Education and Training:

An Opportunity to Achieve a **Just Transition** to a Low-Carbon, Socially Inclusive Economy

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Acknowledgments

This report is the first of two reports exploring the role of postsecondary institutions in a just transition. The forthcoming second report draws on the perspectives of actors from community-based organizations and postsecondary institutions in three case study locations to inform a set of recommendations to close green learning opportunity gaps among historically marginalized communities.

Executive Summary

As U.S. policymakers and implementers move to close the country's emissions gap, a critical oversight threatens not only to slow the country's clean energy transition but also to hinder the achievement of environmental justice. This oversight is the country's lack of transformative investments in closing education and training gaps, especially at the postsecondary level, including technical and community colleges and universities, and especially among historically marginalized communities across the country.

Without the equitable participation of underserved and disadvantaged populations across the U.S. in green learning opportunities, the country cannot build the diverse green workforce it needs to meet the demands of rapid decarbonization efforts, nor can the country achieve a just transition. If U.S. policymakers do not course-correct through bolder policy, and if postsecondary institutions do not respond to the green learning needs of their communities, long-standing inequities in education and training will continue to put the country at odds with its ambition to transition to a low-carbon economy that leaves no one behind.

The Context

The current U.S. climate policy landscape includes President Joe Biden's executive order on tackling the climate crisis at home and abroad and a tripartite of historic legislation, including the Infrastructure Investment and Jobs Act (IIJA), CHIPS and Science Act, and the Inflation Reduction Act (IRA). Importantly, the President's Justice40 Initiative functions to ensure 40% of the benefits of green investments reach communities that have been historically overburdened by pollution and economic underinvestment. Together with complementary state level efforts, this federal policy landscape is expected to drive inclusive green job growth and the achievement of environmental justice over the next decade and beyond.

Celebration is warranted, especially the momentum generated toward reducing U.S. emissions by 50% by 2030. However, earmarked investments to the education and training needed to translate policy intention to climate action and environmental justice are inadequate and short-sighted, putting the U.S.'s climate goals and its vision for a just transition at risk (Figure A).

In the near term, the lack of investment in education and training not only means decarbonizing sectors will struggle to deploy the green workforce needed by employers, but it also means that efforts to shift the entire economy to become low-carbon and socially inclusive will also be stalled. In the long term, future generations will be hampered in their capacity to address the mounting impacts of climate change while bearing the burden of reducing the emissions they did not cause. And persisting inequities in the education and training system mean historically marginalized communities and disadvantaged populations will continue to face undue hurdles to both participate in and benefit from green transitions. In short, the transition to a low-carbon economy does not promise to be empowering, inclusive, or transformative.

Figure A. Combined Potential Investments Unlocked by IIJA, CHIPS, and IRA Over the Next 5-10 Years, at the time of writing

TOTAL AUTHORIZED NEW SPENDING:	→	POTENTIAL FUNDING AVAILABLE TO EDUCATION AND TRAINING:	→	CURRENTLY EARMARKED FOR EDUCATION AND TRAINING:
$2 TRILLION		**$180 BILLION**		**$960 MILLION**

The Challenge

In 2021, the U.S. green workforce constituted approximately 23.7% of overall U.S. employment. Of this green workforce, 80% are white, 75% are male, and nearly 45% concentrated in 3 sectors (Manufacturing, Construction, and Transportation and Warehousing). With green jobs anticipated to grow significantly over the next decade, our analysis suggests that without transformative investments in education and training, the green workforce of the future will likely be characterized by the same demographics as the green workforce today, leaving the prospects of a socially inclusive, low-carbon economy out of reach.

We have found that a bachelor's degree is key to entering the green economy's most promising jobs in the next decade. This points to an urgent need to close education and training gaps among underrepresented populations, especially at the postsecondary level where historic marginalization and systemic discrimination promises only to perpetuate their continued exclusion from the green economy.

What kinds of policies and investments are needed in the U.S. to course correct toward a more just transition? To answer this, decision-makers and advocates first need to understand what the challenges are to achieve a just transition that currently characterizes the country's education and training scenario. From this baseline, decision-makers and advocates can better identify policy entry points and priority investments that can redirect the country toward a more just transition.

To aid this process, we highlight three challenges—a green jobs gap, green skills gap, and green learning opportunities gap—that our analysis suggests, if left unclosed, are set to define the future of the green economy in an unjust and inequitable way.

First

The green jobs gap is a snapshot of what the current green economy looks like across sectors and across demographics, telling us who holds which green jobs and where the gaps in participation are across different populations.

What we find is that the current green economy is stratified along gender and racial lines, and that these stratifications are further defined by historic inequities in education and training. If participation in the green economy's fastest-growing jobs requires

more education, as indicated earlier, then populations underrepresented in postsecondary education are set to experience heightened barriers to economic equality. Green investments that do not address educational inequities will not only reproduce gender and racial gaps in the composition of the future green workforce, perpetuating occupational segregation observed in the non-green economy. But they will also perpetuate gender and racial pay gaps in the future green economy, limiting the transformative potential of green economic transitions.

For example, women, Black or African Americans and Hispanic or Latino populations are, on average, overrepresented in green occupations for which no formal educational credential or a high school diploma or equivalent is needed to enter and for which the median annual wage is below the national median wage. Meanwhile, men, Asian, and white workers are overrepresented in those green occupations requiring a bachelor's degree to enter and for which they receive some of the highest levels of compensation.

Second

The green skills gap is a preliminary sketch of tomorrow's green workforce based on current trends in green skills acquisition—proxied here by degrees conferred in the major fields of study that are associated with the most in-demand green jobs. The green skills gap tells us who is on course to build the skills required for tomorrow's green jobs and who may need extra support to do so.

What we find is that the current demographic distribution of green skills will make it difficult to improve the diversity of the green workforce tomorrow. This is especially the case for already gender and racially stereotyped green occupations, like Educational Instruction and Library or Construction and Extraction, whose emerging pool of talent (i.e., those individuals who are completing fields of study and/or training that are relevant and/or required for those green jobs) is largely constituted by individuals from the same gender and racial groups. In other words, because the green skills gap generally reflects the green jobs gap, we cannot expect the green workforce tomorrow to look much different than today–unless transformative action is taken to close the green skills gap.

For example, Hispanic or Latino populations are overrepresented in fields of study needed to enter green Construction and Extraction occupations,

where they are already more highly represented in the green workforce. Black or African American populations are overrepresented in fields of study needed for green Office and Administrative Support occupations, where they are already highly represented.

This also has implications for who is likely to benefit from green jobs growth. For instance, women are overrepresented in fields of study associated with green jobs that are not projected to increase in demand any time soon nor expected to receive any targeted federal stimulus in the future. This includes fields of study associated with green Educational Instruction and Library occupations—despite the need for more educators, trainers, and instructors to support the scale of green skill-building required over the next decade.

Notably, for some populations and for some occupations, it may be harder to access green jobs than it is to acquire the green skills needed for those jobs. For instance, women are slightly overrepresented in fields of study associated with high-wage green jobs like Chief Sustainability Officers or Compliance Managers. Yet they are underrepresented in the labor market hosting these jobs. Such observations are a reminder that education and training investments must simultaneously help diversify who is entering and completing fields of study and training required for green jobs *and* tackle the institutionalized systems of exclusion and discrimination preventing underrepresented populations from transitioning to and thriving in those green jobs.

Third

The green learning opportunities gap reflects the likelihood for the country to course correct, given the country's current education and training landscape. The green learning opportunities gap tells us whether we could close the green skills gap among historically marginalized communities across the country by showing us who has the opportunity to participate in the kinds of education and training needed for green careers. It does this by mapping out the geography of green learning opportunities and their proximity to historically marginalized communities.

Based on our analysis of a pilot Green Learning Opportunities Database in three states (Hawai'i, Illinois, Kentucky), we find that there are deep spatial inequalities in the current education and training landscape. Such patchy geographic distribution of

green learning opportunities creates significant obstacles for members of disadvantaged communities to access the skill-building opportunities they would need to benefit from green jobs investments and green economic transitions. Without investments targeted at green learning opportunity "deserts," the country will have a difficult time changing course.

For example, green learning opportunity deserts in southeastern rural Kentucky overlap with Appalachian communities that have experienced not only historic underinvestment but also a toxic legacy by the coal industry that has contributed to the region's heightened exposure to cancer-causing environmental pollutants and environmental hazards like flooding. For states like Hawai'i, green learning opportunity deserts are exacerbated by geographic isolation, both in terms of its outer islands and in relation to the U.S. mainland.

Notably, Chicago, Illinois, like other metropolitan areas in our analysis, appear to be green learning opportunity "oases," outliers in terms of the greater proximity of green learning opportunities to disadvantaged communities in urban settings. Yet, despite the increased proximity, systemic discrimination within postsecondary education as well as the high cost of tuition and transportation can render even the closest green learning opportunity inaccessible for disadvantaged communities.

Without greater attention to closing these three systemic gaps in education and training through more robust and transformative investments, the country's vision of a just transition will be unattainable. The future green economy will be far from inclusive or equitable.

The Opportunity

Postsecondary institutions, including technical and community colleges and universities across the country, have an important role to play in closing education and training gaps among underrepresented populations. To do so, postsecondary institution leaders and education stakeholders must step up their underlined collective leadership in shaping future U.S. climate policy. They can do this in four ways.

1. **By defining a New Green Learning Agenda for postsecondary institutions:** Such a task is trained on three approaches to lifelong green learning that builds a breadth of green skills and is directed toward achieving climate and environmental justice.

2. **By strengthening and supporting just transition education and training ecosystems:** This requires postsecondary institutions to work together in partnership with community-based organizations, nongovernmental organizations, high school career and technical education programs, and industry-aligned organizations to fill critical gaps in the provision of quality and diverse green learning opportunities across the country.

3. **By advocating for and directing financing and resources toward building "human infrastructure"— or investments in people:** Such investments must be centered on upending systemic discrimination and legacies of exclusion while expanding access among historically marginalized communities to learning opportunities that build a breadth of green skills.

4. **By filling data gaps for justice-centric data analysis in education and training:** Such an effort means empowering decision-makers with data, tools, and analysis disaggregated at multiple levels in order to facilitate the identification of blind spots in the country's education and training landscape

Complementing these policy recommendations, a forthcoming follow-up report explores steps postsecondary institutions can take themselves to help close green learning opportunity gaps.

Conclusion

The U.S. transition to a clean energy economy is an unprecedented opportunity to not only green the economy but also to transform deeper-seated inequities in opportunity and historic legacies of underinvestment. But the composition of the green economy today suggests that without <u>bold, targeted investments</u> in filling critical gaps in education and training, the future green economy will perpetuate the demographic stratifications and socioeconomic inequalities that are all too familiar for historically marginalized populations.

Not directing resources to diverse green learning opportunities across the country puts the U.S.'s goal for a just transition at risk. U.S. policymakers, decision-makers, and advocates must view education and training as a non-negotiable investment in any future U.S. climate policy.

To close the emissions gap and to achieve a just transition, the country must close its education and training gaps. And to close its education and training gaps, the country must close its inequality gaps. Postsecondary institutions, especially community colleges in collaboration with community-based organizations, have a critical role to play.

Overview

As the U.S. moves from celebrating to implementing its legislative wins on environmental justice, clean energy transitions, and well-paying green jobs, a critical oversight lies hidden in the country's strategy and investments around the education and training of the present and future green workforce. In particular, long-standing gaps in green learning opportunities among historically marginalized communities mean that they face unequal opportunities to build the breadth of skills needed to access and thrive in well-paying green careers and to lead their communities toward a more sustainable, equal, and fairer future. If the U.S. continues to move in its current trajectory on green jobs without bolstering the role of postsecondary institutions, including technical and community colleges and universities, to fill these green learning gaps, the country risks falling short of its ambition to transition to a low-carbon economy without leaving anyone or any community behind.[1]

But just how big are the education and training gaps facing historically marginalized and disadvantaged communities across the country? What role can postsecondary institutions play to fill these gaps?

This report answers these questions by sharing new analyses of current trends in the green economy and their implications for a just transition. The report also highlights transformative actions that can be taken by postsecondary institutions to close critical gaps in green skills and green learning opportunities among historically marginalized communities through a New Green Learning Agenda–a vision for education and training institutions in times of climate change that centers the pursuit of climate justice.

The goal of this paper is twofold: first, to convince U.S. policymakers, climate decision-makers, and policy advocates that investments in education and training are non-negotiable in any policy pursuit of a just transition. Second, to urge postsecondary institution leaders to step up their ambition in both their role in meeting their communities' green learning needs and their approach to supporting a just transition.

Section 1 lays out the context for the paper, including President Joe Biden's Justice40 Initiative and the U.S.'s most recent climate policy tripartite. Section 2 highlights three significant gaps that could define the future of the green economy, and therefore the country's ability to achieve a just transition. Section 3 proposes a set of recommendations to help close these gaps by redefining the role of postsecondary institutions in a just transition.

This report is the first product of a two-part, multisited endeavor to investigate and bolster the role of postsecondary institutions in a larger ecosystem of green learning opportunities that promote a just transition in the U.S. A follow-up report will provide insights and recommendations from three case studies in Hawai'i, Illinois, and Kentucky on how postsecondary institutions must work with communities to address underlying systemic challenges, including environmental racism and structural inequality. Together, these papers advocate for a more holistic and intersectional approach to filling education and training gaps for a just transition.

The Context

President Biden's executive order on tackling the climate crisis at home and abroad in 2021 (Exec. Order No. 14008, 2021) propelled the focus of public policy discussions on climate strategies in the United States toward those that rapidly close the emissions gap.[2] Since then, the U.S. has passed several key climate legislations, including the Infrastructure Investment and Jobs Act (IIJA),[3] the CHIPS and Science Act, and the Inflation Reduction Act (IRA), that together will help put the country on a path to reducing its greenhouse gas emissions by 50% by 2030. Importantly, the investments made possible by these legislations intend to create millions of decent, well-paying jobs in the transition to a more sustainable economy.

Where less progress has been made, including in the IIJA and IRA, is in more rigorous and transformative policy and investment in closing the *education* and *training gaps* (Kwauk & Kane, 2021) (Box 1). These gaps include, at the individual level, the lack of a breadth of green skills needed to develop and implement climate solutions by a green workforce in all sectors at all scales, as well as a lack of knowledge about climate change, its causes, and its impacts across all members of society. At the systems level, education and training gaps also include the lack of lifelong green learning opportunities from early childhood through adulthood, especially among historically marginalized communities[4] and underrepresented populations—which disproportionately include people of color, Indigenous people, women, and rural communities—to build the knowledge and skills needed to support a consistent and diverse stream of talent for and creators of green jobs. Closing the emissions gap is dependent on closing the education and training gaps. The initial reduction in emissions in the U.S. may come from the rapid decarbonization of high-emitting sectors like energy, manufacturing, and transportation through innovation in clean energy and low-carbon technologies. But sustained reductions over the long-term and eventually maintaining a low-carbon economy will require new ways of thinking, being, and doing across every sector in ways that hold environmental stewardship and social equality at the core (Kwauk & Casey, 2021). Education and training are key to enabling such shifts in mindset and practice. Without investments in green learning opportunities, not only will decarbonizing sectors struggle to deploy the workforce needed in the near-term, but future generations will be hampered in their capacity to address the mounting impacts of climate change across all sectors of the economy while bearing the burden of reducing emissions they did not cause (Hausfather, 2019).

Closing the education and training gaps will also require closing *inequality gaps* that have historically prevented underrepresented and underserved populations from accessing basic learning opportunities—let alone green learning opportunities (Darling-Hammond, 2001). These gaps include those that are structured by gender, racial, and socioeconomic inequalities within and outside of our education and training systems that have "pulled" historically marginalized populations into stereotypical fields of study, created "glass doors" that have prevented them from entering certain fields of study, and/or "pushed" them out of the education system entirely. Without tending to inequalities in accessing green learning opportunities, the green workforce of the future will likely be characterized by the same gender, racial, and skills gaps as the current green workforce (Environmental Justice Leadership Forum, 2020).

Ensuring equal access to green learning opportunities is as much a civil rights issue and a gender equality issue as it is an environmental and climate justice

Box 1. The Difference Between Education and Training

EDUCATION	Change habits in the long-term	Foster a better understanding of, and ability to address climate change and its effects
TRAINING	Develop practical skills	

Source: UNESCO/UNFCCC. (2016). Action for Climate Empowerment: Guidelines for Accelerating Solutions Through Education, Training, and Public Awareness. https://unesdoc.unesco.org/ark:/48223/pf0000246435

> — Closing the emissions gap is dependent on closing education and training gaps.

issue (Barnes et al., 2022; Holthaus, 2020; Simmons, 2020). Not only do historically marginalized populations tend to experience heightened environmental risks due to their proximity to environmental hazards; but they are also more likely to experience magnified effects of climate change due to existing social, health, and economic inequities (Gloor et al., 2002; Laughland, 2021; Whyte, 2020). This includes time poverty and an unequal burden of care that weighs upon low-income and frontline communities. Unequal access to green learning opportunities further hamstring the capacities of and limit the opportunities for historically marginalized communities and disadvantaged populations to participate in green transitions in ways that are empowering, self-determined, and transformative.

The U.S. climate policy landscape on green education and training

When President Biden committed to tackling the climate crisis, he made a commitment to do so while delivering environmental justice. He established the Justice40 Initiative to drive at least 40 percent of the benefits of climate and clean energy investments toward "disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment (Exec. Order 14008, 2021)." Importantly, the programs covered by the Justice40 Initiative include training and workforce development initiatives that target participation from historically marginalized communities (Executive Office of the President, 2021). This offers an important opportunity to close critical education and training gaps that would otherwise have prevented historically marginalized populations from participating in the wave of economic opportunities stemming from green investments.

The current federal climate policy landscape, which includes the "triple whammy" of the IIJA, the CHIPS and Science Act, and the IRA, builds on this commitment to pursuing environmental justice while progressing the country's climate targets (Carey & Shepard, 2022). These three historic policies are complemented by a host of strategies, plans, and initiatives at the federal level (including the American Rescue Plan Act) and the state level (like Illinois's Climate and Equitable Jobs Act).[5] Together, these investments are expected to

help drive the decarbonization of the U.S. economy while simultaneously creating millions of good, quality, well-paying union jobs. The IIJA on its own is projected to create 2 million new jobs in manufacturing and construction (Evans, 2022a), while the IRA is expected to add at least another 1 million jobs annually in the clean energy, manufacturing, and transportation sectors, and other related sectors through direct and indirect job growth (Pollin et al., 2022).

To ensure there is a workforce to fill these jobs, U.S. climate policy has included investments in education and training with provisions for the inclusion of historically marginalized communities. However, the earmarked investments are short-sighted and inadequate. They are short-sighted because they are often narrowly defined, short-term, occupation-specific training programs that fill the immediate green skills gaps of sectors already receiving the bulk of policy attention. To illustrate, the IRA is investing $4.5 billion in the High-Efficiency Electric Home Rebate program and only $200 million in a Home Energy Efficiency Contractor Training program. The latter ensures there is a sufficient workforce to fulfill the increased demand for home energy efficiency upgrades that the former program will create. What is missing, for example, is a simultaneous investment in building cohorts of postsecondary teachers and trainers who can ensure all future energy and construction workers, architects, engineers, and other professionals are equipped with the knowledge and skills required to sustain, maintain, and evolve an energy-efficient built environment.

The investments in education and training are inadequate because they do not come near the level of investment needed to build the immediate and future green workforce the country needs (Table 1). Together, the IIJA, CHIPS, and IRA authorize nearly $2 trillion in new spending over the next 5 to 10 years. At the time of writing, of this $2 trillion, we estimate that, at most, only $180 billion (or roughly 9%) could be available for education and training,[6] while just $960 million of the $180 billion has been earmarked for these activities. If provisions in the CHIPS and Science Act are any indication of how the remainder of the $180 billion will likely be spent, these funds will go towards research and development, student scholarships and stipends, and mentorship for graduate students and early-career professionals. While it is important to help retain underrepresented populations in science-related fields, these types of targeted investments are unlikely to benefit underserved populations who are not already on educational tracks toward a green career.

Table 1. Education and Training Provisions in U.S. Climate Policy

EDUCATION AND TRAINING PROVISIONS IN THE JUSTICE40 INITIATIVE	
Covered programs include investment in training and workforce development "related to climate, natural disasters, environment, clean energy, clean transportation, housing, water and wastewater infrastructure, and legacy pollution reduction, including in energy communities."	

