable energy systems such as wind and solar, there are still jobs within traditional utilities companies that involve clean energy that are not counted in these specific industries. Partially green industries, such as electric power distribution, does not discern between electricity generated by clean sources.

**Table 10. Proxy Variables for Clean Energy**

Green Sub-Cluster	Proxy Variable Description
<b>Renewable Electric Power Distribution</b>	<i>Percent of Clean Energy Used by FPL – 27%</i> According to Florida Power & Light's 2020 fuel mix, 3.5% energy source was projected to be

	generated by FPL's PV and solar thermal facilities, while nuclear power generated 23% in 2020 (FPL, 2020).
<b>Renewable Electric Power Generation</b>	<i>Pure green – No IR</i>

#### Historical Data Availability

The Florida Power & Light fuel mix data includes their projections through the next nine years. FPL aims to have 16% of energy generated by solar by 2029.

#### Sensors, Instruments, R&D

Sensors, instruments, and R&D includes industries related to the manufacturing of devices necessary to monitor temperature, environmental controls, emissions, etc., as well as scientific research industries. Industries related to sensors and instruments are considered pure green, and therefore do not need an intensity ratio. R&D comprises research industries in fields of nanotechnology, biotechnology, physical engineering, and life sciences, which are likely to include research related to environment and climate change mitigation. Since these areas of research are not exclusively green, data on current grants awarded for environmental research was analyzed to determine green intensity.

**Table 11. Proxy Variable for Sensors, Instruments, R&D**

Green Sub-Cluster	Proxy Variable Description
<b>Sensors &amp; Instruments</b>	<i>Pure green – No IR</i>
<b>R&amp;D</b>	<p><i>Percent of Grant Funding Support Environmental Research by the National Science Foundation – 10%</i></p> <p>According to data on grants distributed to institutions in Miami, about 10% of funding went to projects associated with "green" NSF organizations. Grants administered by the following divisions were considered green: Environmental Biology, Environmental Engineering, Environmental Chemical Science, Atmospheric and Geospace Sciences, Earth Sciences, Ocean Sciences, and Polar Programs.</p>

#### Historical Data Availability

The NSF has historical data on previous years' grant administration, allowing analysis of if and how prioritization of environmental research has changed.

#### Limitations/Additional Areas for Research

- Jobs classified within NAICS industries for research and development may not capture jobs that involve environmental research but are within universities.

#### Environmental Advocacy & Regulation

The environmental advocacy and regulation cluster includes all industries and organizations that work toward environmental justice and education within Miami's communities, as well as those that enforce environmental regulations and compliance. These include conservation organizations and other social nonprofits, as well as law firms. Two proxy variables were used: one to determine the proportion of legal professions considered green, the other to determine the green intensity in advocacy-related social organizations.

**Table 12. Proxy Variable for Environmental Advocacy & Regulation**

Green Sub-Cluster	Proxy Variable Description
<b>Environmental Law</b>	<p><i>Percent of Law Firms Specializing in Environmental Law – 2%</i></p> <p>An online database for legal firms shows that 2% of Miami's law firms specialize in environmental law (Martindale, 2021).</p>
<b>Environmental Advocacy</b>	<p><i>Percent of environmental organizations registered for GiveMiamiDay 2020 – 4%</i></p> <p>49 out of the 877 nonprofit organizations registered for GiveMiamiDay in 2020 were environmentally focused, or 4% (The Miami Foundation, 2020).</p>

#### Historical Data Availability

The data sources used for the above proxy variables do not have a clear link to historical data, making it more difficult to estimate how these ratios may have changed over time.

**Limitations/Additional Areas for Research**

- Relying on one foundation to estimate the percentage of grant funds allocated to environmental advocacy/education may limit the scope of the community-based environmental work being done in Miami.

## Appendix III: Existing Definitions of the Green Economy and Green Jobs

While the concept of a “green” or “clean” economy has existed for some time,<sup>20</sup> it did not gain widespread recognition until the late 2000s following the 2008 financial crisis. Initially, the idea gained traction as a tool for achieving sustainable development efforts. International organizations such as the Organization for Economic Cooperation and Development (OECD) and UN Environmental Programme (UNEP) proposed broad definitions of the green economy that were adopted in subsequent reports as national and local governments began tracking and investing in their own green economies. The UNEP's definition was presented in 2008:

Green jobs encompass work that preserves and/or restores the environment through a variety of means, including but not limited to, reducing energy and natural resource consumption, decarbonizing the economy, minimizing waste generation and protecting ecosystems and biodiversity (UN Environmental Program, 2011).