EDUCATION AND TRAINING PROVISIONS IN THE IIJA	
FUNDING AVAILABLE FOR EDUCATION AND TRAINING: approximately $62 million (unspecified allocation)	TOTAL FUNDING: $1.2 trillion over 5 years

- Permits states to direct funding to pre-apprenticeships, apprenticeships, on-the-job training, and vocational school support.
- Requires the Secretary of Transportation and the Secretary of Labor to study ways to increase the diversity of the transportation workforce through strategies like pre-apprenticeship programs and local hiring preferences.
- Calls on the National Academy of Sciences to study the workforce development needs of the intelligent transportation technologies and systems industry, and for the Secretary of Transportation to conduct a public service announcement campaign across diverse segments of the country to increase awareness of transportation career opportunities.

EDUCATION AND TRAINING PROVISIONS IN THE CHIPS AND SCIENCE ACT	
FUNDING AVAILABLE FOR EDUCATION AND TRAINING: approximately $174 billion (authorized, not appropriated)	TOTAL FUNDING: $278.2 billion over 10 years

- $200 million for 5 years to CHIPS for America Education and Workforce Fund to promote the growth of the semiconductor workforce.
- $200 million for 5 years to the Department of Energy's Director of the Office of Science to support efforts to develop a scientific workforce by fostering collaborations between K12 teachers, students, and faculty in postsecondary institutions, early-career researchers, and National Laboratories.
- $100 million for 5 years to the Director of the National Science Foundation to strengthen rural STEM education and to broaden the participation of rural students in STEM.
- $10 million for 5 years to the Secretary of the Department of Energy's Science Education Enhancement Act to develop and increase the diversity of a STEM workforce.
- Calls on the NSF to support research and development to improve STEM education at community colleges and in career and technical education.
- Requires outreach to historically Black colleges and universities (HBCUs), minority serving institutions (MSIs), tribal colleges and universities, postsecondary institutions that serve veterans and rural communities, labor organizations, and emerging research institutions to participate in science, technology, education, and math (STEM) education and to build a STEM workforce.
- Identifies postsecondary institutions, in partnership with state and local governments, labor unions, businesses, and community-based organizations across the country, to host regional innovation and technology hubs to catalyze regional economic growth and development through technology, innovation, and manufacturing.

EDUCATION AND TRAINING PROVISIONS IN THE INFLATION REDUCTION ACT (IRA)	
FUNDING AVAILABLE FOR EDUCATION AND TRAINING: approximately $4.5 billion	TOTAL FUNDING: $500 billion over 10 years

- $3 billion to the EPA to administer Environmental and Climate Justice Block Grants to a partnership of tribal and local governments, community-based organizations, nonprofit organizations, and postsecondary institutions to support cross-cutting investments that engage and benefit disadvantaged communities in building climate resilience, reduction of greenhouse gas emissions and air pollution, improvement of indoor air quality, and to address environmental and climate-related health risks.[7]
- $200 million in assistance to states and municipalities to provide training for contractors to install energy efficiency improvements.[8]
- $250 million to land grant institutions and minority serving institutions, including Tribal land grant colleges and Hispanic or Latino serving institutions to support agricultural research and education, including providing pathways to careers in the agricultural sector.
- Grants states and municipalities to adopt energy-efficient building codes and to provide training and enforcement programs to achieve full compliance.
- Provides competitive grants to state, municipalities, tribes, or non-profit school transportation entities to replace heavy-duty vehicles with zero-emission vehicles, and to train a workforce to support the maintenance, operations, and charging/fueling.

Source: AASHTP (2021), Badlam et al. (2022), Evans (2022b), Office of Management and Budget (OMB) (2021), The White House (2021)

The Challenge

Achieving a just transition in the current U.S. climate policy context will be challenging. In 2021, the U.S. green workforce, as conventionally defined (see Box 2), constituted approximately 23.7% of overall U.S. employment, or approximately 33 million of 140 million jobs in the U.S. On average, the U.S. green workforce was approximately 80% white and 75% male—a clear <u>overrepresentation</u> by these two groups as the Bureau of Labor Statistics (BLS) estimates that they constitute 77% and 50% of the total U.S. workforce, respectively. While participation is also higher by Hispanic or Latino (19%) and Asian Americans (7%) compared to their shares of total U.S. employment (at 17% and 6%, respectively[9]), Black or African Americans are presently underrepresented in the green economy, with a participation rate of approximately 10%, compared to making up 12% of total U.S. employment (see Figures 1 and 2).

Nearly 20% of the U.S.'s green workforce is in Manufacturing, and another 25% is employed in infrastructure jobs in Construction and in Transportation and Warehousing—sectors that are already at the core of U.S. climate investment.[10] In contrast, the sectors with some of the lowest shares of BLS-identified green occupations are Educational Services, Healthcare and Social Assistance (see Figure 3, as well as Figure 17 in Annex A: Supplementary Materials). This is despite the education sector being an essential green sector for building knowledge, skills, and behaviors for green jobs and climate action, and the health sector being essential for building climate resilience and adaptive capacity among populations most vulnerable to the unequal health impacts of climate change and environmental injustice (Novello & Carlock, 2019; Palladino & Gunn-Wright, 2021). The education and health sectors are also among the top employing sectors in the U.S. labor market–an opportunity for the rapid scale out of a breadth of green skills across the U.S. labor force.[11]

> ❝ — A bachelor's degree will be key to entering the green economy's most promising jobs in the next decade.

With the recent passage of historic climate policies, the green workforce is projected to grow significantly. But who will have access to these green jobs? Who will benefit from green investments? Our analysis suggests that the populations most likely to benefit from green transitions are those who will be able to access postsecondary education and training. Indeed, looking across 80 green "bright outlook" occupations,[12] it is quite clear that a bachelor's degree will be key to entering the green economy's most promising jobs in the next decade (see Figure 4, as well as Figure 18 in Annex: Supplementary Materials).

This points to an urgent need to close education and training gaps among underrepresented populations, especially at the postsecondary level, lest their historic exclusion from such opportunities will be the cause for their further exclusion in the green economy. But how? What kinds of policies and investments will be required to ensure historically marginalized populations benefit from this green growth?

To understand the type and extent of investments needed in education and training, decision-makers and advocates need to better understand the baseline scenario and just how far off a just transition is under business–or education–as usual. Our analysis has identified a suite of challenges that, if left unaddressed, will hinder the participation, inclusion, and empowerment of historically marginalized and disadvantaged communities, including environmental justice communities, underinvested communities, and underrepresented and underserved populations. These challenges include 1) the current stratification of green jobs by gender and race (a green jobs gap), 2) the limited representation of historically underserved groups (women, people of color, rural populations, etc.) in the fields of study required by the most in-demand green jobs (a green skills gap), and 3) the unequal distribution of green learning opportunities for members of disadvantaged communities to build a breadth of green skills (a green learning opportunities gap).

Figure 1. Green Employment, by Gender (%), 2021

75.9%

of the U.S.
green workforce
was **male**

◼ Male ◼ Female

Source: Current Population Survey (CPS). https://www.census.gov/programs-surveys/cps.html
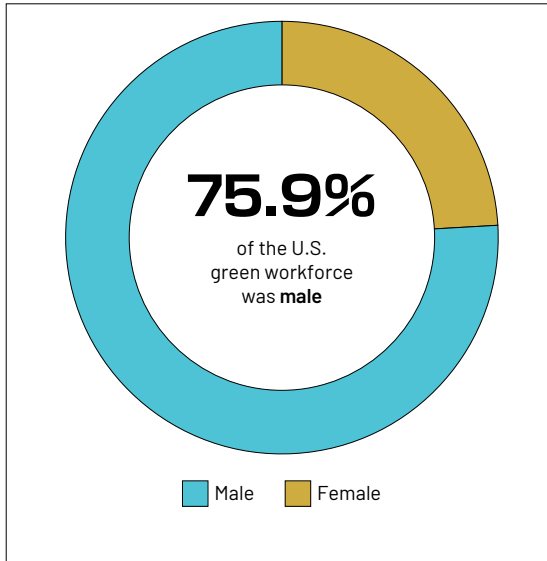
Figure 2. Green Employment, by Race (%), 2021

79.0%

of the U.S.
green workforce
was **white**

◼ White ◼ Hispanic or Latino
◼ Black or African American ◼ Asian

Source: Labor force statistics from CPS, https://www.census.gov/programs-surveys/cps.html; BLS, https://www.bls.gov/cps/cpsaat11.htm
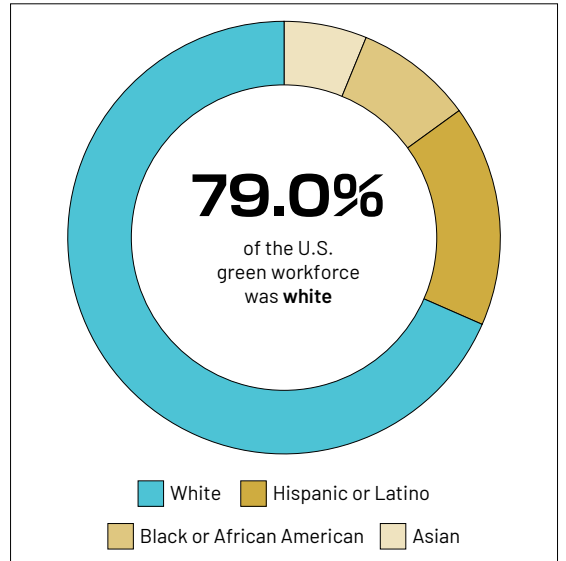
Figure 3. Green Employment, by Sector (%), 2021

42.8%

of the U.S.
green workforce is in
**manufacturing and
infrastructure jobs**

◼ Manufacturing ◼ Construction
◼ Transport and Warehousing ◼ Other

Source: Current Population Survey (CPS). https://www.census.gov/programs-surveys/cps.html
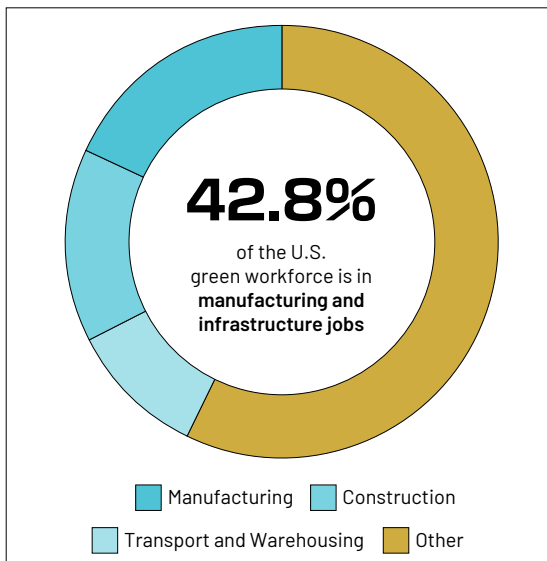
Figure 4. Green Employment, by Typical Education Needed for Entry

60.8%

of U.S. green jobs
require a **bachelor's degree**
irrespective of experience

◼ Bachelor's degree ◼ Other

Source: Labor force statistics from CPS, https://www.census.gov/programs-surveys/cps.html; BLS, https://www.bls.gov/cps/cpsaat11.htm
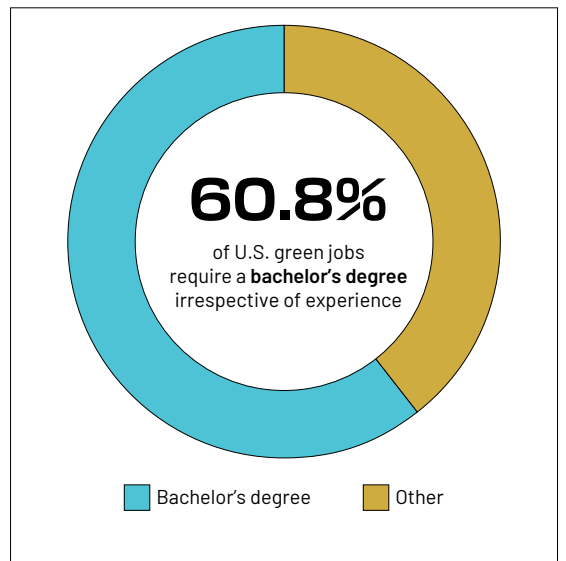
Box 2. What Is a Green Job?

The conventional definition

The U.S. Bureau of Labor Statistics (BLS) defines a green job as those occupations that "produce goods or provide services that benefit the environment or conserve natural resources," and/or occupations in which "workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources" (Bureau of Labor Statistics, n.d.). This can include jobs with tasks and activities reduce the use of fossil fuels, decrease pollution and greenhouse gas emissions, increase the efficiency of energy usage, develop and adopt renewable sources of energy, and recycle materials (Dierdoff et al., 2011).

Using this conventional definition, the BLS has identified over 200 green occupations, ranging from top executives to production workers, and organized into 12 major greening activities in the economy, including Environmental Protection, Governmental and Regulatory Administration, Green Construction, Renewable Energy Generation, Manufacturing, Transportation, Research, Design, and Consulting Services, and Energy Trading.

An expanded definition

While the economy and the environment are at the heart of a conventional definition of green jobs, a less conventional definition stresses the addition of a third, social dimension. That is, green jobs would have to satisfy three criteria. They must promote: 1) environmental sustainability, 2) economic empowerment, and 3) social empowerment (see Figure 5).

Figure 5. An Expanded Definition of Green Jobs

Jobs that produce goods or provide services that preserve or restore environment

ENVIRONMENTAL SUSTAINABILITY

Decent jobs that offer equal opportunity for historically marginalised populations

ECONOMIC EMPOWERMENT

Green Job

SOCIAL EMPOWERMENT

Jobs that build social assets and community resilience through gender equality, racial equality, social integration, and community development.

Such an expanded definition recognizes the need to anchor green jobs in the achievement of social justice, acknowledging that the achievement of environmental sustainability or restoration does not on its own rectify generations of environmental harm posed to certain communities as a result of deep structural inequities. Adding a social justice dimension also centers the health and wellbeing of communities in the pursuit of greener economic activities, placing economic value on care work and thus helping to prioritize support to caregivers of young and old to enable them to participate in the green economy (Novello & Carlock, 2019).

Thus, a more transformative definition of green jobs might be: *"...any job that contributes to the well-being and flourishing of present and future generations; upholds human rights, including women's rights and the rights of indigenous populations and peoples of color; and supports the regeneration of the natural world, its resources, and its socio-ecological systems on which our human economies rely. Green jobs center, nurture, and develop our individual and collective capacity to care for others and the environment and to educate ourselves and others about the unsustainability of the status quo."* (Kwauk & Casey, 2021, p. 4)

THE GREEN JOBS GAP

Early stratification suggests underrepresented populations will struggle to benefit from green investments

The current demographic distribution of green jobs, conventionally defined, suggests that the transition to a greener economy will not be felt equally across the workforce.[13] Current participation in green jobs is stratified along gender and racial lines that are associated with long-standing educational inequalities as well as wage inequalities[14] (see Annex A: Supplementary Materials for Table 5) Specifically, underrepresented populations are more highly represented in the low-skilled, low-paying green jobs: Women, Black or African Americans, and Hispanic or Latino populations are, on average, overrepresented in green occupations for which no formal educational credential or a high school diploma or equivalent is needed to enter, and for which the median annual wage is below the national median wage ($45,000). Meanwhile, men, Asian American, and white Americans are overrepresented in those green occupations requiring a bachelor's degree to enter, and for which they receive some of the highest levels of compensation.[15]

> " — The current demographic distribution of green jobs, conventionally defined, suggests that the transition to a greener economy will not be felt equally across the workforce.

Participation in the most in-demand green jobs requires more education, putting populations that have been historically excluded from learning opportunities at an early disadvantage when it comes to realizing economic equality and economic security in a future low-carbon economy. These early signs of stratification are a red flag, signaling that green job growth is on track to reproduce occupational segregation seen in the non-green economy (Zhavoronkova et al., 2022). Business as usual–or rather, education as usual–is set to widen inequality gaps, including wage inequality, despite measures in U.S. climate policy requiring workers to be paid prevailing wages (Patrinos & Macdonald, 2022; Williams et al., 2022).

To illustrate, we highlight a sample of 29 green bright outlook occupations–the most in-demand green jobs over the next decade. This includes 15 green jobs that are expected to have 100,000 or more job openings over the next decade and 15 green jobs that are anticipated to grow faster than average over the next decade. For the most part, these 29 green jobs are both high-skilled and high-paying: 18 of the 29 occupations require a bachelor's degree for entry and 14 pay an annual median wage near or above $100,000. In the minority, 9 of these 29 occupations require no formal education credential or a high school diploma or equivalent, and 6 pay below the national median wage ($45,000) (see Annex A: Supplementary Materials for Table 6). Here, we look more closely at our two sub-samples of green bright outlook occupations (those with the most job openings to come, and those growing the fastest) for a snapshot of how these jobs are currently distributed.

First, of the 15 green occupations anticipating the largest number of job openings (more than 100,000 jobs) over the next decade, Management occupations will host 6 of these 15 occupations and are expected to experience more than 113,000 job openings (see Figures 6a and 6b). General and Operations Managers are expected to see 300,000 job openings–the third largest job openings of the green bright outlook occupations. All of these require at least a bachelor's degree to enter. Currently, these positions are occupied predominantly by white males and are among the highest-paying green jobs ($97,970 to $124,650). Compared to their share of total U.S. employment, women, Black or African Americans, and Hispanic or Latino workers are very underrepresented in green Management occupations, while Asian workers are just around their share (between 4.6–6.5%).

On the other end of the spectrum, Recycling and Reclamation Worker occupations, as well as Laborers and Freight, Stock, and Material Mover occupations require no formal education credential to enter. Yet, these are among some of the least paid green bright outlook occupations ($31,230), well below the national median wage ($45,000) and just a quarter of the median annual wage of Manager occupations. Currently, after white males, these occupations are more likely to be filled by Hispanic or Latino and Black or African American males. While Recycling and Reclamation workers are expected to grow by 421,900 openings— the largest number of job openings of the NE green bright outlook occupations—they do not reflect the

type of well-paying jobs that U.S. policy discourse has promised. A similar story is seen with Customer Service Representative occupations, although an occupation predominated by women (64.8%) with a high representation by Black or African American workers (18.5%) and Hispanic or Latino workers (19.7%).

Expected to experience the second largest number of job openings over the next decade (389,400), Customer Service Representative occupations require only a high school diploma or equivalent to enter, but an annual median wage of $36,920 (see Figures 6a and 6b).

Figure 6a. Distribution of Green Occupations With at Least 100,000 Annual Job Openings, 2021–2031, Disaggregated by Level of Education Needed to Enter and Gender
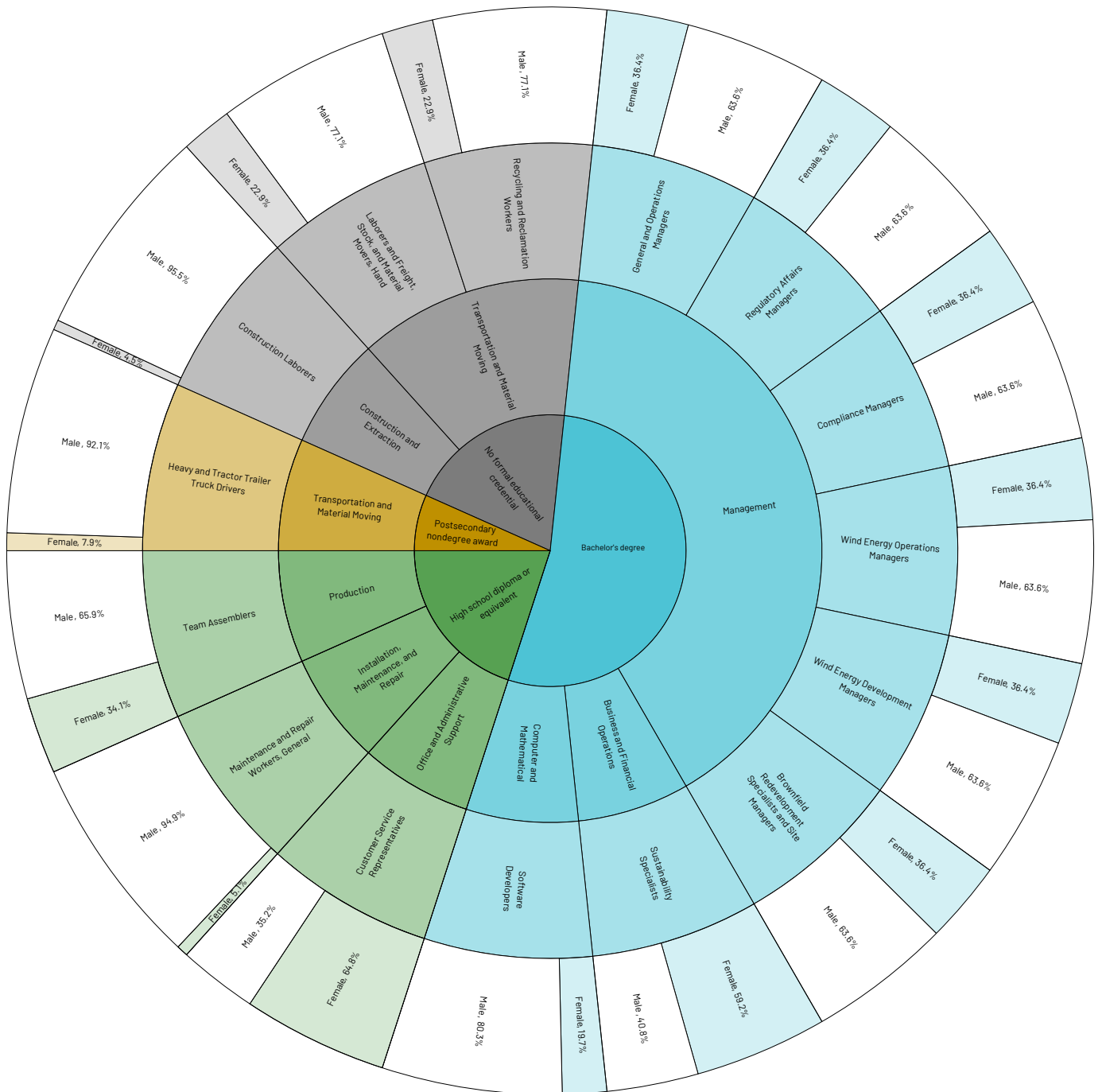
Note: Wages, education, and experience requirements are reported at 6-digit SOC levels, often shared by several ONET occupations which are reported at 8-digit levels.

Figure 6b. Distribution of New Green Occupations With at Least 100,000 Annual Job Openings, 2021-2031, Disaggregated by Level of Education Needed to Enter and Race
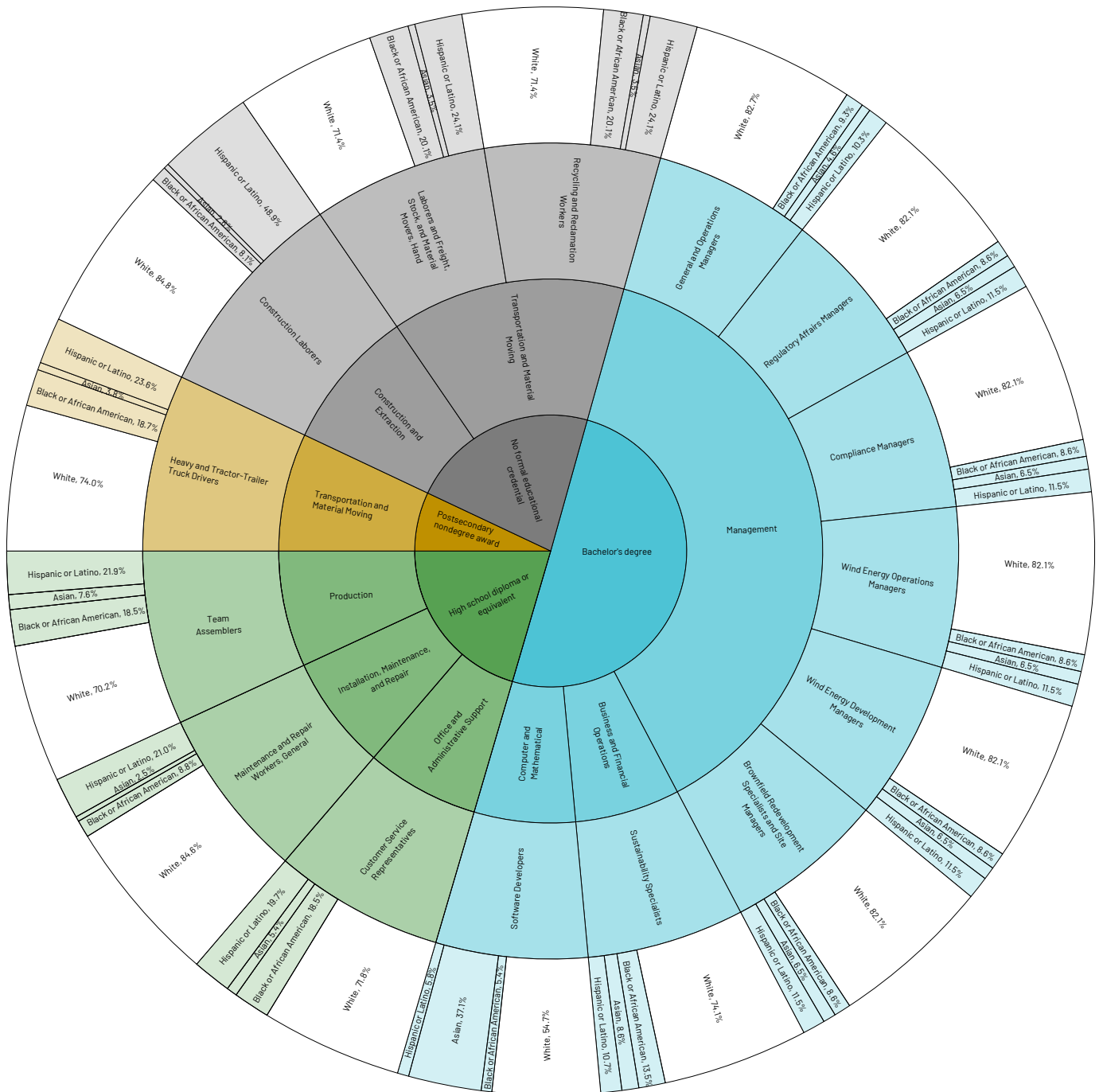
Note: Wages, education, and experience requirements are reported at 6-digit SOC levels, often shared by several ONET occupations which are reported at 8-digit levels. of the median annual wage of Manager occupations. Currently, after white males, these occupations are more likely to be filled by Hispanic or Latino and Black or African American males. While Recycling and Reclamation workers are expected to grow by 421,900 openings—the largest number of job openings of the NE green bright outlook occupations—they do not reflect the type of well-paying jobs that U.S. policy discourse has promised. A similar story is seen with Customer Service Representative occupations, although an occupation predominated by women (64.8%) with a high representation by Black or African American workers (18.5%) and Hispanic or Latino workers (19.7%). Expected to experience the second largest number of job openings over the next decade (389,400), Customer Service Representative occupations require only a high school diploma or equivalent to enter, but an annual median wage of $36,920 (see Figures 6a and 6b).

> **These early signs of stratification are a red flag, signaling that green job growth is on track to reproduce occupational segregation seen in the non-green economy.**

Similar trends are also emerging among the 15 fastest-growing NE green occupations (occupations projected to experience a growth rate of 10% or higher), although the fastest of the fastest-growing NE green jobs require some of the lowest educational levels (see Figures 7a and 7b). For instance, Wind Turbine Service Technicians and Solar Photovoltaic Installers are projected to experience 44.3% and 27.2% growth, respectively, among the fastest growth to be seen across all the NE green occupations. These two occupations require a postsecondary nondegree award (Wind Turbine Service Technicians) or a high school diploma or equivalent (Solar Photovoltaic Installers) to enter.[16]

After white workers, Hispanic or Latino workers make up the second largest share of Wind Turbine Service Technicians (21.5%), and among Solar Photovoltaic Installers, Hispanic or Latino workers and Black or African American workers make up the second and third largest shares, at 36.3%, and 15.8%, respectively. Both are higher than their shares of total U.S. employment. Both occupations are almost exclusively held by males: 97.3% of Wind Turbine Service Technicians and 94.2% of Solar Photovoltaic Installers. Notably, workers in these occupations are also some of the lowest paid in this sub-sample of in-demand green occupations, with an annual median wage of $56,260 and $47,670, respectively.[17]

In contrast, white and Asian workers predominate those fastest-growing NE green occupations that require a bachelor's degree to enter. For example, green Software Developer occupations are expected to grow by 26% over the next decade, and green Software Quality Assurance Analysts and Tester occupations are expected to grow by 20.8%.

Currently, Asian workers hold the second largest share (after white workers) of both occupations, at 37.1% and 27.6%, respectively—nearly 5 to 6 times their share of the employed U.S. labor force—and earn on average between $98,220 to $120,730, annually. Black or African Americans follow closely in three occupations requiring bachelor's degrees: Software Quality Assurance Analysts, where they hold the third largest share (14.1%) after white workers, and Logistics Analysts and Logistics Engineers. The latter two green occupations are expected to experience 27.7% growth over the next decade, and Black or African Americans workers currently hold the second largest share (after White workers) at 13.4%, earning a median annual wage of $77,030 (see Figures 7a and 7b).

Figure 7a. Distribution Across the Fastest-Growing (10% and Above) Green Occupations, 2021-2031, Disaggregated by Education Level Needed to Enter and Gender

Note: Wages, education, and experience requirements are reported at 6-digit SOC levels, often shared by several ONET occupations which are reported at 8-digit levels. Also, Service Unit Operators for Oil and Gas have not been included in this chart because of missing demographic data.

Figure 7b. Distribution Across the Fastest Growing (10% and Above) Green Occupations, 2021—2031, Disaggregated by Education Level Needed to Enter and Race
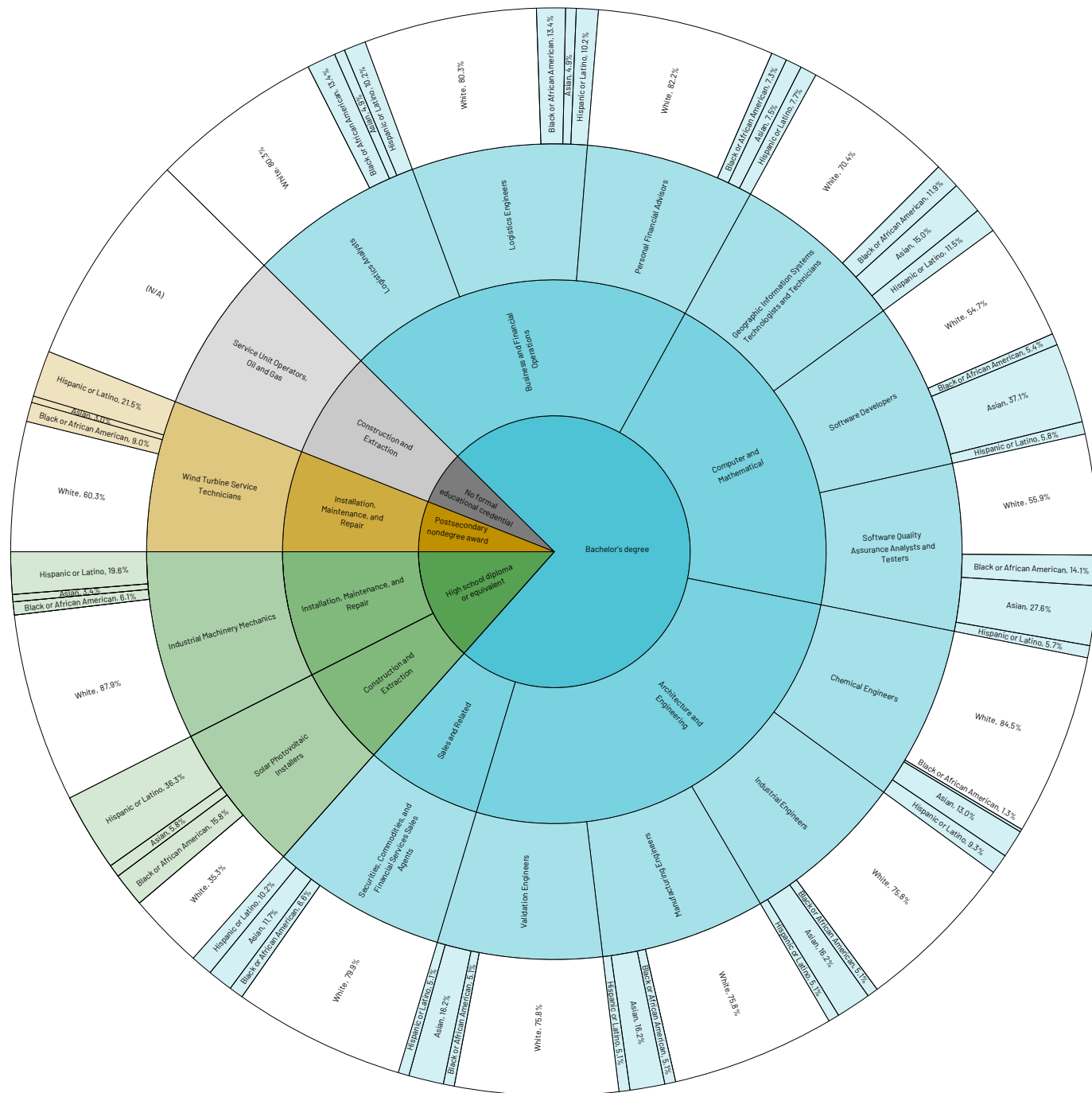
Note: Wages, education, and experience requirements are reported at 6-digit SOC levels, often shared by several ONET occupations which are reported at 8-digit levels. Also, Service Unit Operators for Oil and Gas have not been included in this chart because of missing demographic data.

THE GREEN SKILLS GAP

Tomorrow's green workforce may look much like today's

If the demographic distribution of our sample of 29 NE green occupations provides any indication of the U.S.'s prospects of achieving a just transition, the current stratification of underrepresented populations across lower-skilled green occupations suggests the road ahead to well-paying green jobs for these populations will be uneven. When we attempt to sketch a picture of what the future green workforce might look like, based on who is acquiring the necessary degrees and skills to enter green jobs, the picture does not appear to improve. Indeed, current trends in green skills acquisition[18] suggest that the future green workforce will, for the most part, reproduce the demographic distribution of green jobs that we are currently seeing—absent interventions to close green skills gaps.

> " — Current trends in green skills acquisition suggest that the future green workforce will, for the most part, reproduce the demographic distribution of green jobs that we are currently seeing—absent interventions to close green skills gaps.

For starters, the gender distribution across the fields of study associated with green careers echoes the current gender distribution of green employment (Figure 8). Females are grossly underrepresented in the fields of study associated with occupation groups like Installation, Maintenance, and Repair (9%); Construction and Extraction (17%); Production (19%), and Architecture and Engineering (23%). These occupations include some of the green jobs with the fastest annual growth projected over the next decade and which currently are overrepresented by males, as seen in the previous section. In contrast, females are overrepresented in fields of study associated with green occupations in Educational Instruction and Library (68%), in Legal (63%), and in Arts, Design, Entertainment, Sports, and Media (61%)–occupation groups that, for the most part, do not include any green jobs that will be in demand over the next decade.[19] This is despite the need for more educators, trainers, and instructors to support the scale of green skill-

building required over the next decade, for more environmental lawyers and regulators, and more climate communicators in journalism and the news media.

Similarly, when we look at the racial distribution of green skills (again, proxied by degrees conferred), we can see that the most immediate potential future green workforce also looks much the same as the current green workforce, although with less pronounced disparities as those seen in the labor market (see Figure 9). Hispanic or Latino populations are overrepresented in fields of study needed to enter green Construction and Extraction occupations like Solar Photovoltaic Installers and Construction Laborers, as well as green Installation, Maintenance, and Repair occupations like Wind Turbine Service Technicians or Industrial Machinery Mechanics, where they are already more highly represented in the green workforce.

Black or African American populations are overrepresented or highly represented in fields of study needed for green Office and Administrative Support occupations and for green Business and Financial Operations occupations, which include green jobs like Customer Service Representatives and Sustainability Specialists where they are already highly represented.

Asian populations are overrepresented in fields of study required for green Computer and Mathematical occupations, like Software Developers, Software Quality Assurance Analysts, and Testers jobs of which they are already highly overrepresented in the current green workforce.

And, finally, American Indian, Alaskan Native, Native Hawaiian, and Pacific Islander populations are barely represented in any major field of study, raising continued concern about their opportunities for inclusion in green transitions.

Of course, there is no single story here. If we look beyond over- and underrepresentation by specific groups, there are notable cases that cue us into nuances in the green skills gap and their implications for who is more likely to get green jobs in the future—and therefore where policy attention should be directed. For some green occupations, the green skills gap may not start at the point of degrees conferred (or more specifically, within the education system), but rather emerges in the school-

to-work transition. So, for some groups and some occupations, it may be harder to access green jobs than it is to acquire the green skills needed for those jobs.

For instance, we know that females dominate green Office and Administrative Support occupations like Customer Service Representatives (64.8%). However, when it comes to their completion of fields of study associated with green Office and Administrative Support occupations, females constitute just over

50% of graduates. In contrast, females are slightly overrepresented in fields of study (e.g., Business Management and Administration) associated with high-wage green jobs like Chief Sustainability Officers (51.9%), Compliance Managers (54.4%), and Regulatory Affairs Managers (53.8%) (see Table 2), yet are highly underrepresented in the labor market hosting these jobs, at 29.1%, 36.4%, and 36.4%, respectively (see Table 6, Annex A: Supplementary Materials).

Figure 8. Average Completion Rates in Major Fields of Study Associated With Green Careers/Green Jobs, by Major Occupation Group and Gender
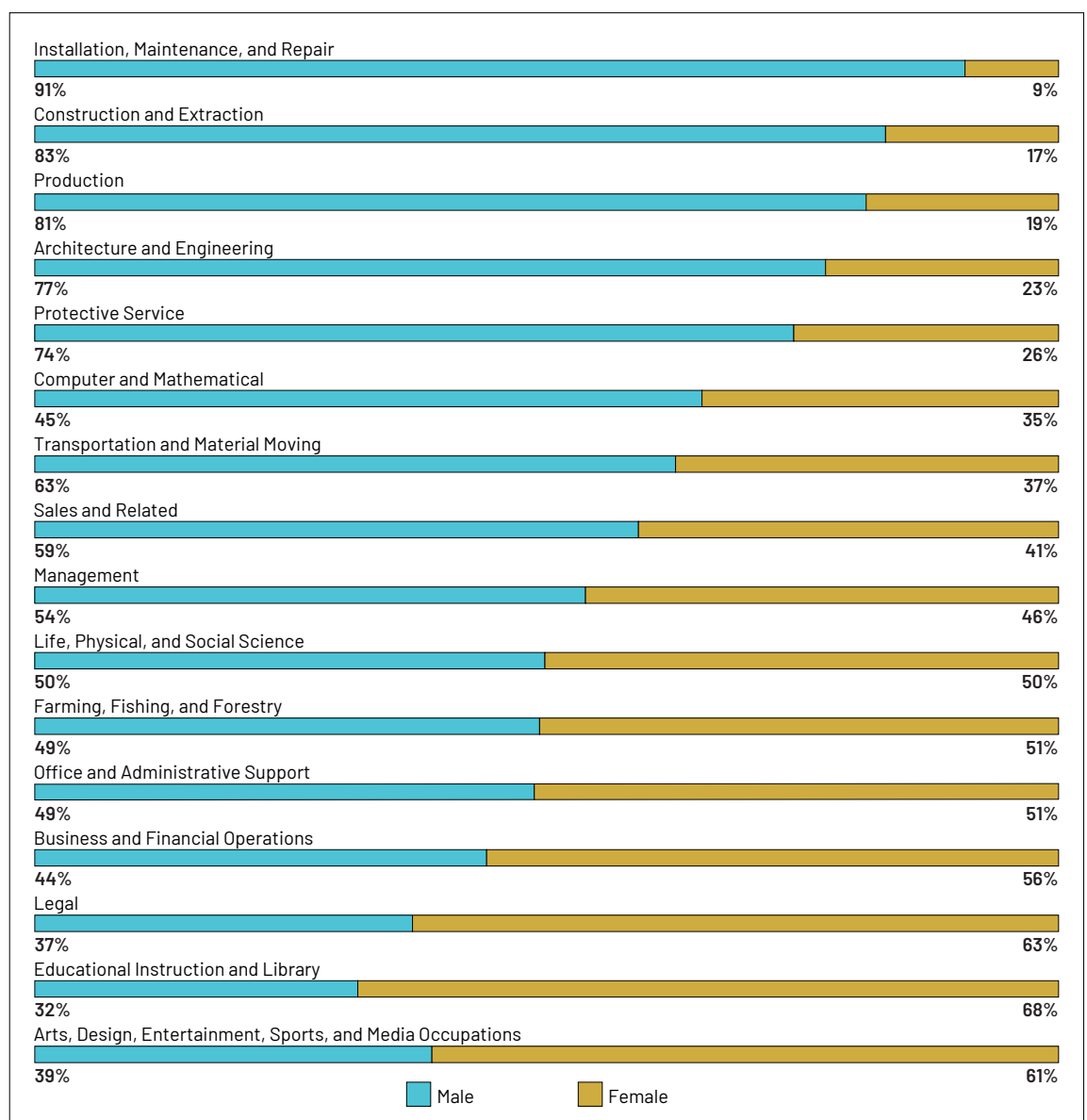
Installation, Maintenance, and Repair
91%   9%
Construction and Extraction
83%   17%
Production
81%   19%
Architecture and Engineering
77%   23%
Protective Service
74%   26%
Computer and Mathematical
45%   35%
Transportation and Material Moving
63%   37%
Sales and Related
59%   41%
Management
54%   46%
Life, Physical, and Social Science
50%   50%
Farming, Fishing, and Forestry
49%   51%
Office and Administrative Support
49%   51%
Business and Financial Operations
44%   56%
Legal
37%   63%
Educational Instruction and Library
32%   68%
Arts, Design, Entertainment, Sports, and Media Occupations
39%   61%

■ Male   ■ Female

Note: Average completion rates for each occupation group includes all fields of study associated with the green occupations of each major occupation group. Average completion rates are interpreted here as degrees conferred. And, completion rates have been aggregated over award levels, i.e., adding completion rates at the certificate to postgraduate levels.