The OECD and UNEP maintain that green jobs must be decent jobs that promote equity and pay adequate wages (OECD, 2012). This qualification underlines the UN's efforts to encourage policy makers to integrate environmental, social, and economic considerations in drafting policy, ensuring that the green economy goals also contribute to poverty reduction and economic mobility (UN Development Programme, 2012).

The US government started quantifying the green economy in 2010 with an initiative to collect data on green jobs (US Bureau of Labor Statistics, 2013). This effort was an outcome of the American Recovery and Reinvestment Act (ARRA) which, at the time, was the largest fiscal stimulus in recent history. Per ARRA stipulations, about 17% of all direct government spending was to be dedicated to green investments. These included block grants for states' renewable energy efficiency efforts, investments in public transport and clean vehicles, and ecosystem restoration (Popp, Vona, Marin, & Chen, 2020). Following the ARRA, the Bureau of Labor Statistics (BLS) started tracking the green economy through a Green Goods and Services Survey, finding in 2011 that green jobs accounted for 2.4% of US employment. As the BLS green jobs initiative was cut short due to funding limitations in 2013, data on overall US green employment growth since 2013 is limited.

---

<sup>20</sup> One of the first concepts for a green economy was presented in the 1989 *Blueprint for a Sustainable Economy* by the London Environmental Economics Centre.

## Appendix IV: NAICS-Green Cluster Crosswalk

2017 NAICS	Description	Greenness	Green Cluster	Green Sub-Cluster
221111	Hydroelectric Power Generation	Pure Green	Clean Energy	Energy Generation
221113	Nuclear Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221114	Solar Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221115	Wind Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221116	Geothermal Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221117	Biomass Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221118	Other Electric Power Generation	Pure Green	Clean Energy	Energy Generation
221122	Electric Power Distribution	Partially Green	Clean Energy	Energy Transmission
221310	Water Supply and Irrigation Systems	Pure Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
221320	Sewage Treatment Facilities	Pure Green	Waste Management	Waste Cleanup & Remediation
221330	Steam and Air-Conditioning Supply	Partially Green	Green Buildings	Building Systems
236115	New Single-Family Housing Construction (except For-Sale Builders)	Partially Green	Green Buildings	Construction
236116	New Multifamily Housing Construction (except For-Sale Builders)	Partially Green	Green Buildings	Construction
236117	New Housing For-Sale Builders	Partially Green	Green Buildings	Construction
236118	Residential Remodelers	Partially Green	Green Buildings	Construction
236210	Industrial Building Construction	Partially Green	Green Buildings	Construction
236220	Commercial and Institutional Building Construction	Partially Green	Green Buildings	Construction
237110	Water and Sewer Line and Related Structures Construction	Pure Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
237130	Power and Communication Line and Related Structures Construction	Partially Green	Clean Energy	Energy Transmission
237210	Land Subdivision	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
237990	Other Heavy and Civil Engineering Construction	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
238130	Framing Contractors	Partially Green	Green Buildings	Construction
238140	Masonry Contractors	Partially Green	Green Buildings	Construction
238150	Glass and Glazing Contractors	Partially Green	Green Buildings	Construction
238160	Roofing Contractors	Partially Green	Green Buildings	Construction
238170	Siding Contractors	Partially Green	Green Buildings	Construction
238190	Other Foundation, Structure, and Building Exterior Contractors	Partially Green	Green Buildings	Construction
238210	Electrical Contractors and Other Wiring Installation Contractors	Partially Green	Green Buildings	Building Systems