This matters because while both types of jobs are expected to experience over 100,000 job openings over the next decade, green Customer Service Representative jobs pay less than the national median wage, while Management jobs pay some of the highest wages in the green economy, threatening to further exacerbate the gender pay gap. Furthermore, these two examples suggest that forces in and on the way to the labor market, including institutionalized exclusion and discrimination against women, hostile or unwelcoming workplace environment and culture,

> " — A singular education approach to supporting a just transition will not work. Rather, multiple educational interventions will be needed at once.

and inflexible workplace policies and practices, among others, are influencing whether or not females and males with the requisite degrees are getting the job, although further research is needed.

There is a similar story to tell about race and the green skills gap that emerges on the way from school to the labor market. For example, using the example above for Chief Sustainability Officers, Compliance Managers, and Regulatory Affairs Managers, white students represent 50.2%, 52.8%, and 53.2% of those completing degrees in these jobs' major fields of study. However, white workers held 85.7%, 82.1%, and

82.1% of these high-paying jobs in 2021 (see Table 2).

In another example, Asian students are relatively underrepresented in the major fields of study for green Architecture and Engineering occupations like Industrial Engineers (less than 5%, see Figure 9 below). Yet, Asian workers are highly overrepresented in the Industrial Engineer workforce (16.2%, see Figure 7b above), which is expected to be one of the fastest-growing green occupations in the next decade.

These nuances in representation suggest that a singular education approach to supporting a just transition will not work. Rather, multiple educational interventions will be needed at once. In some cases, it will be about diversifying *who* is entering and completing fields of study and training that are relevant and/or required for certain green jobs. In other cases, it will be about supporting school-to-career transitions by removing barriers to green jobs and making green job working conditions more inclusive and empowering. Some of this may be accomplished by providing sufficient supportive transitional career services from the education and training programs, but a good portion of the interventions will need to be in partnership with other actors, including those handling licensing and certifications or even human resources and recruiting that may create additional entry barriers. The bottom line is that we cannot expect the demographic distribution of green jobs to look any different tomorrow than it does today without intentional efforts to address the stratification of green skills by gender and race.

Table 2. Accessibility of Green Jobs in Governmental and Regulatory Administration Occupations that require a Business Management and Administration Degree

FIELDS OF STUDY	EDUCATION COMPLETION RATE			LABOR MARKET STATISTICS FOR GREEN WORKFORCE			
	MALE (TOTAL)	FEMALE (TOTAL)	WHITE (TOTAL)	BACHELOR'S DEGREE	FEMALE	WHITE	MEDIAN ANNUAL WAGE, 2021
BUSINESS MANAGEMENT AND ADMINISTRATION	45.9	54.1	52.7	34.9	36.5	82.1	125,708
BACHELOR'S DEGREE	45.7	54.3	52.8	34.9	36.6	82.1	126,084
CHIEF SUSTAINABILITY OFFICERS	48.1	51.9	50.2	40.5	29.1	85.7	179,520
COMPLIANCE MANAGERS	45.6	54.4	52.8	34.5	36.4	82.1	124,650
REGULATORY AFFAIRS MANAGERS	46.2	53.8	53.2	34.5	36.4	82.1	124,650
SUSTAINABILITY SPECIALISTS	35.4	64.6	49.9	38.9	59.2	74.1	74,670
HIGH SCHOOL DIPLOMA OR EQUIVALENT	84.1	15.9	50.2	22.2	10	87.6	61,640
ENERGY AUDITORS	84.1	15.9	50.2	22.2	10	87.6	61,640

Note: Relevant fields of study for Governmental and Regulatory Administration occupations also include Government and Public Administration and Science, Technology, Engineering, and Mathematics (STEM). This table displays data only for the Business Management and Administration degrees. Some degree holders may hold multiple degrees.

Figure 9. Average Completion Rates in Major Fields of Study Associated With Green Careers/Green Jobs, by Major Occupation Group and Race
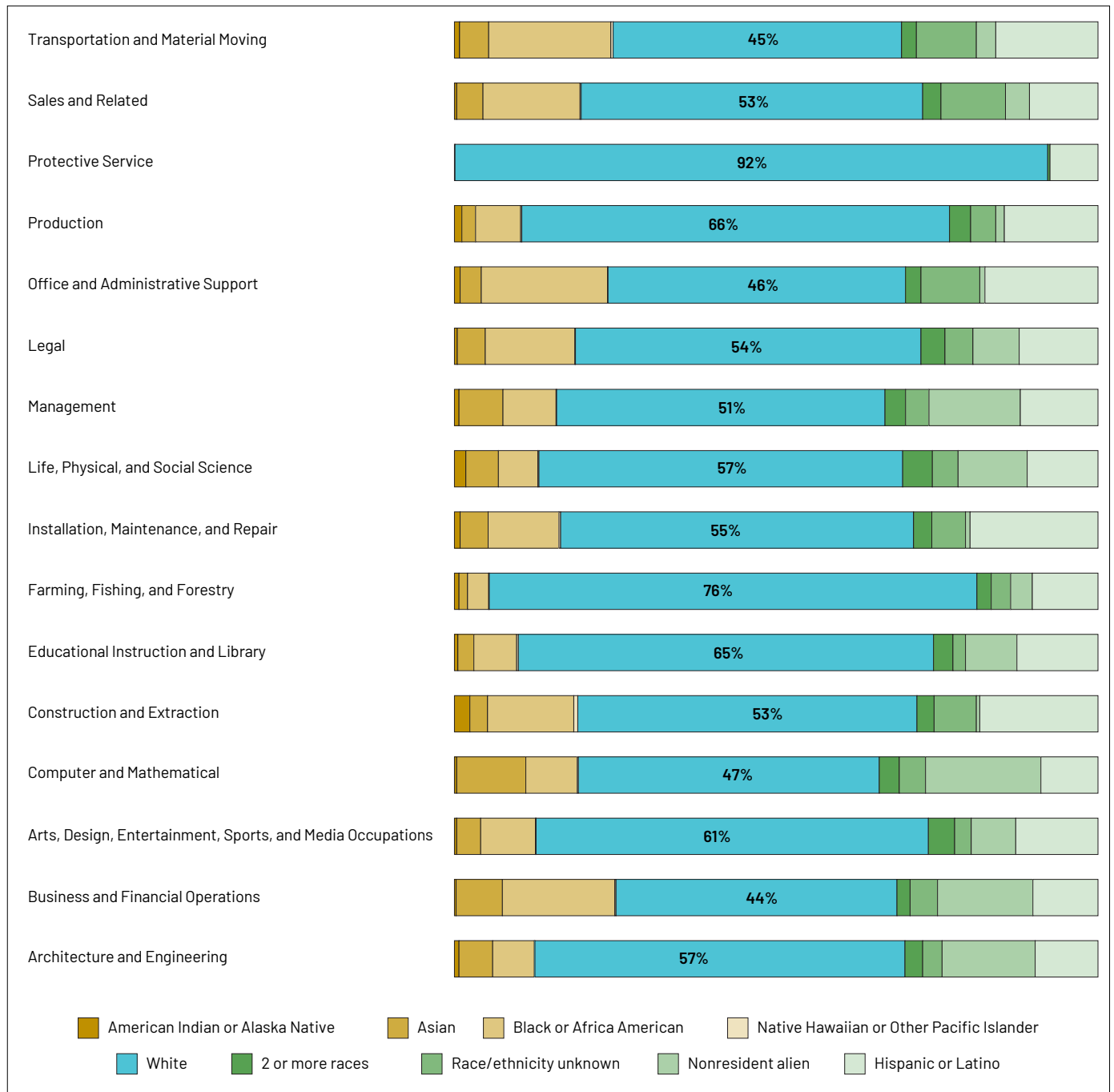
Note: Average completion rates for each occupation group includes all fields of study associated with the green occupations of each major occupation group. Average completion rates are interpreted here as degrees conferred. And, completion rates have been aggregated over award levels, i.e., adding completion rates at the certificate to postgraduate levels.

THE GREEN LEARNING OPPORTUNITIES GAP

Limited reach of postsecondary institutions will constrain opportunities for underrepresented populations

The evidence, while nuanced, clearly indicates that the U.S.'s path to a just transition will not be possible without addressing educational inequities defined along gender and race. But what are the opportunities to change this trajectory? If U.S. policymakers and postsecondary institution leaders were to get serious about closing green skills gaps, are there enough opportunities for historically marginalized communities and underrepresented populations to participate in the education and training needed for green career pathways?[20]

" — There appears to be an unequal distribution of green learning opportunities, especially across historically marginalized communities.

Our preliminary analysis suggests no. Specifically, there appears to be an unequal distribution of green learning opportunities, especially across historically marginalized communities. Such a green learning opportunities gap, if left unaddressed, will thwart any well-intentioned effort to close the green skills gap.

Box 3. What Is a Green Learning Opportunity?

> A GREEN LEARNING OPPORTUNITY IS AN EDUCATION OR TRAINING PROGRAM THAT AIMS TO DEVELOP A BREADTH OF GREEN SKILLS IN LEARNERS, EMPOWERING THEM TO CONTRIBUTE TO BUILDING A JUST, EQUITABLE, AND INCLUSIVE GREEN ECONOMY.

To illustrate this geography of green learning opportunities, we have mapped the geographic reach of a sample of green learning opportunities in the three states (Hawai'i, Illinois, and Kentucky) featured as case studies in the follow-up report to this paper (Figures 10, 11, and 12).[21] These states reflect diverse geographies across the country,

have diverse approaches to decarbonization, sustainability, and climate action, have diverse histories with extractive industries and environmental racism and represent the diversity of communities that are at the heart of a just transition.

Although preliminary, our analysis suggests that there are spatial inequalities in green learning opportunities across disadvantaged communities. Communities in rural areas—or the case of Hawai'i in the outer islands—appear especially to be green learning opportunity "deserts." That is, these are areas that the EPA has identified as "disadvantaged" and where there does not appear to be a degree- or certificate-awarding opportunity to build green skills, nor one within range of a reasonable commute.[22] While this geographic distribution of green learning opportunities may simply reflect the location of postsecondary institutions across the country, the bottom line is that distance matters. Disadvantaged communities do not have equal access—in this case, geographically speaking—to education and training opportunities that are needed to build a breadth of green skills required for green jobs. And this green learning opportunities gap will go on to sabotage the country's prospects at a truly just transition.

Digging further into our case study states provides further nuance. In Kentucky, the gaps in coverage are notably large among EPA-identified disadvantaged communities in the southeastern region of the state (Hillman, 2016).[23] These green learning opportunity deserts also happen to be areas where historic underinvestment in Appalachian communities, combined with the legacy of mountain-top removal and strip mining practices by the coal industry, has contributed to the region's heightened risk of exposure to cancer-causing environmental pollutants and environmental hazards like flooding (Brugars, 2019; DeBolt et al., 2021). In Hawai'i and Illinois, the distribution of EPA-identified disadvantaged communities may be less concentrated than in Kentucky, but their geographic distance to green learning opportunities suggests access to green skills building may be just as constrained.

This gap in coverage is critical for a number of reasons. In terms of access, members of historically marginalized communities tend not to have the means to relocate for short or extended education or training programs (Hillman, 2016).

Figure 10. Green Learning Opportunities in Hawai'i (8 of 17 PSIs represented)
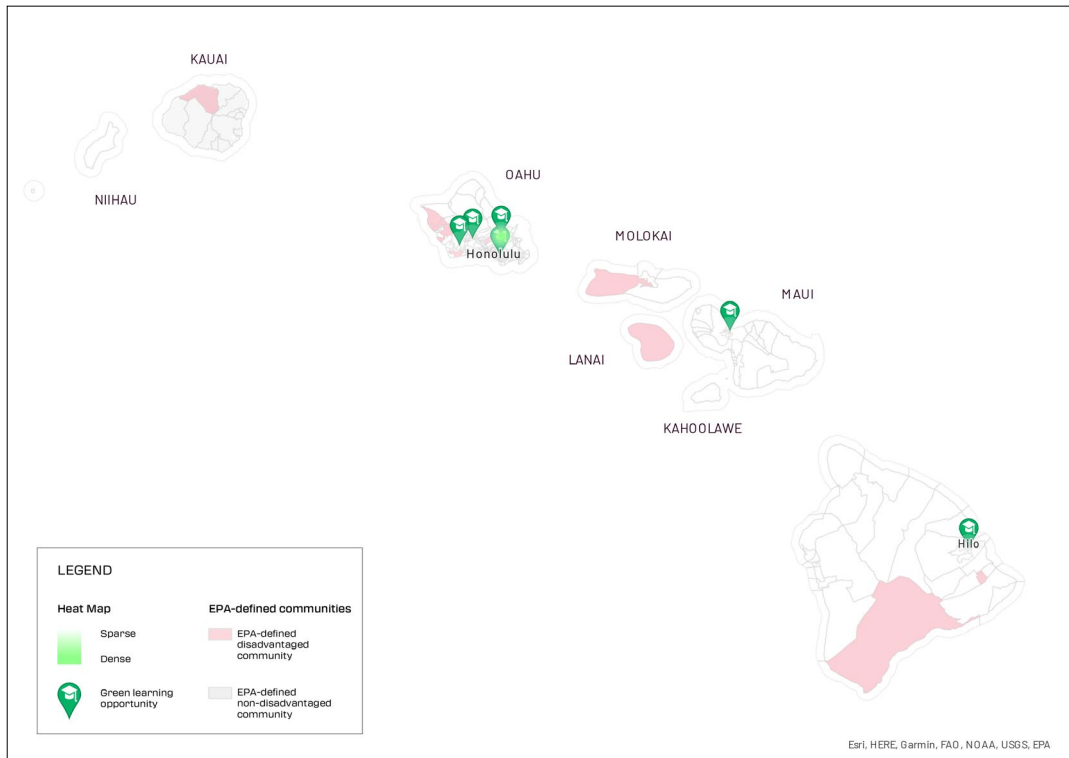
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute (a 10-mile radius). For instance, the green learning opportunities in Honolulu, O'ahu overlap with 23 disadvantaged communities and therefore have a brighter green radius than the green learning opportunity in Kahului, Maui, which is in the proximity of 2 disadvantaged communities.

Figure 11. Green Learning Opportunities in Illinois (16 of 152 PSIs represented)
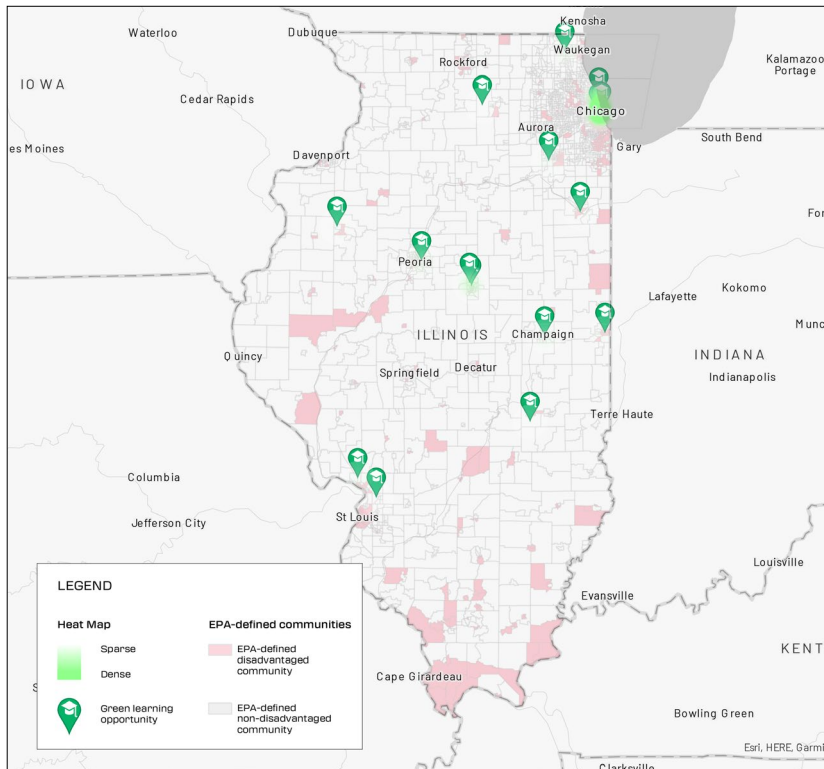
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute (a 10-mile radius). For example, 173, 415, and 392 disadvantaged communities are within a reasonable commute of 3 green learning opportunities in Chicago, Illinois, and thus "brighter" green, compared to 2 disadvantaged communities within a reasonable commute of the green learning opportunity in Champaign, Illinois. The brightness of the green radius has been weighted based on the total size of the census tract identified as a disadvantaged community.

Figure 12. Green Learning Opportunities in Kentucky (7 of 57 PSIs represented)
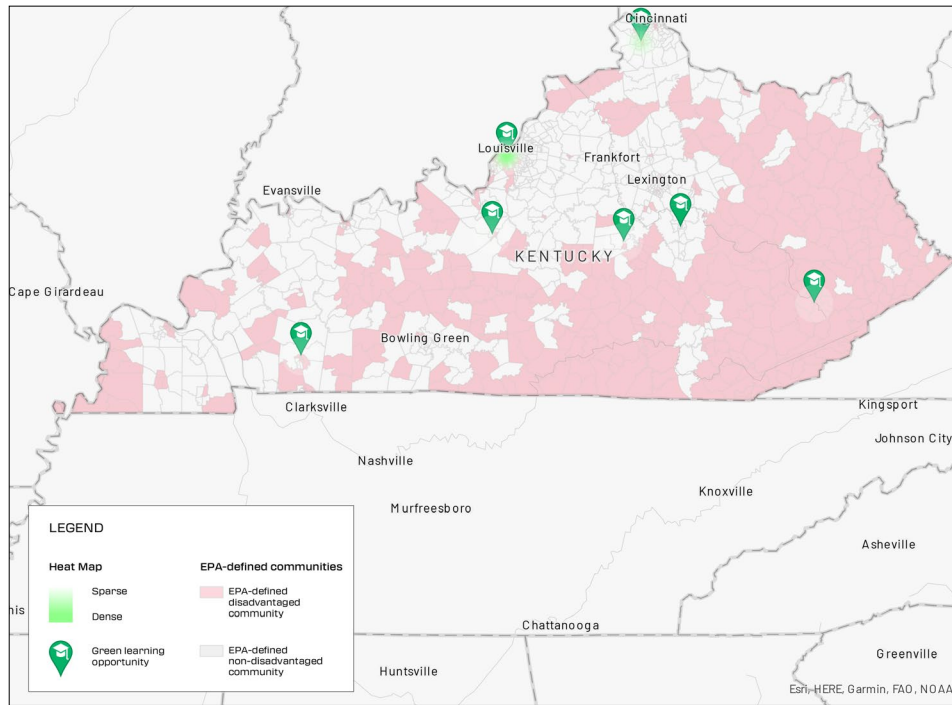
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute (a 10-mile radius). For example, 78 disadvantaged communities are located within a reasonable commute of a green learning opportunity in Louisville, Kentucky, compared to 11 disadvantaged communities within a reasonable commute of a green learning opportunity in Hazard, located in the southeastern region of the state.

And for learners from these populations who are relatively place-bound (due to care or job responsibilities or limited transportation options, for instance), even relatively short geographic distances to green learning opportunities can hamstring the best of efforts to build their green skills (Price & Curtis, 2018; Sablosky et al., 2021; Gordon, 2019). Barriers to access can quickly become barriers to achieving a just transition, as it is these underserved populations who stand the most to lose from green economic transitions designed without their participation.

The devastating floods that hit the southeastern region of Kentucky—a green learning opportunity desert—in July 2022 is a case in point of the urgent need to support communities that have the greatest need for locally-led green transitions with local opportunities to build green skills needed to drive those transitions.

Notably, in our three-state analysis, large metropolitan areas like Honolulu, Hawai'i, Chicago, Illinois, and Louisville, Kentucky appear to be outliers in terms of the greater proximity of green learning opportunities to disadvantaged communities in urban settings (see Figures 13, 14, and 15). However, these green learning opportunity "oases" may be misleading. The geographic clustering of green learning opportunities may simply be a reflection of the fact that urban areas host a higher number of postsecondary institutions, as well as a higher concentration of disadvantaged populations. Despite the increased proximity, systemic discrimination and structures of inequity within postsecondary education writ large, as well as the cost of attending, can render even the closest learning opportunity, green or non-green, inaccessible for underrepresented populations and disadvantaged communities.[24]

While this preliminary analysis of the geography of green learning opportunities should start to sound the alarm around the prospects of a just transition, further analysis across other U.S. states in addition

> " — Barriers to access can quickly become barriers to achieving a just transition, as it is these underserved populations who stand the most to lose from green economic transitions designed without their participation.

to completion of the Green Learning Opportunities Database are needed to build more conclusive evidence of the extent of the green learning opportunities gap and the diversity of the policy response needed.

In the meantime, what this preliminary analysis tells us is that different geographies require care and attention. For historically marginalized communities in green learning opportunity deserts, policy and practice must focus on creating or extending local education and training ecosystems.

For historically marginalized communities in green learning opportunity oases, policy, and practice must focus on repairing neglected community relationships to create better access to the current wealth of opportunities. Together, these approaches not only help to pave the way for historically marginalized populations to participate in the green economy, but they also help to close long-standing education and training gaps and to strengthen the green learning opportunities landscape across the country.

Figure 13. A Close-up of Green Learning Opportunities in Chicago, Illinois
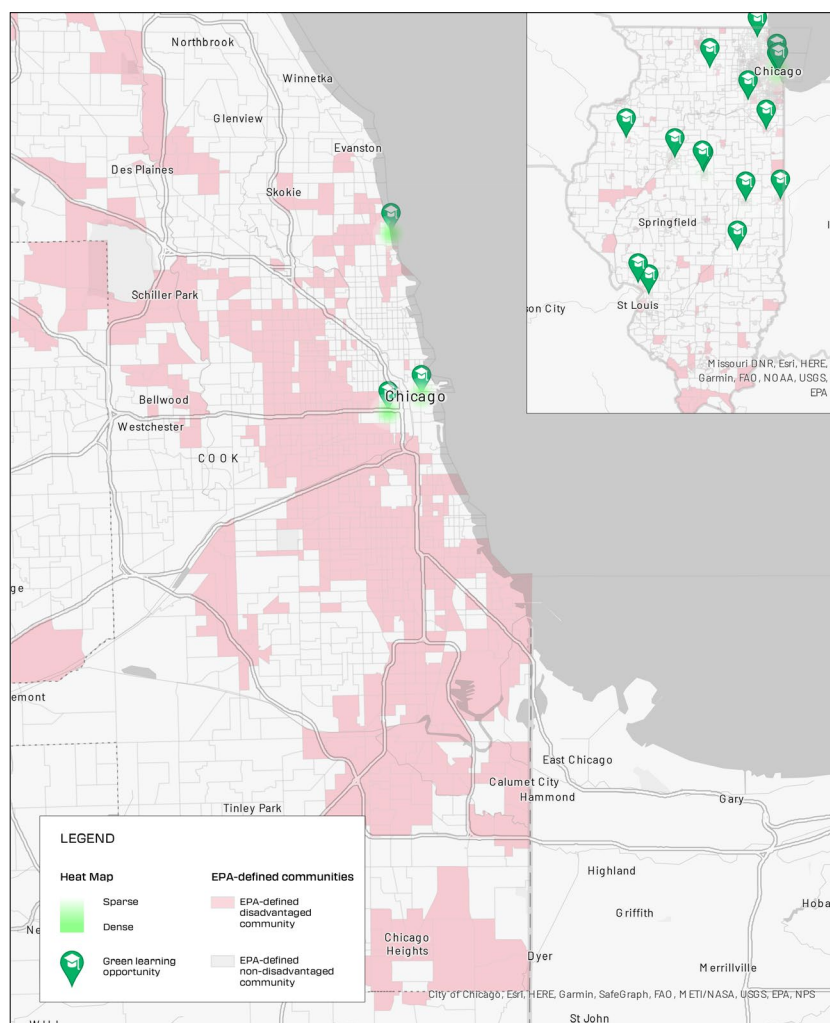
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute. The map may underrepresent the presence of a green learning opportunity due to the preliminary nature of the Green Learning Opportunities Database.

Figure 14. A Close-up of Green Learning Opportunities in Honolulu, Hawai'i
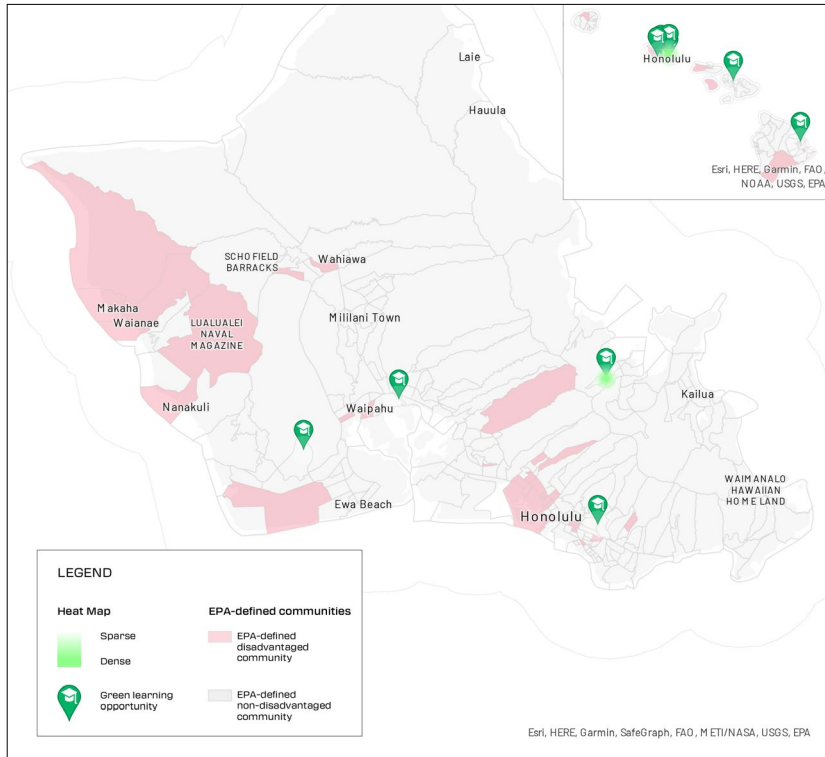
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute. Map may underrepresent the presence of a green learning opportunity due to the preliminary nature of the Green Learning Opportunities Database.

Figure 15. A Close-up of Green Learning Opportunities in Louisville, Kentucky
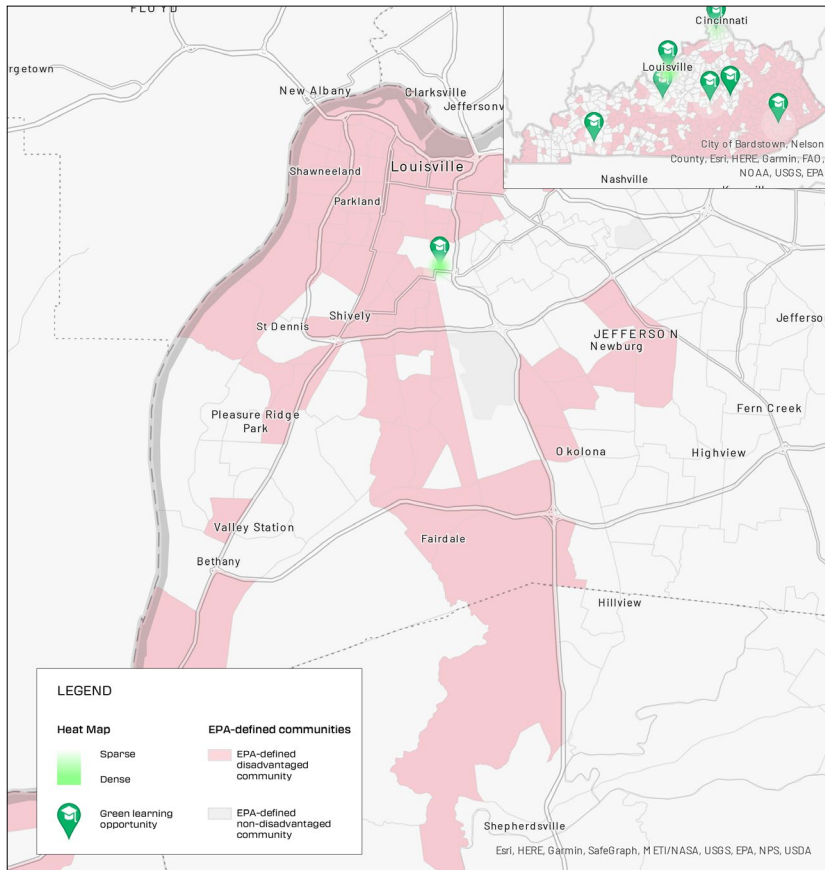
Note: Greener radiuses around green learning opportunities indicate a green learning opportunity with a greater number of EPA-identified disadvantaged communities located within the distance of a reasonable commute. Map may underrepresent the presence of a green learning opportunity due to the preliminary nature of the Green Learning Opportunities Database.

The Opportunity

Currently, U.S. climate policy—and the subsequent resources they unlock—are largely directed at industry-specific approaches to education and training, with a few exceptions (Table 3). Not only does this approach mean that populations and communities currently underrepresented in these industries, nor on track to enter them, will be excluded from green investments; but it also does little to address the systemic education and training gaps that put the U.S.'s vision for a just transition at risk. Under an education-as-usual scenario, those populations who are unable to access postsecondary education will have fewer pathways into the most in-demand green jobs over the next decade than those with access to postsecondary institutions.

Herein lies the opportunity for postsecondary institutions, including technical and community colleges and universities across the country, to step up their collective leadership in U.S. climate policy to define a transformative strategy for education and training that makes a just transition to a low-carbon, socially inclusive economy possible.[25]

As U.S. policymakers and implementers move further to close the emissions gap, and as advocates work to shape future U.S. climate legislation, they, together with postsecondary institutions and education stakeholders, must work together on four actions to direct more attention and resources to close the country's critical education and training gaps.

Table 3. Examples of Complementary U.S. Federal Efforts to Support Green Learning Opportunities

|	
WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY'S FEDERAL SUSTAINABILITY PLAN	Pillar 2 focuses on developing a climate- and sustainability-focused workforce, including identifying federal workforce human capital requirements for the effective implementation of sustainability goals
DEPARTMENT OF TRANSPORTATION'S STRATEGIC PLAN, 2022-2026	Includes an objective to invest in education and training to empower transportation workers with the skills and pathways to quality transportation jobs through sector-based community college partnerships, apprenticeships, on-the-job training, and other measures
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT'S CLIMATE ACTION PLAN	Goal 3 focuses on pursuing environmental justice, including through the creation of green job opportunities and the development of a green workforce in compliance with Section 3 requirements, where recipients of federal housing assistance also have access to employment and economic opportunities
DEPARTMENT OF ENERGY'S REACHING A NEW ENERGY SCIENCES WORKFORCE (RENEW) INITIATIVE	Dedicates $40 million in grants to help build a more diverse STEM workforce, targeting research opportunities, internships, training programs, and mentoring opportunities to beneficiaries at HBCUs, MSIs, and other institutions
DEPARTMENT OF ENERGY'S ADVANCED MANUFACTURING OFFICE'S INDUSTRIAL ASSESSMENT CENTERS PROGRAM	Supports university-based Industrial Assessment Centers to assist small- and medium-sized manufacturers in reducing their emissions and lowering their energy costs by training students and professionals in the industrial manufacturing sector to conduct energy-efficiency assessments
NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES ENVIRONMENTAL CAREER WORKER TRAINING PROGRAM	Partners with community colleges, HBCUs, and apprenticeship programs to provide education and training opportunities to individuals from historically marginalized communities to enter careers in environmental cleanup, construction, hazardous waste removal, and emergency response

> **❝** — One such paradigm shift attempts to direct attention from designing education and training systems that are responsive to industry needs to, instead, defining a New Green Learning Agenda that orients education and training systems to be responsive to a climate impacted world.

1. Define a new green learning agenda for postsecondary institutions

While some advocates have suggested that to accomplish the U.S.'s rapid decarbonization goals there is a need for a complete system redesign of the country's reskilling infrastructure, others suggest that a more fundamental paradigm shift around education and training is needed (Edelman, 2021; Kinol, Miller, Axtell, et al., 2023; Escobari, 2019). One such paradigm shift attempts to direct attention from designing education and training systems that are responsive to industry needs —a task that was never perfect and will only get more difficult with time— to, instead, defining a New Green Learning Agenda that orients education and training systems to be responsive to a climate impacted world (Kwauk & Casey, 2021). Such an agenda goes beyond preparing some learners with green skills to ensure all learners have the foundations for sustainable habits of mind, a planetary consciousness, and a justice-oriented worldview.

While the specifics of a New Green Learning Agenda should be locally co-defined by education, community, youth, and union leaders, as well as other just transition stakeholders, a New Green Learning Agenda can be generally defined by its three lifelong approaches to green learning, breadth of green skills, and climate justice:

- **First**, education and training must ensure that the present and future workforce has the specific skills needed to execute and lead the transformation of sectors undergoing rapid decarbonization, like energy and transportation, as well as those sectors moving toward sustainability, like health and education.

- **Second**, education and training must contribute to greener ways of thinking, being, and doing in the world, ensuring that every learner is capable to navigate a climate-impacted world.

- **Third**, education and training must ensure every learner understands the root drivers of climate vulnerability and has the capacity and desire to help change unsustainable and inequitable systems through individual and collective action (Kwauk & Casey).

Notably, these approaches to a New Green Learning Agenda expand the breadth of green skills to which education and training must orient. Rather than a binary (green or not-green), green skills lie on a continuum: from the specific to the generic and to the transformative capacities needed to contribute to a socially-, economically-, and environmentally-just human society that cares for the human and non-human world and reduces the impact of human activity on others (Bowen et al., 2018; Kwauk & Casey, 2022) (Table 4).

Importantly, such a view toward green learning means adopting an expanded definition of green jobs, expanding our attention to green sectors beyond conventional ones like agriculture, construction, forestry, manufacturing, renewable energy, and transportation to also include low-carbon sectors like education and health care. Not only do the latter sectors tend to be dominated by women and people of color, but they are also vital to building the necessary human capital (e.g., knowledge, skills, attitudes, competencies, capabilities, and social networks) of present and future

Table 4. A Breadth of Green Skills

GREEN SKILLS FOR GREEN JOBS	GREEN LIFE SKILLS	SKILLS FOR A GREEN TRANSFORMATION
Specific capacities — those green skills needed to thrive in green jobs, broadly defined *Examples: care work, coding, construction*	**Generic capacities** — those cross-cutting "life skills" or "socioemotional skills" that contribute to greener ways of thinking, being, and doing *Examples: problem-solving, critical thinking, teamwork, coping with uncertainty, empathy*	**Transformative capacities** — those skills needed to disrupt and change both the individual behaviors and structural factors that exacerbate the climate crisis and/or environmental racism *Examples: the ability to recognize and redress unequal relations of power, coalition building, solidarity*

generations. Such capital is necessary to support and drive further innovation in a greener, more inclusive economy, as well as to build greater climate resilience and adaptive capacity among all communities.

Conventional education and training systems have often delegated the three approaches to green learning to different levels of education and institutional type: Community and technical colleges have traditionally focused on green skills for green jobs; K12 institutions have focused on green life skills, often through the aegis of environmental education; and four-year postsecondary institutions, especially social science programs and liberal arts institutions, have focused on building more transformative green skills. But a New Green Learning Agenda places the responsibility of teaching a breadth of green skills across every educational level and every institutional type—in this way eliminating, or at least reducing, the conditions that make a green skills gap possible. Making a breadth of green skills the business of the K12 system and every postsecondary institution means that green job opportunities—and the household and community benefits that these bring—will no longer be structured by who had the opportunity to pursue certain fields of study or whether they had the opportunity to do so at certain types of institutions.

2. Strengthen and support just transition education and training ecosystems

To implement a New Green Learning Agenda, postsecondary institutions must partner with community-based organizations, nongovernmental organizations, high school career and technical education programs, and industry-aligned

> " — Postsecondary institutions must partner with community-based organizations, nongovernmental organizations, high school career and technical education programs, and industry-aligned organizations that offer education and training to fill critical gaps in the provision of quality and diverse green learning opportunities across the country.

organizations that offer education and training to fill critical gaps in the provision of quality and diverse green learning opportunities across the country. Doing this, postsecondary institutions can play a critical role in strengthening, coordinating, and/or developing hyper-local ecosystems of education and training. Postsecondary institutions can and should be at the center of these ecosystems because of the multitude of resources they hold (from human capital to knowledge assets to physical assets, like classrooms and technology) that can be leveraged by a wider ecosystem of education and training actors. This is especially crucial in green learning opportunity deserts where underserved and disadvantaged communities have little to no access to green learning services and resources and, subsequently, green skills development.[26]

Using natural ecosystems as a metaphor and the many life-supporting ecosystem services that nature provides to human society as a model, just transition education and training ecosystems can become important service delivery systems for communities undergoing rapid transitions in the context of climate change and environmental justice. Here, we highlight four of these ecosystem services.

- **First** are their *provisioning services*. This includes the most basic products and services that make education and training the green learning opportunities that they can be: from the breadth of green skills to planetary consciousness, from sustainability mindsets and competencies to the social networks and relationships that are important foundations for building economic opportunity grounded in environmental stewardship and social justice. Other basic products and services are more material in nature, including the provision of physical (or digital) learning spaces as well as material and digital teaching and learning technologies and resources. Others are also human in nature, including faculty, technical experts, and facilitators.

- **Second** are the *regulating services.* These work together to create and maintain the conditions that make the ecosystem functional, resilient, and sustainable. In the context of a just transition, important regulating services of an education and training ecosystem may include, for example, the advancement of equality and inclusion through the promotion of policies and practices (including college affordability) that redress past and present harms and exclusions caused by

institutions of learning; the equitable distribution of green learning opportunities to communities geographically isolated from and/or historically and/or socioeconomically excluded from the nearest green learning opportunities; or the moderation and mediation of relationships between underserved and underrepresented communities, community-based organizations, K12 education institutions, postsecondary education institutions, and industry and the private sector to build meaningful connections and better coordination across the just transition education and training ecosystem. When such justice-oriented regulating services break down, the education and training ecosystem may function to exacerbate climate vulnerability and environmental racism and perpetuate intergenerational poverty, unequal relations of power, and structures of exclusion.