238220	Plumbing, Heating, and Air-Conditioning Contractors	Partially Green	Green Buildings	Building Systems
238290	Other Building Equipment Contractors	Partially Green	Green Buildings	Building Systems
238310	Drywall and Insulation Contractors	Partially Green	Green Buildings	Construction
238320	Painting and Wall Covering Contractors	Partially Green	Green Buildings	Construction
238340	Tile and Terrazzo Contractors	Partially Green	Green Buildings	Construction
238350	Finish Carpentry Contractors	Partially Green	Green Buildings	Construction
238390	Other Building Finishing Contractors	Partially Green	Green Buildings	Construction
238910	Site Preparation Contractors	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
238990	All Other Specialty Trade Contractors	Partially Green	Green Buildings	Construction
314110	Carpet and Rug Mills	Partially Green	Green Buildings	Construction
314120	Curtain and Linen Mills	Partially Green	Green Buildings	Construction
314999	All Other Miscellaneous Textile Product Mills	Partially Green	Green Buildings	Construction
321114	Wood Preservation	Partially Green	Green Buildings	Construction
321211	Hardwood Veneer and Plywood Manufacturing	Partially Green	Green Buildings	Construction
321212	Softwood Veneer and Plywood Manufacturing	Partially Green	Green Buildings	Construction
321213	Engineered Wood Member (except Truss) Manufacturing	Partially Green	Green Buildings	Construction
321214	Truss Manufacturing	Partially Green	Green Buildings	Construction
321219	Reconstituted Wood Product Manufacturing	Partially Green	Green Buildings	Construction
321911	Wood Window and Door Manufacturing	Partially Green	Green Buildings	Construction
321918	Other Millwork (including Flooring)	Partially Green	Green Buildings	Construction
321991	Manufactured Home (Mobile Home) Manufacturing	Partially Green	Green Buildings	Construction
321992	Prefabricated Wood Building Manufacturing	Partially Green	Green Buildings	Construction
324122	Asphalt Shingle and Coating Materials Manufacturing	Partially Green	Green Buildings	Construction
325311	Nitrogenous Fertilizer Manufacturing	Partially Green	Agriculture & Food	Agriculture & Food
325510	Paint and Coating Manufacturing	Partially Green	Green Buildings	Construction
325612	Polish and Other Sanitation Good Manufacturing	Partially Green	Green Buildings	Construction
325991	Custom Compounding of Purchased Resins	Partially Green	Waste Management	Recycling
326191	Plastics Plumbing Fixture Manufacturing	Partially Green	Green Buildings	Building Systems
326199	All Other Plastics Product Manufacturing	Partially Green	Green Buildings	Building Systems
327310	Cement Manufacturing	Partially Green	Green Buildings	Construction
327320	Ready-Mix Concrete Manufacturing	Partially Green	Green Buildings	Construction
327331	Concrete Block and Brick Manufacturing	Partially Green	Green Buildings	Construction

327332	Concrete Pipe Manufacturing	Partially Green	Green Buildings	Construction
327390	Other Concrete Product Manufacturing	Partially Green	Green Buildings	Construction
327410	Lime Manufacturing	Partially Green	Green Buildings	Construction
327420	Gypsum Product Manufacturing	Partially Green	Green Buildings	Construction
327993	Mineral Wool Manufacturing	Partially Green	Green Buildings	Construction
327999	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing	Partially Green	Green Buildings	Construction
331110	Iron and Steel Mills and Ferroalloy Manufacturing	Partially Green	Green Buildings	Construction
332312	Fabricated Structural Metal Manufacturing	Partially Green	Green Buildings	Construction
332321	Metal Window and Door Manufacturing	Partially Green	Green Buildings	Construction
332911	Industrial Valve Manufacturing	Partially Green	Green Buildings	Construction
332913	Plumbing Fixture Fitting and Trim Manufacturing	Partially Green	Green Buildings	Building Systems
332919	Other Metal Valve and Pipe Fitting Manufacturing	Partially Green	Green Buildings	Building Systems
332996	Fabricated Pipe and Pipe Fitting Manufacturing	Partially Green	Green Buildings	Building Systems
333413	Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing	Partially Green	Green Buildings	Building Systems
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	Partially Green	Green Buildings	Building Systems
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing	Partially Green	Green Buildings	Building Systems
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
334514	Totalizing Fluid Meter and Counting Device Manufacturing	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
334516	Analytical Laboratory Instrument Manufacturing	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
334519	Other Measuring and Controlling Device Manufacturing	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
335110	Electric Lamp Bulb and Part Manufacturing	Partially Green	Green Buildings	Building Systems
335121	Residential Electric Lighting Fixture Manufacturing	Partially Green	Green Buildings	Building Systems
335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing	Partially Green	Green Buildings	Building Systems

335129	Other Lighting Equipment Manufacturing	Partially Green	Green Buildings	Building Systems
335210	Small Electrical Appliance Manufacturing	Partially Green	Green Buildings	Building Systems
335220	Major Household Appliance Manufacturing	Partially Green	Green Buildings	Building Systems
335312	Motor and Generator Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
335911	Storage Battery Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336111	Automobile Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336112	Light Truck and Utility Vehicle Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336320	Motor Vehicle Electrical and Electronic Equipment Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336340	Motor Vehicle Brake System Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336350	Motor Vehicle Transmission and Power Train Parts Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
336390	Other Motor Vehicle Parts Manufacturing	Partially Green	Sustainable Transportation	Electric Vehicles
423930	Recyclable Material Merchant Wholesalers	Pure Green	Waste Management	Recycling
453310	Used Merchandise Stores	Pure Green	Waste Management	Recycling
483212	Inland Water Passenger Transportation	Pure Green	Sustainable Transportation	Water Transportation
485111	Mixed Mode Transit Systems	Pure Green	Sustainable Transportation	Private Transit
485112	Commuter Rail Systems	Pure Green	Sustainable Transportation	Private Transit
485113	Bus and Other Motor Vehicle Transit Systems	Pure Green	Sustainable Transportation	Private Transit
485119	Other Urban Transit Systems	Pure Green	Sustainable Transportation	Private Transit
485210	Interurban and Rural Bus Transportation	Pure Green	Sustainable Transportation	Private Transit
485410	School and Employee Bus Transportation	Pure Green	Sustainable Transportation	Private Transit
485510	Charter Bus Industry	Pure Green	Sustainable Transportation	Private Transit
541110	Offices of Lawyers	Partially Green	Regulation & Advocacy	Environmental Law
541310	Architectural Services	Partially Green	Green Buildings	Architecture & Engineering
541320	Landscape Architectural Services	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
541330	Engineering Services	Partially Green	Green Buildings	Architecture & Engineering
541350	Building Inspection Services	Partially Green	Green Buildings	Architecture & Engineering

541360	Geophysical Surveying and Mapping Services	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
541370	Surveying and Mapping (except Geophysical) Services	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
541380	Testing Laboratories	Partially Green	Sensors, Instruments, R&D	Research & Development
541410	Interior Design Services	Partially Green	Green Buildings	Architecture & Engineering
541420	Industrial Design Services	Partially Green	Green Buildings	Architecture & Engineering
541620	Environmental Consulting Services	Pure Green	Waste Management	Waste Cleanup & Remediation
541713	Research and Development in Nanotechnology	Partially Green	Sensors, Instruments, R&D	Research & Development
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Partially Green	Sensors, Instruments, R&D	Research & Development
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	Partially Green	Sensors, Instruments, R&D	Research & Development
561730	Landscaping Services	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
562111	Solid Waste Collection	Partially Green	Waste Management	Recycling
562112	Hazardous Waste Collection	Pure Green	Waste Management	Waste Cleanup & Remediation
562119	Other Waste Collection	Partially Green	Waste Management	Recycling
562211	Hazardous Waste Treatment and Disposal	Pure Green	Waste Management	Waste Cleanup & Remediation
562219	Other Nonhazardous Waste Treatment and Disposal	Pure Green	Waste Management	Waste Cleanup & Remediation
562910	Remediation Services	Pure Green	Waste Management	Waste Cleanup & Remediation
562920	Materials Recovery Facilities	Pure Green	Waste Management	Recycling
562998	All Other Miscellaneous Waste Management Services	Pure Green	Waste Management	Waste Cleanup & Remediation
712190	Nature Parks and Other Similar Institutions	Pure Green	Regulation & Advocacy	Environmental Advocacy
811111	General Automotive Repair	Partially Green	Sustainable Transportation	Electric Vehicles
811113	Automotive Transmission Repair	Partially Green	Sustainable Transportation	Electric Vehicles
811118	Other Automotive Mechanical and Electrical Repair and Maintenance	Partially Green	Sustainable Transportation	Electric Vehicles
811211	Consumer Electronics Repair and Maintenance	Partially Green	Green Buildings	Building Systems
811212	Computer and Office Machine Repair and Maintenance	Partially Green	Green Buildings	Building Systems
811213	Communication Equipment Repair and Maintenance	Partially Green	Green Buildings	Building Systems