- **Third** and **fourth** are ecosystem services that postsecondary institutions may not often consider but are vital in the context of just transitions: cultural and supporting services. *Cultural services* are those nonmaterial benefits that contribute to the development of community identity, community belonging, and a sense of place–from the hyper-local to the global. They create a sense of community that is vital to unlocking the transformative thinking, artistic ideas, technological innovations, and humanitarian benefits of our best climate solutions. And finally, *supporting services* are those benefits that enable all other ecosystem services within the just transition education and training ecosystem to exist. This includes those policies and partnerships that enable the basic needs of learners to be met (e.g., food, housing, transportation, health care, child care, etc.), and, where possible, the subsidization of the cost of green learning for learners through financial assistance.

Without providing support services, the opportunity to access green learning opportunities and develop the green skills necessary to participate in green jobs will be compromised by inequity and inequality. While postsecondary institutions on their own may not be able to provide these two services—nor are they necessarily set up to do so—it is in partnership with other entities, including community-based organizations and environmental justice organizations, that they can help to guide the necessary attention and resources to benefit those communities in most need.

In short, there is no single role that postsecondary institutions should play nor any single service that postsecondary institutions should provide in supporting a just transition. Rather, postsecondary institutions, as part of a larger just transition education and training ecosystem, must fill an array of locally responsive roles, all in service of local community development needs.

3. Advocate for and direct financing toward building "human infrastructure"

To fill green learning opportunities gaps, especially in green learning opportunity deserts, postsecondary institution leaders and education stakeholders must begin advocating for "human infrastructure" investments—or, investments in people.[27] Past efforts at infusing a people dimension into (physical) infrastructure investments from the American Recovery and Reinvestment Act (ARRA) of 2009 have taught us three important lessons for directing human infrastructure investments toward the pursuit of a just transition.

First, we know that the *timing* of education and training investments is critical (Mundaca & Ritcher, 2015; Vona et al., 2019). With the ARRA, because of the slow deployment of funds to state agencies and nonprofit

Figure 16. Ecosystem Services Provided by a Just Transition Education and Training Ecosystem

SUPPORTING SERVICES		
Services necessary to produce all other ecosystem services (e.g., basic needs of learners, subsidization of cost, adequate compensation of providers)		
PROVISIONAL SERVICES Products obtained from the ecosystem (e.g., green skills, social networks phyical classrooms, digital learning resources, human resources)	**REGULATING SERVICES** Benefits obtained from the regulation of ecosystem processes (e.g., inclusive education, education equity, equal access, educational continuity across levels in the system)	**CULTURAL SERVICES** Nonmaterial benefits obtained from ecosystems (e.g., sense of community, sense of place)

organizations for the Green Jobs Program, training programs ended up training participants toward the end of the stimulus, in some cases as late as 2013. This left trainees ready to join the green workforce after many green stimulus incentives had already expired, leaving employers in a difficult position to honor commitments to hire program graduates (Mundaca & Richter, 2015). Already, the IRA is poised to repeat this same mistake. While the legislation provides employers with incentives to fill immediate green skills gaps through on-the-job training[28], it has not directed sufficient resources to the broader education and training ecosystem to support such training efforts–as industry-specific as they are.[29]

> " — Postsecondary institutions will need to build and/or restore relationships of trust with community-based entities, especially with those for whom postsecondary institutions may not have always shared power and resources equally in the past. This will also entail co-defining a green learning agenda together from the start.

Second, we know that the *types of skills and capacities* that education and training programs target also matter. The ARRA era illustrates and reaffirms the challenges in developing timely and relevant job-specific skills training programs when there is a great deal of asymmetrical information between training institutions and industries–not to mention a significant time lag between when there is clarity about specific skills needs and when training providers are ready to deliver these specific skills trainings (Edelman, 2011; Scully-Russ, 2013). Moreover, employers' needs may shift mid-program, leaving specific skills training disconnected from market needs (Department of Labor, 2012). Such a scenario is increasingly likely given the rapidly shifting green technology and climate policy landscapes, and places even greater importance on a green learning agenda that is broad enough and foundational enough that leaves learners agile enough to step into a number of different possible priority actions.

Third, and finally, *where* investments are targeted and *to whom* also matter. Research suggests that directing education and training investments in locations where the labor force already possesses green skills is more likely to be successful in registering long-term green job growth (Chen, 2020). But this approach has obvious implications for a just transition, as it favors those communities with existing access to green learning opportunities. Disadvantaged communities that have experienced historic underinvestment will continue to be overlooked as they do not have the pre-existing green skills–likely because of a lack of nearby green learning opportunities–to attract additional green learning investments. In addition, the pressure for training providers to demonstrate impact immediately through successful job placements disincentivizes providers to target "higher risk" populations that may be harder to move from training to job offer.

To avoid this last set of pitfalls, human infrastructure investments must be centered on upending systemic discrimination and legacies of exclusion while expanding access among historically marginalized communities to learning opportunities that build a breadth of green skills. The CHIPS and Science Act provides one entry point for this, channeling investments in STEM education in rural communities across the country. Such efforts could provide important seed funding for building just transition education and training ecosystems in green learning opportunity deserts. The IRA also provides an incentive for transformative systems change by directing funding to community-based organizations and environmental justice organizations. That is, the IRA has (intentionally or unintentionally) built-in incentives for the establishment of just transition education and training ecosystems by putting community-based entities in the driver's seat and setting eligibility requirements for postsecondary institutions to partner with them. Critically, to pursue such partnerships, postsecondary institutions will need to build and/or restore relationships of trust with community-based entities, especially with those for whom postsecondary institutions may not have always shared power and resources equally in the past. This will also entail co-defining a green learning agenda together from the start. Such steps cannot be bypassed in pursuit of education and training for a just transition.

4. Fill data gaps for justice-centric data analysis in education and training

To facilitate problem diagnosis and solution generation for just transition education and training ecosystems, postsecondary institution leaders and local education stakeholders must become

more aware of the green learning opportunity gaps in their surrounding communities and the green learning opportunity deserts beyond their borders. This means supporting the capacity of decision-makers to identify their blind spots and to make more justice-centered evidence-informed decisions.

Apparent throughout this paper is the impact that a lack of data, missing data, and incompatible datasets can have on understanding the extent of the green skills gap in the U.S. and the cost of not investing in filling these gaps. For example, this analysis does not provide insight into whether the green jobs gap and the green skills gap are co-located in EPA-identified disadvantaged communities. Nevertheless, it does suggest that to ensure green transitions benefit everyone and every community, active efforts are needed to monitor these gaps as well as to build data systems that enable this. This means data disaggregated at a level that could facilitate a diligent eye on issues of justice, equity, diversity, and inclusion not only in conventional green jobs and their associated fields of study but also in less conventional green jobs in education and health.

Indeed, ascribing to a conventional definition of green jobs can have a lasting impact on what data is collected and/or what types of data are included in datasets, therefore determining what types of analyses, insights, and outlooks are reported on and mainstreamed by institutions like BLS. This can then influence how policy and decision-makers understand the parameters of the green economy, what problems get diagnosed, and what solutions get identified. Taking an expanded view to define green jobs can help build data systems that are oriented to a more justice-centered shade of green, thus shaping our approach to monitoring and tracking progress toward important social foundations. For example, the education and health sectors are vital for climate adaptation and environmental justice. Having data that can help illuminate *who* is more or less likely to have access to green learning opportunities and to develop the breadth of green skills required by green

jobs (conventionally *and* less conventionally defined) will help decision-makers better target education and training investments and strategies to the populations and communities in most need of a just transition.

On this note, postsecondary institutions, alongside national skills-building advocates, can play an important role in helping to empower decision-makers with the data, tools, and analysis to chart a path to decarbonization in a way that advances local community priorities, addresses community needs, and redresses systemic inequities. The U.S. Government's recent Environmental Justice Screening Tool (EJScreen) and Climate and Economic Justice Screening Tool (CEJST) are examples of efforts to fill data and knowledge gaps for the very purpose of helping decision-makers center justice-oriented outcomes in their decisions.[30] State efforts exist as well, like Ohio's Climate Equity Indicators Report, as do non-state efforts like EcoRise's Gen: Thrive Climate, Equity, and Education Map and our Green Learning Opportunities Database (especially once fully completed) (Evan et al., 2021; EcoRise, n.d.).

Postsecondary institutions across the country can not only help bolster such efforts but also monitor their own institution's performance on these justice-centered indicators. Without such data, education stakeholders will continue to face an uphill battle when trying to convince policy and decision-makers to direct attention and resources to the implementation of a New Green Learning Agenda and the strengthening of just transition education and training ecosystems.

Conclusion

The U.S. transition to a clean energy economy is an unprecedented opportunity to not only green the economy but also to transform deeper-seated inequities in opportunity and historic legacies of underinvestment. But the composition of the green economy today suggests that without bold, targeted investments in filling critical gaps in education and training, the future green economy will perpetuate the demographic stratifications and socioeconomic inequalities that are too familiar for historically marginalized populations.

" — Education and training must be viewed as a non-negotiable investment in any U.S. climate policies to close the emissions gap and achieve a just transition.

Postsecondary institutions, especially community colleges in collaboration with community-based organizations, have a critical role to play to support a more just transition. Importantly, this role should not be limited to research and development of green technology or even the delivery of technical knowledge and a breadth of green skills.

The role of postsecondary institutions must also extend to agents of systems change in service of community needs and priorities for environmental and climate justice. This may mean fundamentally reorienting postsecondary institutional priorities, objectives, practices, and relationships away from business as usual toward one of community service.

Not directing resources to diverse green learning opportunities across the country puts the U.S.'s goal for a just transition at risk. Those populations who have faced historic underinvestment, environmental injustices, and social and economic exclusion will continue to not have an equal opportunity to gain the breadth of green skills required to participate in green jobs. Education and training must be viewed as a non-negotiable investment in any U.S. climate policies to close the emissions gap and achieve a just transition.

References

American Association of State Highway and Transportation Officials (AASHTO). (2021, September 15). *AASHTO comprehensive analysis of the Bipartisan Infrastructure Bill: Infrastructure Investment and Jobs Act (IIJA)*. https://policy.transportation.org/wp-content/uploads/sites/59/2021/09/2021-09-15-AASHTO-Comprehensive-Analysis-of-IIJA-FINAL.pdf

Badlam, J., Clark, S., Gajendragadkar S., Kumar, A., O'Rourke, S., & Swartz, D. (2022, October 4). *The CHIPS and Science Act: Here's what's in it.* McKinsey. https://www.mckinsey.com/industries/public-and-social-sector/our-insights/the-chips-and-science-act-heres-whats-in-it

Barnes, A., Alexander, M., Buchanan, M., Ahmed, O., Zhavoronkova, M., Hoffman, E., Chyung, C., Argento-McCurdy, H., & Madson, D. (2022). *Uplifting women in the clean energy economy*. Center for American Progress. https://www.americanprogress.org/article/uplifting-women-in-the-clean-energy-economy/

Bergant, K., Mano, R., & Shibata, M. I. (2022). *From polluting to green jobs: A seamless transition in the U.S.?* International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2022/07/01/From-Polluting-to-Green-Jobs-A-Seamless-Transition-in-the-U-S-520244

BlackOak Collective. (n.d.). *BlackOak Collective: Your black environmental home.* https://www.blackoakcollective.org

Bowen, A., Kuralbayeva, K., & Tipoe, E. L. (2018). *Characterising green employment: The impacts of 'greening' on workforce composition.* Energy Economics, 72, 263–275. https://doi.org/10.1016/j.eneco.2018.03.015

Briscoe, C., Madray, C., & Valletta, R.D. (2022). *Higher education's role in advancing climate justice.* Second Nature. https://secondnature.org/wp-content/uploads/HE_Climate_Justice.pdf

Bureau of Labor Statistics. (2022) *BLS reports labor force characteristics by race and ethnicity, 2021.* U.S. Department of Labor. https://www.bls.gov/opub/reports/race-and-ethnicity/2021/home.htm

Bureau of Labor Statistics. (n.d.) *Green jobs definition.* U.S. Department of Labor. https://www.bls.gov/green/green_definition.pdf

Bureau of Labor Statistics. (n.d.). *Labor force statistics from the Current Population Survey*. U.S. Department of Labor. https://www.bls.gov/cps/cpsaat11.htm

Bruggers, J. (2019, November 21). Appalachia's strip-mined mountains face a growing climate risk: Flooding. *Inside Climate News.* https://insideclimatenews.org/news/21112019/appalachia-mountains-flood-risk-climate-change-coal-mining-west-virginia-extreme-rainfall-runoff-analysis/

Carey, L., & Shepard, J. U. (2022). *Congress's climate triple whammy: Innovation, investment, and industrial policy.* RMI. https://rmi.org/climate-innovation-investment-and-industrial-policy/

Chen, Z., Marin, G., Popp, D., & Vona, F. (2020). Green stimulus in a post-pandemic recovery: The role of skills for a resilient recovery. *Environmental and Resources Economics, 76*, 901–911. https://doi.org/10.1007/s10640-020-00464-7

Council on Environmental Quality. (n.d.). *Justice40 tracts map May 2022.* Esri https://www.arcgis.com/home/item.html?id=bdac3e391cd04d2396983fc67c23bf1c

Darling-Hammond, L. (2001). *Inequality in teaching and schooling: How opportunity is rationed to students of color in america.* National Library of Medicine, National Institutes of Health. https://www.ncbi.nlm.nih.gov/books/NBK223640/

DeBolt, C. L., Brizendine, C., Tomann, M. M., & Harris D. A. (2021). Lung disease in Central Appalachia: It's more than coal dust that drives disparities. *Yale Journal of Biology and Medicine, 94*(3), 477–486. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8461577/

Office of Inspector General. (2012). *Recovery Act: Green Jobs Program reports limited success in meeting employment and retention goals as of June 30, 2012*. Department of Labor. https://www.oig.dol.gov/public/reports/oa/2013/18-13-001-03-390.pdf

Dierdorff, E. C., Norton, J. ., Gregory, C. M., Rivkin, D., & Lewis, P. (2011). *Greening of the world of work: Revisiting occupational consequences*. National Center for O*NET Development; U.S. Department of Labor. https://www.onetcenter.org/dl_files/Green2.pdf

Dream.Org. (n.d.). *Green for all*. https://dream.org/green-for-all/

EcoRise. (n.d.). *Mapping K-12 environmental education programs*. https://www.ecorise.org/our-work/gen-thrive/

Edelman, D. (2021). *Who will get all the new green jobs? Equitable workforce development policy for a changing climate*. Next100. https://thenext100.org/wp-content/uploads/pdf_greenjobsa_next100_FINAL.pdf

Environmental Justice Leadership Forum. (2020). *Green jobs report: Creating a green workforce: Community-based solutions for a diverse green jobs sector*. https://www.weact.org/wp-content/uploads/2020/12/FINAL-2_Green-Jobs-Report_Full-Report-Full-View.pdf

Escobari, M., Seyal, I., & Meaney, M. (2019). *Realism about reskilling: Upgrading the career prospects of America's low-wage workers*. Brookings. https://www.brookings.edu/wp-content/uploads/2019/01/Realism-About-Reskilling-Final-Report.pdf

Evans, M. (2022b, August 19). *Inflation Reduction Act: Limited funding for workforce, but not enough. National* Skills Coalition. https://nationalskillscoalition.org/blog/news/inflation-reduction-act-limited-funding-for-workforce-but-not-enough/

Evans, M. (2022a, June 7). *The Bipartisan Infrastructure Law: What state skills advocates need to know to influence implementation of transportation dollars to meet community skills needs*. National Skills Coalition. https://nationalskillscoalition.org/blog/inclusive-recovery/infrastructure/the-bipartisan-infrastructure-law-what-state-skills-advocates-need-to-know-to-influence-implementation-of-transportation-dollars-to-meet-community-skills-needs/

Even, T. L., Trott, C. D., Gray, E. S., Roncker, J., Basaraba, A., Harrison, T., Petersen, S., Sullivan, S., & Revis, S. (2021). *Climate equity indicators report - 2021, city of Cincinnati. The American cities climate challenge equity capacity building fund*. Bloomberg Foundation. https://www.cincinnati-oh.gov/sites/oes/assets/File/Climate%20Equity%20Indicators%20Report_2021.pdf

Exec. Order No. 14008, 86 FR 7619, 7619–7633 (2021). https://www.govinfo.gov/content/pkg/FR-2021-02-01/pdf/2021-02177.pdf

Executive Office of the President. (2021, July 20). *Interim implementation guidance for the Justice40 Initiative* (M-21-28). Office of Management and Budget. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf

Gloor, J. L., Mestre, E. B., Post, C., & Ruigrok, W. (2022). We can't fight climate change without fighting for gender equity. *Harvard Business Review*. https://hbr.org/2022/07/we-cant-fight-climate-change-without-fighting-for-gender-equity

Gordon, L. (2019, December 19). *Too far away: Distance is a barrier to bachelor's degrees for rural community college students*. EdSource. https://edsource.org/2019/too-far-away-distance-is-a-barrier-to-bachelors-degrees-for-rural-community-college-students/621189

Green 2.0. (2022). *2022 NGO and foundation transparency report card*. https://diversegreen.org/wp-content/uploads/2023/03/2022-ngo-foundation-transparency-report-card.pdf

Gurley, L. K. (2022). *Shifting America to solar power is a grueling, low-paid job*. Vice. https://www.vice.com/en/article/z34eyx/shifting-america-to-solar-power-is-a-grueling-low-paid-job
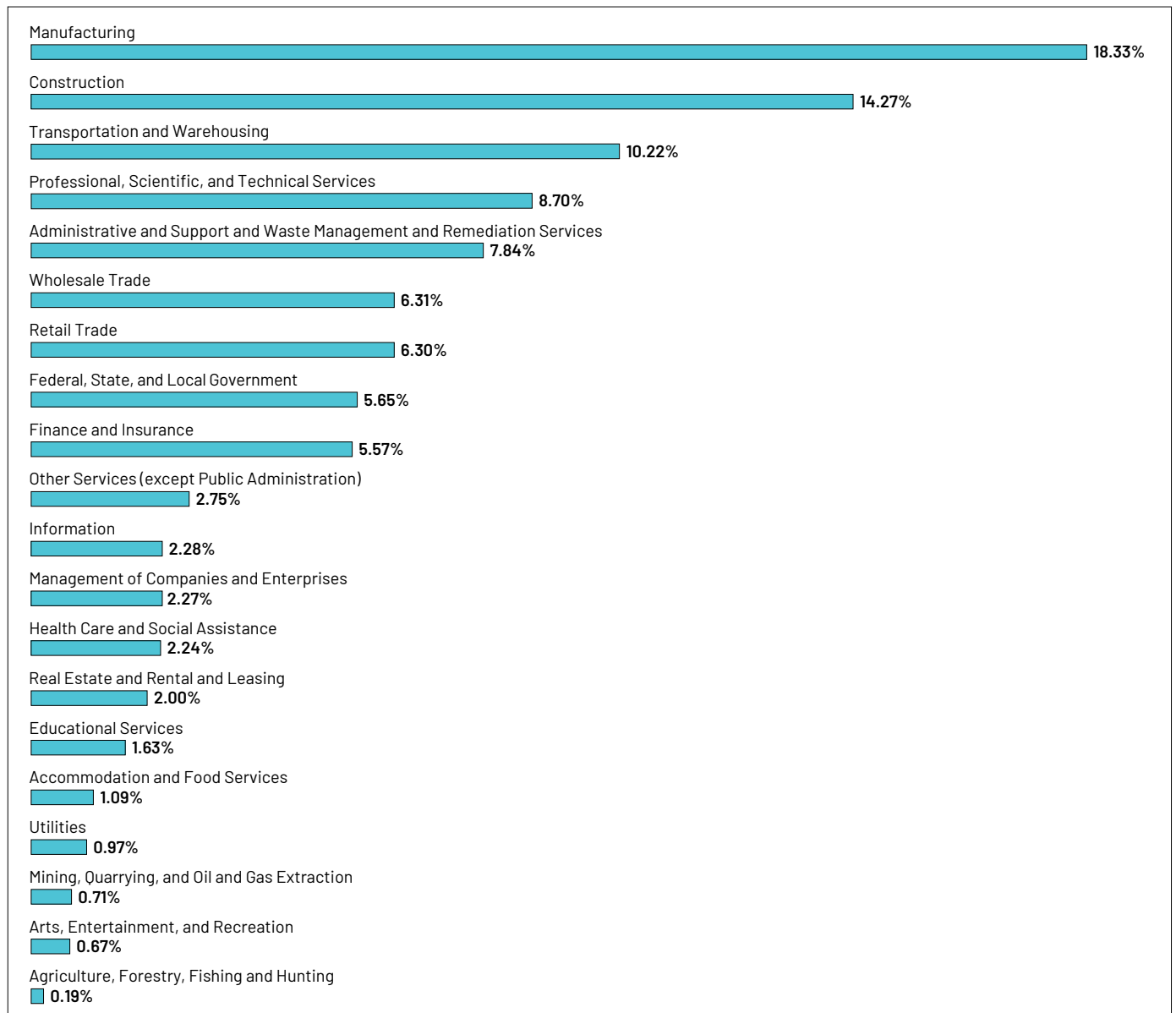
Hausfather, Z. (2019). *Analysis: Why children must emit eight times less CO2 than their grandparents.* Carbon Brief. https://www.carbonbrief.org/analysis-why-children-must-emit-eight-times-less-co2-than-their-grandparents/