811219	Other Electronic and Precision Equipment Repair and Maintenance	Pure Green	Sensors, Instruments, R&D	Sensors & Instruments
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	Partially Green	Green Buildings	Building Systems
811412	Appliance Repair and Maintenance	Partially Green	Green Buildings	Building Systems
813211	Grantmaking Foundations	Partially Green	Regulation & Advocacy	Environmental Advocacy
813219	Other Grantmaking and Giving Services	Partially Green	Regulation & Advocacy	Environmental Advocacy
813312	Environment, Conservation and Wildlife Organizations	Pure Green	Regulation & Advocacy	Environmental Advocacy
813910	Business Associations	Partially Green	Regulation & Advocacy	Environmental Advocacy
813920	Professional Organizations	Partially Green	Regulation & Advocacy	Environmental Advocacy
813940	Political Organizations	Partially Green	Regulation & Advocacy	Environmental Advocacy
924110	Administration of Air and Water Resource and Solid Waste Management Programs	Pure Green	Waste Management	Waste Cleanup & Remediation
924120	Administration of Conservation Programs	Pure Green	Regulation & Advocacy	Environmental Advocacy
926120	Regulation and Administration of Transportation Programs	Pure Green	Sustainable Transportation	Public Transit
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	Partially Green	Clean Energy	Energy Transmission
926140	Regulation of Agricultural Marketing and Commodities	Partially Green	Agriculture & Food	Agriculture & Food
926150	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors	Partially Green	Regulation & Advocacy	Environmental Law
441110	New Car Dealers	Partially Green	Sustainable Transportation	Electric Vehicles
441120	Used Car Dealers	Partially Green	Sustainable Transportation	Electric Vehicles
221121	Electric Bulk Power Transmission and Control	Partially Green	Clean Energy	Energy Transmission
454110	Electronic Shopping and Mail-Order Houses	Partially Green	Sustainable Transportation	Trucking & Package Delivery
484110	General Freight Trucking, Local	Partially Green	Sustainable Transportation	Trucking & Package Delivery
484121	General Freight Trucking, Long-Distance, Truckload	Partially Green	Sustainable Transportation	Trucking & Package Delivery
484122	General Freight Trucking, Long-Distance, Less Than Truckload	Partially Green	Sustainable Transportation	Trucking & Package Delivery
484220	Specialized Freight (except Used Goods) Trucking, Local	Partially Green	Sustainable Transportation	Trucking & Package Delivery
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance	Partially Green	Sustainable Transportation	Trucking & Package Delivery
491110	Postal Service	Partially Green	Sustainable Transportation	Trucking & Package Delivery
492110	Couriers and Express Delivery Services	Partially Green	Sustainable Transportation	Trucking & Package Delivery

492210	Local Messengers and Local Delivery	Partially Green	Sustainable Transportation	Trucking & Package Delivery
901149	US Postal Service	Partially Green	Sustainable Transportation	Trucking & Package Delivery
561790	Other Services to Buildings and Dwellings	Partially Green	Green Buildings	Building Systems
238110	Poured Concrete Foundation and Structure Contractors	Partially Green	Green Buildings	Construction
238120	Structural Steel and Precast Concrete Contractors	Partially Green	Green Buildings	Construction
238330	Flooring Contractors	Partially Green	Green Buildings	Construction
237310	Highway, Street, and Bridge Construction	Partially Green	Climate Resilient Infrastructure	Climate Resilient Infrastructure
423110	Automobile and Other Motor Vehicle Merchant Wholesalers	Partially Green	Sustainable Transportation	Electric Vehicles
423120	Motor Vehicle Supplies and New Parts Merchant Wholesalers	Partially Green	Sustainable Transportation	Electric Vehicles
423130	Tire and Tube Merchant Wholesalers	Partially Green	Sustainable Transportation	Electric Vehicles
423140	Motor Vehicle Parts (Used) Merchant Wholesalers	Partially Green	Sustainable Transportation	Electric Vehicles
423620	Household Appliances, Electric Housewares, and Consumer Electronics Merchant Wholesalers	Partially Green	Green Buildings	Building Systems
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	Partially Green	Green Buildings	Building Systems
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	Partially Green	Green Buildings	Building Systems
441310	Automotive Parts and Accessories Stores	Partially Green	Sustainable Transportation	Electric Vehicles
441320	Tire Dealers	Partially Green	Sustainable Transportation	Electric Vehicles
443141	Household Appliance Stores	Partially Green	Green Buildings	Building Systems
444110	Home Centers	Partially Green	Green Buildings	Building Systems
488510	Freight Transportation Arrangement	Partially Green	Sustainable Transportation	Trucking & Package Delivery
532111	Passenger Car Rental	Partially Green	Sustainable Transportation	Electric Vehicles
532112	Passenger Car Leasing	Partially Green	Sustainable Transportation	Electric Vehicles
483111	Deep Sea Freight Transportation	Partially Green	Sustainable Transportation	Water Transportation
483112	Deep Sea Passenger Transportation	Partially Green	Sustainable Transportation	Water Transportation
483113	Coastal and Great Lakes Freight Transportation	Partially Green	Sustainable Transportation	Water Transportation

483114	Coastal and Great Lakes Passenger Transportation	Partially Green	Sustainable Transportation	Water Transportation
483211	Inland Water Freight Transportation	Partially Green	Sustainable Transportation	Water Transportation
	Public Regulation Jobs	Partially Green	Regulation & Advocacy	Public Environmental Regulation
482110	Rail transportation	Pure Green	Sustainable Transportation	Private Transit

## Appendix V: Green Occupations

**Table 13. Green enhanced skill occupations that offer a living wage and are expected to grow in the next 10 years**

Occupation	Median Hourly Wage	Typical On-the-Job-Training	Work Experience Required	Typical Entry Level Education	Middle Skill?
<b>Energy</b>					
Civil Engineers	\$39.00	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.31	None	None	Bachelor's degree	NO
Mechanical Engineers	\$38.78	None	None	Bachelor's degree	NO
Nuclear Engineers	\$48.46	None	None	Bachelor's degree	NO
Power Plant Operators	\$34.75	Long-term on-the-job training	None	High school diploma or equivalent	YES
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
<b>Climate Resilient Infrastructure</b>					
Power Plant Operators	\$34.75	Long-term on-the-job training	None	High school diploma or equivalent	YES
Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Environmental Engineers	\$33.60	None	None	Bachelor's degree	NO
Service Unit Operators, Oil and Gas	\$20.82	Moderate-term on-the-job training	None	No formal educational credential	YES
Environmental Engineering Technologists and Technicians	\$25.25	None	None	Associate's degree	YES
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$30.27	Moderate-term on-the-job training	None	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Public Relations Specialists	\$26.75	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.41	None	None	Bachelor's degree	NO
Mechanical Engineers	\$38.79	None	None	Bachelor's degree	NO
Urban and Regional Planners	\$37.33	None	None	Master's degree	NO
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES

Landscape Architects	\$31.47	Internship/residency	None	Bachelor's degree	NO
Architects, Except Landscape and Naval	\$31.17	Internship/residency	None	Bachelor's degree	NO
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
<b>Education, Regulation, &amp; Advocacy</b>					
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Personal Financial Advisors	\$48.48	Long-term on-the-job training	None	Bachelor's degree	NO
Arbitrators, Mediators, and Conciliators	\$25.83	Moderate-term on-the-job training	Less than 5 years	Bachelor's degree	NO
News Analysts, Reporters, and Journalists	\$24.19	None	None	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Personal Financial Advisors	\$40.48	Long-term on-the-job training	None	Bachelor's degree	NO
Public Relations Specialists	\$26.75	None	None	Bachelor's degree	NO
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES
<b>Buildings</b>					
Power Plant Operators	\$34.75	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Urban and Regional Planners	\$37.33	None	None	Master's degree	NO
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Architects, Except Landscape and Naval	\$31.17	Internship/residency	None	Bachelor's degree	NO
Landscape Architects	\$31.47	Internship/residency	None	Bachelor's degree	NO

Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Civil Engineers	\$39.00	None	None	Bachelor's degree	NO
Geoscientists, Except Hydrologists and Geographers	\$46.54	None	None	Bachelor's degree	NO
Civil Engineers	\$39.00	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.31	None	None	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Architects, Except Landscape and Naval	\$31.17	Internship/residency	None	Bachelor's degree	NO
Electronics Engineers, Except Computer	\$50.21	None	None	Bachelor's degree	NO
Public Relations Specialists	\$26.75	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.31	None	None	Bachelor's degree	NO
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES
Construction and Building Inspectors	\$29.38	Moderate-term on-the-job training	5 years or more	High school diploma or equivalent	YES
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
Environmental Engineering Technologists and Technicians	\$25.25	None	None	Associate's degree	YES
<b>Sensors, Instruments, &amp; R&amp;D</b>					
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Civil Engineers	\$39.00	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.31	None	None	Bachelor's degree	NO
Electronics Engineers, Except Computer	\$50.21	None	None	Bachelor's degree	NO
Geoscientists, Except Hydrologists and Geographers	\$46.54	None	None	Bachelor's degree	NO
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Civil Engineers	\$39.00	None	None	Bachelor's degree	NO
Electrical Engineers	\$43.31	None	None	Bachelor's degree	NO
Mechanical Engineers	\$38.79	None	None	Bachelor's degree	NO

Public Relations Specialists	\$26.79	None	None	Bachelor's degree	NO
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
Electro-Mechanical and Mechatronics Technologists and Technicians	\$21.00	None	None	Associate's degree	YES
<b>Transportation</b>					
Transportation Inspectors	\$43.71	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Transportation Inspectors	\$43.71	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Industrial Engineering Technologists and Technicians	\$26.20	None	None	Associate's degree	YES
Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Electronics Engineers, Except Computer	\$50.21	None	None	Bachelor's degree	NO
Mechanical Engineers	\$38.79	None	None	Bachelor's degree	NO
News Analysts, Reporters, and Journalists	\$24.19	None	None	Bachelor's degree	NO
Public Relations Specialists	\$26.79	None	None	Bachelor's degree	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$30.27	Moderate-term on-the-job training	None	Bachelor's degree	NO
Electronics Engineers, Except Computer	\$50.21	None	None	Bachelor's degree	NO
Mechanical Engineers	\$28.79	None	None	Bachelor's degree	NO
Public Relations Specialists	\$26.75	None	None	Bachelor's degree	NO
Sales Representatives, Wholesale and	\$30.27	Moderate-term on-the-job training	None	Bachelor's degree	NO