Hillman, N. W. (2016). Geography of college opportunity: The case of education deserts. *American Educational Research Journal, 53*(4), 987–1021. https://doi.org/10.3102/0002831216653204

Holthaus, E. (2020). Why climate change is a civil rights battle. *The Correspondent.* https://thecorrespondent.com/539/why-climate-change-is-a-civil-rights-battle

Jennings, S. (2023). WE ACT addresses inequity for BIPOC communities in Justice40 Initiative Memo. *Environmental Leader.* https://www.environmentalleader.com/2023/02/we-act-addresses-inequity-for-bipoc-communities-in-justice40-initiative-memo/

Kinol, A., Miller, E., Axtell, H., Hirschfeld, I., Leggett, S., Si, Yutong, & Stephens, J.C. (2023). *Climate justice in higher education: A proposed paradigm shift towards a transformative role for colleges and universities.* Climatic Change, 176: 15. https://doi.org/10.1007/s10584-023-03486-4

Kwauk, C., & Casey, O. (2021). *A new green learning agenda: Approaches to quality education for climate action.* Brookings. https://www.brookings.edu/research/a-new-green-learning-agenda-approaches-to-quality-education-for-climate-action/

Kwauk, C., & Casey, O. (2022). A green skills framework for climate action, gender empowerment, and climate justice. *Development Policy Review, 40*(S2), e12624. https://doi.org/10.1111/dpr.12624

Kwauk, C. , & Kane, J. W. (2021). *Empowering the U.S. Global Change Research Program to further climate education and training.* Brookings. https://www.brookings.edu/research/empowering-the-us-global-change-research-program-to-further-climate-education-and-training/

Laughland, O. (2021). Cancer Alley Activists Score a Win Against Giant Plastics Conglomerate. *Mother Jones.* https://www.motherjones.com/environment/2021/08/environmental-justice-cancer-alley-activist-win-delay-louisiana-formosa-plastics-plant/

Marcus, R. (2021). *Reducing gender inequalities in science, technology, engineering and maths.* ODI. https://odi.org/en/insights/reducing-gender-inequalities-in-science-technology-engineering-and-maths/

Moffatt, M., & Khan, S. (2022). *Retraining workers will be essential for our net-zero goals.* https://policyoptions.irpp.org/magazines/retraining-workers-net-zero-economy/

Mundaca, L., & Richter, J. L. (2015). Assessing 'green energy economy' stimulus packages: Evidence from the U.S. programs targeting renewable energy. *Renewable and Sustainable Energy Reviews, 42,* 1174–1186. https://doi.org/10.1016/j.rser.2014.10.060

National Center for Education Statistics. (n.d.a). *Integrated postsecondary education data system.* Department of Education. https://nces.ed.gov/ipeds/datacenter/DataFiles.aspx?gotoReportId=7&fromIpeds=true

National Center for Education Statistics. U.S. Department of Education. (n.d.b). *Lists of postsecondary institutions enrolling populations with significant percentages of undergraduate minority students.* Department of Education. https://nces.ed.gov/programs/digest/d21/tables/dt21_317.20.asp?current=yes

Novello, A., & Carlock, G. (2019). *Redefining green jobs for a sustainable economy.* The Century Foundation. https://tcf.org/content/report/redefining-green-jobs-sustainable-economy/

Office of Management and Budget. (2021). *Interim implementation guidance for the Justice40 Initiative.* The White House. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf

O*NET OnLine. (n.d.). https://www.onetonline.org/

Palladino, L., & Gunn-Wright, R. (2021, April). *Care and climate: Understanding the policy intersections. A Feminist Green New Deal Coalition brief.* Feminist Green New Deal Coalition. https://feministgreennewdeal.com/wp-content/uploads/2021/04/FemGND-IssueBrief-Draft7-Apr15.pdf

Patrinos, H. A., & Macdonald, K. (2022). *Education quality, green technology and the economic impact of carbon pricing.* SSRN. https://ssrn.com/abstract=4222093

Pollin, R., Lala, C., & Chakraborty, S. (2022). *Job creation estimates through proposed Inflation Reduction Act.* Political Economy Research Institute. https://peri.umass.edu/publication/item/1633-job-creation-estimates-through-proposed-inflation-reduction-act

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*, 27321. https://www.nber.org/papers/w27321

Price, D .V., & Curtis, D. (2018, March). *Overcoming transportation barriers to improve postsecondary student success* [Brief]. DVP-Praxis. https://www.dvp-praxis.org/wp-content/uploads/2018/02/Kresge-Higher-Education-and-Transportation-Brief.pdf

Rutgers: Center for MSIs. (2020). *List of minority serving institutions January 2020.* https://cmsi.gse.rut gers.edu/sites/default/files/MSI%20List.pdf

Sablosky E., K., Dorrance, J., Martinez, A., Foxen, P., & Mihas, P. (2021). *Dreams interrupted: A mixed-methods research project exploring Latino college completion.* University of North Carolina at Chapel Hill; UNIDOS U.S. https://www.unidosus.org/wp-content/uploads/2021/09/unidosus_unc_dreaminterrupted.pdf

Scully-Russ, E. (2013). The dual promise of green jobs: A qualitative study of federally funded energy training programmes in the U.S.A. *European Journal of Training and Development, 37*(3), 257–272. https://doi.org/10.1108/03090591311312732

Seed Center. (n.d.). *Member directory.* https://theseedcenter.org/membership/member-directory/

Simmons, D. (2020). Why climate change is a civil rights battle. *The Correspondent.* https://thecorrespondent.com/539/why-climate-change-is-a-civil-rights-battle.

UNESCO/UNFCCC. (2016). *Action for climate empowerment: Guidelines for accelerating solutions through education, training, and public awareness.* https://unesdoc.unesco.org/ark:/48223/pf0000246435

U.S. Department of Education. (n.d.). *Lists of ostsecondary institutions enrolling peopulations with significant percentages of undergraduate minority students.* https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html

Vona, F., Marin, G. & Consoli, D. (2019). Measures, drivers and effects of green employment: Evidence from U.S. local labor markets, 2006-2014. Journal of Economic *Geography, 19*(5), 1021–1048. https://doi.org/10.1093/jeg/lby038

White House Environmental Justice Advisory Council. (2021, May 21*). Final recommendations: Justice40 Climate and Economic Justice Screening Tool & Executive Order 12898 Revisions.* https://www.epa.gov/sites/default/files/2021-05/documents/whiteh2.pdf

Whyte, K. (2020). Too late for indigenous climate justice: Ecological and relational tipping points. *WIRES Climate Change, 11*(1), e603. https://doi.org/10.1002/wcc.603

Williams, M., Zhavoronkova, M., & Madland, D. (2022). *The Inflation Reduction Act provides pathways to high-quality jobs.* Center for American Progress. https://www.americanprogress.org/article/the-inflation-reduction-act-provides-pathways-to-high-quality-jobs/

Young, S., Mallory, B., & McCarthy G. (2021, July 20). *The path to achieving Justice40.* https://www.whitehouse.gov/omb/briefing-room/2021/07/20/the-path-to-achieving-justice40/

Zhavoronkova, M., Khattar, R., & Brady, M. (2022). *Occupational segregation in America.* Center for American Progress. https://www.americanprogress.org/article/occupational-segregation-in-america/

Annex A: Supplementary Materials

Figure 17. Sectoral Composition of U.S. Green Employment, 2021

Sector	Percentage
Manufacturing	18.33%
Construction	14.27%
Transportation and Warehousing	10.22%
Professional, Scientific, and Technical Services	8.70%
Administrative and Support and Waste Management and Remediation Services	7.84%
Wholesale Trade	6.31%
Retail Trade	6.30%
Federal, State, and Local Government	5.65%
Finance and Insurance	5.57%
Other Services (except Public Administration)	2.75%
Information	2.28%
Management of Companies and Enterprises	2.27%
Health Care and Social Assistance	2.24%
Real Estate and Rental and Leasing	2.00%
Educational Services	1.63%
Accommodation and Food Services	1.09%
Utilities	0.97%
Mining, Quarrying, and Oil and Gas Extraction	0.71%
Arts, Entertainment, and Recreation	0.67%
Agriculture, Forestry, Fishing and Hunting	0.19%

*excluding state and local schools and hospitals and the U.S. Postal Service (OEWS Designation)

Figure 18. Typical Education and Experience Needed to Enter Any of the 80 Green Bright Outlook Occupations, 2021

None

Postsecondary nondegree award
`██` 2

No formal educational credential
`███` 4

Master's degree
`█` 1

High school diploma or equivalent
`██████████` 12

Bachelor's degree
`████████████████████████████████████` 34

Associate's degree
`███████` 8

Less than 5 years

High school diploma or equivalent
`█` 1

Bachelor's degree
`█████` 6

5 years or more

High school diploma or equivalent
`██` 3

Bachelor's degree
`███████` 8

Note: "None" refers to zero years of experience.

Table 5. Participation in Green occupation Group, by Gender, Race, and Median Annual Wage (% and U.S.D)

MAJOR OCCUPATION	MEDIAN ANNUAL WAGE	FEMALE (%)	ASIAN (%)	BLACK OR AFRICAN AMERICAN (%)	HISPANIC OR LATINO (%)	WHITE (%)
MANAGEMENT	121,931.3	30.0	7.5	7.7	10.6	82.2
COMPUTER AND MATHEMATICAL	104,740	31.1	26.6	10.5	7.7	60.3
ARCHITECTURE AND ENGINEERING	88,090.5	18.3	13.9	6.2	10.5	76.8
BUSINESS AND FINANCIAL OPERATIONS	81,112.9	50.7	6.1	11.0	11.5	79.6
SALES AND RELATED	78,875	29.7	7.5	6.4	11.1	84.0
LIFE, PHYSICAL, AND SOCIAL SCIENCE	76,651.3	47.3	13.4	6.9	7.6	75.8
PRODUCTION	62,135	34.1	7.6	18.5	21.9	70.2
CONSTRUCTION AND EXTRACTION	52,461.4	5.1	2.2	7.2	27.8	87.5
INSTALLATION, MAINTENANCE, AND REPAIR	50,462.5	5.1	3.0	7.5	20.3	86.3
OFFICE AND ADMINISTRATIVE SUPPORT	41,915	64.8	5.4	18.5	19.7	71.8
TRANSPORTATION AND MATERIAL MOVING	41,405	19.5	3.8	18.3	23.3	73.1
COMPOSITION OF LABOR FORCE		**50.0**	**6.0**	**13.0**	**17.0**	**77.0**

Table 6. New and Emerging Green Bright Outlook Occupations With Projected Growth of at Least 10% and/or Job Openings of at Least 100,000 Between 2021–2031

BRIGHT OUTLOOK OCCUPATION	GROW 10% (%)	OPEN > 100K	MEDIAN ANNUAL WAGE, 2021 (DOLLARS)	TYPICAL EDUCATION NEEDED FOR ENTRY	FEMALE (%)	ASIAN (%)	BLACK OR AFRICAN AMERICAN (%)	HISPANIC OR LATINO (%)	WHITE (%)
MANAGEMENT	0 (A)	6 (B)							
Regulatory Affairs Managers		113.1	124,650	Bachelor's degree	36.4	6.5	8.6	11.5	82.1
Wind Energy Operations Managers		113.1	124,650	Bachelor's degree	36.4	6.5	8.6	11.5	82.1
Wind Energy Development Managers		113.1	124,650	Bachelor's degree	36.4	6.5	8.6	11.5	82.1
Compliance Managers		113.1	124,650	Bachelor's degree	36.4	6.5	8.6	11.5	82.1
Brownfield Redevelopment Specialists and Site Managers		113.1	124,650	Bachelor's degree	36.4	6.5	8.6	11.5	82.1
General and Operations Managers		300.4	97,970	Bachelor's degree	36.4	4.6	9.3	10.3	82.7
COMPUTER AND MATHEMATICAL	3 (A)	1 (B)							
Software Developers	26.0	143.4	120,730	Bachelor's degree	19.7	37.1	5.4	5.8	54.7
Geographic Information Systems Technologies and Technicians	10.1		95,270	Bachelor's degree	27.2	15.0	11.9	11.5	70.4
Software Quality Assurance Analysts and Testers	20.8		98,220	Bachelor's degree	46.5	27.6	14.1	5.7	55.9
ARCHITECTURE AND ENGINEERING	4 (A)	0 (B)							
Chemical Engineers	13.9		105,550	Bachelor's degree	12.8	13.0	1.3	9.3	84.5
Industrial Engineers	10.2		95,300	Bachelor's degree	26.0	16.2	5.1	5.1	75.8
Validation Engineers	10.2		95,300	Bachelor's degree	26.0	16.2	5.1	5.1	75.8
Manufacturing Engineers	10.2		95,300	Bachelor's degree	26.0	16.2	5.1	5.1	75.8
BUSINESS AND FINANCIAL OPERATIONS	3 (A)	1 (B)							
Personal Financial Advisors	15.4		94,170	Bachelor's degree	33.8	7.5	7.3	7.7	82.2

BRIGHT OUTLOOK OCCUPATION	GROW 10% (%)	OPEN > 100K	MEDIAN ANNUAL WAGE, 2021 (DOLLARS)	TYPICAL EDUCATION NEEDED FOR ENTRY	FEMALE (%)	ASIAN (%)	BLACK OR AFRICAN AMERICAN (%)	HISPANIC OR LATINO (%)	WHITE (%)
Logistics Engineers	27.7		77,030	Bachelor's degree	39.3	4.9	13.4	10.2	80.3
Logistics Analysts	27.7		77,030	Bachelor's degree	39.3	4.9	13.4	10.2	80.3
Sustainability Specialists		114.2	74,670	Bachelor's degree	59.2	8.6	13.5	10.7	74.1
SALES AND RELATED	1 (A)	0 (B)							
Securities, Commodities, and Financial Services Sales Agents	10.2		62,910	Bachelor's degree	29.3	11.7	6.6	10.2	79.9
PRODUCTION	0 (A)	1 (B)							
Team Assemblers		142.7	36,590	High school diploma or equivalent	34.1	7.6	18.5	21.9	70.2
CONSTRUCTION AND EXTRACTION	2 (A)	1 (B)							
Service Unit Operators, Oil and Gas	17.5		48,410	No formal education credential	N/A	N/A	N/A	N/A	N/A
Solar Photovoltaic Installers	27.2		47,670	High school diploma or equivalent	5.8(*)	5.8(*)	15.8(*)	36.3(*)	35.3(*)
Construction Laborers		143.2	37,770	No formal education credential	4.5	2.6	8.1	48.9	84.8
INSTALLATION, MAINTENANCE, AND REPAIR	2 (A)	1 (B)							
Wind Turbine Service Technicians	44.3		56,260	Postsecondary nondegree award	2.7(*)	3.0(*)	9.0(*)	21.5(*)	60.3(*)
Industrial Machinery Mechanics	16.4		59,840	High school diploma or equivalent	5.1	3.4	6.1	19.6	87.9
Maintenance and Repair Workers, General		160.1	43,180	High school diploma or equivalent	5.1	2.5	8.8	21.0	84.6
OFFICE AND ADMINISTRATIVE SUPPORT	0 (A)	1 (B)							
Customer Service Representatives		389.4	36,920	High school diploma or equivalent	64.8	5.4	18.5	19.7	71.8

BRIGHT OUTLOOK OCCUPATION	GROW 10% (%)	OPEN > 100K	MEDIAN ANNUAL WAGE, 2021 (DOLLARS)	TYPICAL EDUCATION NEEDED FOR ENTRY	FEMALE (%)	ASIAN (%)	BLACK OR AFRICAN AMERICAN (%)	HISPANIC OR LATINO (%)	WHITE (%)
TRANSPORTATION AND MATERIAL MOVING	O (A)	3 (B)							
Heavy and Tractor-Trailer Truck Drivers		259.9	48,310	Post-secondary non-degree award	7.9	3.8	18.7	23.6	74.0
Recycling and Reclamation Workers		421.9	31,230	No formal education credential	22.9	3.5	20.1	24.1	71.4
Laborers and Freight, Stock, and Material Movers, Hand		421.9	31,230	No formal education credential	22.9	3.5	20.1	24.1	71.4

Note: Occupation groups are classified by the 2018 Standard Occupational Classification and Coding Structure. The occupations in the SOC (not bolded rows) are classified at four levels of aggregation with the major group/occupation group (in bold) being aggregated at the highest level. Of these 29 occupations, Management is expected to host 6 of the 15 green occupations with at least 100,000 or more job openings (Open 100k), and Architecture and Engineering are expected to host 4 of the 15 fastest-growing green occupations (Grow 10%). Computer and Mathematical as well as Business and Financial Operations are expected to each host 4 of the most in-demand green jobs. Software Developers, a Computer and Mathematical occupation, is expected to both grow more than 10% and to have more than 100,000 job openings over the next decade. (A) The value contains the total count of occupations that have a growth greater than 10%. (B) The value contains the total count of occupations that have at least 100,000 or more job openings.(NA) Demographic data does not exist for this occupation within the CPS 2021 data. (*) Data source for Solar Photovoltaic Installers from Zippia https://www.zippia.com/solar-installer-pv-jobs/demographics; data source for Wind Turbine Service Technicians from Zippia https://www.zippia.com/wind-turbine-technician-jobs/demographics; all other data from various data sources including BLS, CPS, National Center for Education Statistics (NCES).

Annex B:
Technical Notes

Estimating the green jobs gap

Many researchers have attempted to estimate the size of the green economy in the U.S. with the intention of informing workforce development stakeholders on the education and training needs of key growth occupations (Vona et al., 2019; Bowen et al., 2018, Bergant et al., 2022). But few, to our knowledge, have attempted to provide guidance on the implications for equity and inclusion that could help decision-makers understand the scope of the green skills gap among historically marginalized communities and thus the extent to which investments must be targeted at creating more inclusive and diverse green learning opportunities.

To better analyze green job growth and skills transformation, the BLS has categorized green jobs into 3 classifications of occupations. These classifications can be thought of according to how green transitions and the deployment of green technologies might impact their demand based on their occupational tasks. These green job classifications also have implications for postsecondary education and training, as the job classification indicates what may happen to the skills required of workers in this job and, hence, their educational qualifications and/or training certifications (Dierdoff et al., 2011).