Manufacturing, Technical and Scientific Products					
General and Operations Managers	\$42.72	None	5 years or more	Bachelor's degree	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$30.27	Moderate-term on-the-job training	None	Bachelor's degree	NO
<b>Waste Management</b>					
Power Plant Operators	\$34.75	Long-term on-the-job training	None	High school diploma or equivalent	YES
Power Plant Operators	\$34.79	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Bus and Truck Mechanics and Diesel Engine Specialists	\$23.49	Long-term on-the-job training	None	High school diploma or equivalent	YES
Urban and Regional Planners	\$37.33	None	None	Master's degree	NO
Aerospace Engineers	\$46.62	None	None	Bachelor's degree	NO
Training and Development Specialists	\$27.28	None	Less than 5 years	Bachelor's degree	NO
Personal Financial Advisors	\$40.48	Long-term on-the-job training	None	Bachelor's degree	NO
Environmental Engineers	\$33.60	None	None	Bachelor's degree	NO
Public Relations Specialists	\$26.75	None	None	Bachelor's degree	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$30.27	Moderate-term on-the-job training	None	Bachelor's degree	NO

**Table 14. Green increased demand occupations that offer a living wage and are expected to grow in the next 10 years**

Occupation	Median Hourly Wage	Typical On-the-Job-Training	Work Experience Required	Typical Entry Level Education	Middle Skill?
<b>Clean Energy</b>					
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Environmental Scientists and Specialists, Including Health	\$30.03	None	None	Bachelor's degree	NO

Electrical Power-Line Installers and Repairers	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	YES
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Electrical and Electronics Repairers, Commercial and Industrial Equipment	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	YES
Electrical Power-Line Installers and Repairers	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	YES
<b>Climate Resilient Infrastructure</b>					
Hydrologists	\$37.17	None	None	Bachelor's degree	NO
Electrical and Electronics Repairers, Commercial and Industrial Equipment	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	YES
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Stationary Engineers and Boiler Operators	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	YES
Chemical Technicians	\$21.60	Moderate-term on-the-job training	None	Associate's degree	YES
Boilermakers	\$25.22	Apprenticeship	None	High school diploma or equivalent	YES
Electrical Power-Line Installers and Repairers	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	YES
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Education, Regulation, & Advocacy					
Zoologists and Wildlife Biologists	\$26.20	None	None	Bachelor's degree	NO

First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Forest and Conservation Technicians	\$24.35	None	None	Associate's degree	YES
Stationary Engineers and Boiler Operators	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	YES
<b>Green Buildings</b>					
Chemical Technicians	\$21.60	Moderate-term on-the-job training	None	Associate's degree	YES
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	\$23.28	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Boilermakers	\$25.22	Apprenticeship	None	High school diploma or equivalent	YES
Electrical Power-Line Installers and Repairers	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	YES
Chemical Technicians	\$21.60	Moderate-term on-the-job training	None	Associate's degree	YES
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Zoologists and Wildlife Biologists	\$26.20	None	None	Bachelor's degree	NO
Environmental Scientists and Specialists, Including Health	\$30.03	None	None	Bachelor's degree	NO
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO

First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Chemists	\$29.26	None	None	Bachelor's degree	NO
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO
Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Stationary Engineers and Boiler Operators	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	YES
<b>Sensors, Instruments, &amp; R&amp;D</b>					
Chemical Technicians	\$21.60	Moderate-term on-the-job training	None	Associate's degree	YES
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO
First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Chemists	\$29.26	None	None	Bachelor's degree	NO
Occupational Health and Safety Specialists	\$32.77	None	None	Bachelor's degree	NO

Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
<b>Transportation</b>					
Rail-Track Laying and Maintenance Equipment Operators	\$22.07	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Electrical and Electronics Repairers, Commercial and Industrial Equipment	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	YES
First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
<b>Waste Management</b>					
Operating Engineers and Other Construction Equipment Operators	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Electrical and Electronics Repairers, Commercial and Industrial Equipment	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	YES
Chemical Engineers	\$45.30	None	None	Bachelor's degree	NO
Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
Industrial Engineers	\$32.99	None	None	Bachelor's degree	NO
Chemists	\$29.26	None	None	Bachelor's degree	NO

Environmental Scientists and Specialists, Including Health	\$30.03	None	None	Bachelor's degree	NO
Commercial and Industrial Designers	\$26.43	None	None	Bachelor's degree	NO
First-Line Supervisors of Mechanics, Installers, and Repairers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Production and Operating Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO

**Table 15. Green new and emerging skill occupations that offer a living wage and are expected to grow in the next 10 years**

Occupation	Median Hourly Wage	Typical On-the-Job-Training	Work Experience Required	Typical Entry Level Education	Middle Skill?
<b>Energy</b>					
Civil Engineers	\$32.77	None	None	Bachelor's degree	NO
Mechanical Engineers	\$32.99	None	None	Bachelor's degree	NO
Compliance Officers	\$30.03	None	None	Bachelor's degree	NO
Economists	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	NO
<b>Climate Resilient Infrastructure</b>					
Social Scientists and Related Workers, All Other	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	NO
Plant and System Operators, All Other	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	YES
Mechanical Engineers	\$37.17	None	None	Bachelor's degree	NO
Compliance Officers	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	NO
Engineers, All Other	\$32.99	None	None	Bachelor's degree	NO

Chief Executives	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$21.60	Moderate-term on-the-job training	None	Associate's degree	NO
<b>Education, Regulation, &amp; Advocacy</b>					
Economists	\$25.22	Apprenticeship	None	High school diploma or equivalent	NO
Chief Executives	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	NO
Compliance Officers	\$32.77	None	None	Bachelor's degree	NO
Logisticians	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Chief Executives	\$26.20	None	None	Bachelor's degree	NO
Compliance Officers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
<b>Buildings</b>					
Plant and System Operators, All Other	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Plant and System Operators, All Other	\$24.35	None	None	Associate's degree	YES
Civil Engineers	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	NO
Civil Engineers	\$21.60	Moderate-term on-the-job training	None	Associate's degree	NO
Chief Executives	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Compliance Officers	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Logisticians	\$23.28	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Social Scientists and Related Workers, All Other	\$25.22	Apprenticeship	None	High school diploma or equivalent	NO

First-Line Supervisors of Construction Trades and Extraction Workers	\$22.58	Long-term on-the-job training	None	High school diploma or equivalent	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$21.60	Moderate-term on-the-job training	None	Associate's degree	NO
Chief Executives	\$32.99	None	None	Bachelor's degree	NO
Compliance Officers	\$26.20	None	None	Bachelor's degree	NO
Logisticians	\$30.03	None	None	Bachelor's degree	NO
Engineers, All Other	\$32.77	None	None	Bachelor's degree	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
<b>Sensors, Instruments, R&amp;D</b>					
Civil Engineers	\$26.43	None	None	Bachelor's degree	NO
Civil Engineers	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
Chief Executives	\$32.99	None	None	Bachelor's degree	NO
Compliance Officers	\$29.26	None	None	Bachelor's degree	NO
Logisticians	\$32.77	None	None	Bachelor's degree	NO
Mechanical Engineers	\$26.43	None	None	Bachelor's degree	NO
Electro-Mechanical and Mechatronics Technologists and Technicians	\$28.42	None	Less than 5 years	High school diploma or equivalent	YES
Social Scientists and Related Workers, All Other	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$29.65	Long-term on-the-job training	None	High school diploma or equivalent	NO
Chief Executives	\$21.60	Moderate-term on-the-job training	None	Associate's degree	NO
Logisticians	\$32.77	None	None	Bachelor's degree	NO
Engineers, All Other	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO

<b>Transportation</b>					
Chief Executives	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Logisticians	\$29.26	None	None	Bachelor's degree	NO
Engineers, All Other	\$32.77	None	None	Bachelor's degree	NO
Mechanical Engineers	\$26.43	None	None	Bachelor's degree	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$22.07	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Mechanical Engineers	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	NO
Logisticians	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$28.42	None	Less than 5 years	High school diploma or equivalent	NO
Engineers, All Other	\$32.99	None	None	Bachelor's degree	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$25.74	None	Less than 5 years	High school diploma or equivalent	NO
First-Line Supervisors of Construction Trades and Extraction Workers	\$32.99	None	None	Bachelor's degree	NO
Compliance Officers	\$26.43	None	None	Bachelor's degree	NO
<b>Waste Management</b>					
Plant and System Operators, All Other	\$20.97	Moderate-term on-the-job training	None	High school diploma or equivalent	YES
Logisticians	\$25.51	Long-term on-the-job training	None	Postsecondary nondegree award	NO
Engineers, All Other	\$45.30	None	None	Bachelor's degree	NO

First-Line Supervisors of Construction Trades and Extraction Workers	\$26.43	None	None	Bachelor's degree	NO
Compliance Officers	\$32.99	None	None	Bachelor's degree	NO
Engineers, All Other	\$29.26	None	None	Bachelor's degree	NO
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	\$30.03	None	None	Bachelor's degree	NO