Table 7. Green Job Classifications and Their Skills Implications

GREEN JOB CLASSIFICATION	SKILLS IMPLICATION
INCREASED DEMAND (ID)	These are existing occupations that may not necessarily be green but will nonetheless see an increase in demand because their occupational tasks will be needed in greater quantities in a growing green economy. The jobs and their tasks will likely stay the same; thus, no new skills (or education or training) will likely be required. *Examples: Customer Service Representatives; Electricians; Hydrologists; Occupational Health and Safety Specialists; Power Distributors and Dispatchers; Refrigeration Mechanics and Installers; Software Developers, Systems Software; Welders, Cutters, and Welder Fitters*
ENHANCED SKILL (ES)	These are also existing occupations for which the nature of their occupational tasks are significantly altered in the context of green transitions and/or the deployment of green technologies. While the purpose or function of these jobs may remain the same, they will require a significant degree of re-skilling or up-skilling in a green economy and may require new credentials as a result. *Examples: Agricultural Technicians; Bus and Truck Mechanics; Construction Laborers; Financial Analysts; Hazardous Materials Removal Workers; Landscape Architects; Marketing Managers; Public Relations Specialists; Roofers; Transportation Managers; Urban and Regional Planners*

GREEN JOB CLASSIFICATION	SKILLS IMPLICATION
NEW AND EMERGING (NE)	These are new occupations that emerge as a result of green transitions requiring new and unique work. These jobs can be either entirely novel or derived from an existing job. They will require new skills and/or a new blend of skills. *Examples: Air Quality Control Specialists; Brownfield Redevelopment Specialists and Site Managers; Carbon Capture and Sequestration Systems Installers; Climate Change Analysts, Fuel Cell Technicians; Solar Photovoltaic Installers; Wind Turbine Service Technicians*

Estimates of the size of the green workforce vary by the methodology deployed ranging from 19.4% in ONET/BLS and Bowen et al. (2018) and around 2–3% in Vona et al. (2018). ONET/BLS's approach counts the number of jobs in the three types of jobs associated with the greening process of the economy and the world of work, as noted above in Table 7. On the other hand, Popp et al. 's approach provides a more conservative estimate by excluding a) jobs in green increased demand occupations and b) jobs with less concentration of green tasks (i.e., those below 75 percentile) as a share of total tasks a given worker is expected to perform. We adopted Bowen et al.'s (2018) approach to calculate national green employment and estimate that green occupations currently constitute 23.7% (or approximately 33 million of 140 million) jobs in the U.S. in 2021.

We used the national employment data from the Occupational Employment and Wage Statistics (OEWS) database maintained by BLS and ONET's occupational classification, adopted from ONET's Green Task Development Project, to identify and estimate green employment in the three subcategories of green occupations (green enhanced skill, green new and emerging, and green increased demand). Specifically, employment statistics were disaggregated by NAICS industries for the year 2021.[31]

Since employment statistics from the OEWS database are at the 6-digit level but the green classified occupations are defined at the 8-digit level ONET classification, a green weight was assigned to each 6-digit SOC occupation. This weight was defined as the total number of green occupations among the all occupations within a single 6-digit SOC occupation. Later the weight was applied to the total employment reported at the 6-digit SOC level. It is important to note that since some 6-digit SOC occupations contain more than one occupation within them, we assumed an equal distribution of workers across all specific occupations within each 6-digit SOC occupation. Green employment by the three subcategories was also calculated using the same method and assumptions used to calculate green employment.

To expand on Bowen's approach, an example is provided on the calculation of green employment for a single 6-digit SOC occupation. In this occupation, the broad occupation 'Chief Executives' (SOC code 11-1011) consists of two specific occupations: Chief Executives (ONET-SOC code 11-1011.00), and Chief Sustainability Officers (ONET-SOC code 11-1011.03). Since Chief Sustainability Officer is a green job but the Chief Executive is a non-green job, our estimate of green employment in this broad occupation is half of the total employment in (SOC 11-1011). As a second example, the broad occupation 'Industrial Production Managers' (SOC code 11-3051) consists of six 8-digit occupations: Industrial Production Managers (ONET-SOC code 11-3051.00), Quality Control Systems Managers (ONET-SOC code 11-3051.01), Geothermal Production Managers (ONET-SOC code 11-3051.02), Biofuels Production Managers (ONET-SOC code 11-3051.03), Biomass Power Plant Managers (11-3051.04), and Hydroelectric Production Managers (ONET-SOC 11-3051.06). Since five of the six occupations are considered green jobs, except for Quality Control Systems Managers (ONET-SOC code 11-3051.01), our estimate of green employment in this broad occupation is five-sixths of the total employment in 11-3051.

To calculate the share of green employment by gender and race, labor force statistics from the Current Population Survey (CPS) annual household data for the year 2021 were used (Bureau of Labor Statistics, n.d.). In this exercise, total employment for each 6-digit SOC occupation was multiplied by the green weights calculated in the previous exercise. This value was then multiplied by the demographic weights of females and various races found in the CPS data. The numbers displayed in Figures 1 and 2 are all aggregated to the total green employment in the U.S. It was found that the green economy at present is majority White (approximately 80%) and male (75%). It is important to note that the CPS data is household survey data so it cannot be used to estimate the exact value of green employment, which is why all figures and tables are displayed in percent values.

Analyzing the green skills gap

To make an argument about the importance of investing in education for historically marginalized communities, we used as a proxy the number of awards/degrees conferred during July 2020–June 2021 of historically marginalized populations in the fields of study required by green occupations.

In our analysis, National Center for Education Statistics (NCES)(n.d.a,) completions data (the awards/degrees conferred) was mapped to BLS-identified green occupations using a crosswalk between the field of study and occupations.[32] By merging completions data with green occupations, we combined demographic data from the CPS data source to discuss racial, age, and gender distribution of green skills.

It is important to caveat that estimating the green skills gap using degrees conferred is imperfect. Many factors influence what job a graduate secures upon completing an education or training program. And for those individuals receiving a degree in a field of study that could lead them to a specific green job, it remains unknown whether those who end up taking a different career path than the green job associated with their degree are finding another green job or entering a nongreen job. For instance, does an African American female with a degree in green construction eventually go into a related green field if not into green construction specifically? Nonetheless, this approach provides a valuable proxy for understanding green skills gaps among historically marginalized communities that may further impede their representation and participation in green jobs, making a just transition harder to achieve.

Developing the green learning opportunities database

To our knowledge, there does not exist a comprehensive database of green learning opportunities in the United States, especially one that takes an unconventional, transformative view of green skills and green jobs.[33] This lack of information means postsecondary institution leaders and education decision-makers do not have a full picture of the extent of education and training available and/or needed for a just transition to be achievable.

In response, we developed the Green Learning Opportunities Database of degree- or certificate-awarding education and training programs offered by postsecondary institutions in the U.S. These programs aim to develop a suite of skills, within a breadth of green skills framework, to enable learners to acquire jobs in the green economy. The database is free and available to the public. The database includes information on green learning opportunities by type of program, delivery institution, geographic location, populations reached (including an indication of whether marginalized populations are targeted), and type of green skills and sectors targeted. The database also includes the affordability and availability of financial aid and other relevant indicators that can aid in the analysis of the accessibility of diverse green learning opportunities, especially among historically marginalized communities.

In the Green Learning Opportunities Database, we have identified a nonexhaustive list of approximately 1,200 green learning programs across nearly 500 institutions or initiatives, including 470 postsecondary institutions and 20 nongovernmental organizations (NGOs), across all 50 states, the District of Columbia, Guam, and Puerto Rico. Of the nearly 470 postsecondary institutions, nearly 70 are minority serving institutions according to the U.S. Department of Education's Office of Postsecondary Education (National Center for Education Statistics [NCES], n.d.b.).

Representing at least 10% of postsecondary institutions per state, the majority of green learning opportunities identified in this pilot stage are in traditional green sectors and/or green fields of study, like environmental engineering, environmental science, and agricultural science. Of the nearly 500 institutions and initiatives included, less than 100 (or less than 25%) offer programs in the education and/or health sector, including fields like environmental education, education for sustainability, climate change and public health, or environmental services in healthcare.

We followed a series of steps and protocols to develop the Green Learning Opportunities Database. The first step included consulting existing public databases of green jobs/skills training programs at the federal and state level. Once we identified in these databases which institutions offered green programs with certificates or awards, we searched these institutions for references to other green learning opportunities offered by other postsecondary institutions, NGOs, or government agencies.

In the second phase, we searched via professional organizations by sector (energy, water, electricity, etc.), workforce development organizations, and sustainable education networks. Then we looked into

reviews and rankings of "green colleges" to identify which offered green learning opportunities.

A third phase helped to ensure all states were represented. We used data from the National Center for Education Statistics (n.d.b.) to calculate the total number of postsecondary institutions per state, and then followed several steps to search for at least 10% of postsecondary institutions per state to include in the Green Learning Opportunities Database. We organized our search around three major sources: the List of Minority Serving Institutions, the SEED database, and the ONET database of training opportunities

(Rutgers, 2020; Seed Center, n.d.; O*NET OnLine, n.d.). If we did not achieve 10% by checking the first source, we went to the second and third sources until we achieved 10% representation for each state. For those states where this multisource approach did not result in any green learning opportunities, we conducted a state-specific search of postsecondary institutions. See below for a list of sources consulted.

We did not include a targeted search of online-only green learning opportunities, although some online and hybrid programs are included in the database.

Table 8. Sources Reviewed

TYPE OF SOURCE	NAME OF SOURCE
GOVERNMENT AGENCIES	North American Association for Environmental Education (NAAEE)
	National Oceanic Atmospheric Administration (NOAA)/ NOAA Sea Grant
	Environmental Protection Agency EPA
	Department of Education
	Department of Labor
	Department of Energy
	Workforce DC Energy
	Philadelphia Energy Authority
	New York State Energy Research and Development Authority (NYSERDA)
	National Center for Educational Statistics
	Department of Labor Federal Database-U.S. Federal Climate Program Inventory
	Data.gov
PRIVATE SECTOR (SECTOR-SPECIFIC PROFESSIONAL ASSOCIATIONS)	U.S. Green Power Association
	U.S. Green Building Council
	Sustainable Energy Action Committee
	Interstate Renewable Energy Council (IREC)
	National Fire Protection Association
	National Electrical Contractors Association
	The Green Program
	International Brotherhood of Electrical Workers and National Electrical Contractors Association
	The Green Business Certification Inc. (GBCI)
	The National Ready Mixed Concrete Association
	North American Board of Certified Energy Practitioners, Inc. (NABCEP)

TYPE OF SOURCE	NAME OF SOURCE
WORKFORCE DEVELOPMENT ORGANIZATIONS	Employment Connection
	Green Collar Blog
	Work Ready Kentucky
	Marc Regional Green Jobs
	Sustainable Energy Jobs Platform
	National Council for Workforce Education (NCWE)
EDUCATION COALITIONS	Second Nature (including Briscoe, Madray, & Valletta, 2023)
	American Association of Community Colleges
	National Environmental Education Foundation (NEEF)
	Association for the Advancement of Sustainability in Higher Education (AASHE)
	The Washington-Saratoga-Warren-Hamilton-Essex (WSWHE) Board of Cooperatives
	University of Hawai'i Community Colleges
	Power Corps PHL/Education Works
	The U.S. Partnership for Education for Sustainable Development
	The Higher Education Associations Sustainability Consortium (HEASC)
	Generic Green Skills for TVET Teaching for Learning Resources
	American Association of State Colleges & Universities (AASCU)
	The SEED Center
	The U.S. Partnership for Education for Sustainable Development
EDUCATION REVIEWS	Princeton Review
	Chron.com List of Training Programs for Green Jobs
INTERNATIONAL AGENCIES	United Nations Institute for Training and Research
NGOS	EcoRise
	Post Carbon Institute
	Mile High Youth Corps
	Race to Zero: A Global Initiative for a Zero-Carbon World

Table 9. Inclusion and Exclusion Criteria for the Green Learning Opportunities Database

INCLUSION CRITERIA
• Programs that offer a degree or certificate in a green jobs sector
• Programs that, even if they do not offer a degree or certificate, explicitly prepare/train people for a green job by developing job-specific green skills
• Programs that teach environmental health as well as the impacts of environmental pollutants and toxins on the health of the soil, water, animals, and humans
• Programs aimed at preparing teachers to teach subject areas that contribute to mitigation or to reducing environmental impacts (e.g., renewable energy electrician trainer)
• Programs aimed at training the education workforce (e.g., teachers or teacher trainers/educators) of any grade level in any subject to teach sustainability or through a sustainability approach

EXCLUSION CRITERIA
• Short-term workshops and short courses that do not give a certificate or degree or lead directly to a green job
• Webinars or seminars
• Training centers that do not offer a program description on their website
• Research programs, research awards, research fellowships
• Funding or grants for training programs or to deliver workshops
• Resource guides and articles that provide information about climate change, sustainability, and green jobs, including resources on how to teach subjects related to sustainability, climate change, and environmental sciences
• General programs related to K12 education or K12 teachers

Mapping the green learning opportunities gap

In this preliminary attempt to highlight green learning opportunity deserts or bright spots, the Green Learning Opportunity Database, along with their addresses and geographic coordinates, was used to single out degree- or certificate-awarding education and training programs offered by postsecondary institutions (PSI) in the three case study states, Hawai'i, Illinois, and Kentucky. For this analysis, EPA's EJScreen data, downloaded in May 2022, was used to locate/identify disadvantaged communities within commuting distance to the green learning opportunities (Council on Environmental Quality, n.d.).

To conduct this analysis, there were several steps taken. First, PSIs were located on a map using the geographic information software, ArcGIS. Second, the number of EPA-defined disadvantaged communities within a 10-mile radius of the locations was counted and weighted for the total size (i.e. area) of the census

tracts identified as a disadvantaged communities.[34] Third, a heat map was applied to the map to display the density of locations weighted by the number of EPA-defined disadvantaged communities divided by the total size of the census tract.

Due to the non-exhaustive nature of the Green Learning Opportunity Database, some limitations existed in this preliminary analysis. First, due to the small number of PSIs per state, the preliminary analysis of each state had minimal density difference on the maps of Hawai'i, Illinois, and Kentucky. By further expanding this database, this issue can be resolved. Second, due to the preliminary nature of the database, our analysis of the green learning opportunities gaps uses the PSI/green learning opportunity as the point of reference rather than the disadvantaged communities. Similar to the first issue, completion of the database can strengthen the gaps analysis by using the disadvantaged community or clusters of disadvantaged communities as the point of reference.

Endnotes

1　Importantly, the discussion around a "green" economy and the skills and learning opportunities that entails do not exclude the priorities, mindsets, or experiences of communities for whom a "blue" economy—one centered on marine-based economies rather than land-based economies—take precedence. In this way, "green" and "blue" can be used interchangeably in this report, but would need to be more precisely articulated in practice.

2　The emissions gap is the difference between the projected level of greenhouse gas emissions and the level of emissions needed to achieve the 1.5° Celsius target of the Paris Agreement.

3　The Infrastructure Investment and Jobs Act (IIJA) is also known as the Bipartisan Infrastructure Law (BIL). We will use IIJA throughout this report.

4　In this report, we use the term "historically marginalized and disadvantaged communities" to refer to the White House Environmental Justice Advisory Council's definition of "disadvantaged communities," "community of color," environmental justice community," and "low-income community." (See WHEJAC Final Recommendations: https://www.epa.gov/sites/default/files/2021-05/documents/whiteh2.pdf).

5　While state-level and municipality-level climate policy also plays a critical role in the U.S. policy landscape, this analysis focuses specifically on federal-level policies and initiatives.

6　The uncertainty behind this estimation lies in the fact that education and training—or more precisely, workforce development—is often tucked inside or lumped together with other provisions, making it difficult to discern the specific amount allocated to it.

7　While there is no explicit reference to education and training, the Environmental and Climate Justice Block Grants have been included as a provision for education and training because community-driven efforts to build climate resilience could include green learning opportunities and/or green workforce development initiatives. Education and training in the context of workforce development is not earmarked, so these funds could go to other non-education and non-training purposes. Furthermore, analysis by others suggests the IRA's total budget for environmental justice activities is $12 billion, potentially increasing the total channels for investment in education and training that are not fully apparent now (Pollin, et. Al, 2022).

8　This particular program, the Home Energy Efficiency Contractor Training program, is an example of a narrowly defined, occupation-specific workforce training investment that is typical of how education and training is considered in key climate legislation. It is tied to State Energy Office plans to implement the High-Efficiency Electric Home Rebate Program. In short, this training effort is to ensure there are enough trained contractors to install home energy efficiency upgrades and retrofits.

9　Here, U.S. employment includes the total percentage of the employed U.S. labor force. See Table 1 and 2, https://www.bls.gov/opub/reports/race-and-ethnicity/2021/home.htm. The U.S. green workforce estimates are from the OEWS program, a survey of business establishments on the number of employed persons over a 3-year period.

10　Because our data sources for this analysis stem from organizations that take a conventional approach to green jobs, our analysis leans heavily on specific capacities, or green skills for green jobs.

11   The top 5 employing sectors in the U.S. in 2021 are Health Care and Social Assistance (14.9%), Retail Trade (10.9%), Educational Services (8.7%), Manufacturing (8.65%), and Accommodation and Food Services (8.32%).

12   The U.S. Bureau of Labor Statistics identifies occupations as "bright outlook" if they satisfy one of three criteria: 1) they are projected to grow faster than average across the U.S., with an employment increase of 10% or higher over a 10-year period; 2) they are projected to have 100,000 or more job openings across the U.S. for a 10-year period; or 3) they are a new and emerging occupation. Using this criteria, there are approximately 80 green "bright outlook" occupations, in the sample satisfying at least one of these criteria, the majority of which (N = 65) are new and emerging (NE).

13   Due to definitional issues around green jobs, this analysis of green jobs is limited to employment data that has been collected on conventionally defined green jobs.

14   One occupation (Software Developers, a green Computer and Mathematical occupation) is shared between both categories. That is, green Software Developer jobs are expected to both grow faster than average and also have over 100,000 job openings over the next decade. Hence, the total number of NE green bright outlook occupations analyzed here is 29, rather then 30.

15   Network effects may also be in play, where people follow similar industries as their peers and relatives–an issue of information asymmetry when it comes to labor market opportunities. Regardless, more research is needed to understand why stratification is happening.

16   Additional state licensing, certifications, and on-the-job training requirements may create additional barriers for historically excluded populations.

17   Anecdotal reporting also suggests that the harsh working conditions put workers at greater risk of burnout. See Gurley, L. K. (2022).

18   Here, acquisition of green skills is proxied by the completion of a degree in the major fields of study associated with all BLS-identified green occupations. In some cases, a particular field of study may also serve a non-green occupation in addition to catering for a green job/occupation. Our indicator of a green skills *gap* is measured by the representation, or the lack thereof, of underserved populations receiving a degree in the field of study associated with a green job. Data from the National Center for Education Statistics was used for this analysis (see Technical Note in Annex B).

19   This is with the exception of Regulatory Affairs Managers, an occupation expected to experience more than 100,000 job openings over the next decade and for which Legal is a major field of study. Currently, women represent 53.8% of graduates receiving relevant degrees for Regulatory Affairs Managers; yet they make up only 36.4% of Regulatory Affairs Managers in the labor market (see Table 2).

20   To answer this question, we developed a pilot database of green learning opportunities in the country and mapped these opportunities in relation to the location of EPA-identified disadvantaged communities for three case study states in this project's forthcoming follow-up report (Hawai'i, Illinois, and Kentucky). See the Technical notes in Annex B for more information on the Green Learning Opportunities Database and how we developed it.

21   It is important to keep in mind while interpreting these maps that the green learning opportunities identified in these three states represent at least 10% of all postsecondary institutions in each state. This does not take into account potential coverage by online green learning opportunities, which may be relevant and available for some types of green jobs more than others. To draw more definitive conclusions about geographic distribution and accessibility of green learning opportunities, the pilot Green Learning Opportunities Database will need to be completed.

22   Here, a reasonable commute is considered a 10-mile straight line distance, or roughly a 30-minute commute.

23   Again, completion of the database is needed to confirm this.

24   Of note, none of the postsecondary institutions in Illinois and Kentucky in the Green Learning Opportunities Database are minority serving institutions. Hawai'i is the exception, where all the green learning opportunities in the pilot database are offered by Asian American and Pacific Islander Serving Institutions or by Alaskan Native and Native Hawaiian Serving Institutions.

25   While our analysis does not investigate strategies that intentionally seek to increase the representation of disadvantaged and/or underrepresented populations in education and training, our findings do suggest that there is a need for affirmative action to help jump start the process of educational systems transformation. Such a strategy is needed alongside active efforts to increase the availability of green learning opportunities—not just to make existing opportunities more accessible and inclusive—especially for historically marginalized communities.

26   Importantly, strengthening a just transition education and training ecosystem does not necessarily mean building more satellite campuses in green learning opportunity deserts. Nor does it mean proliferating online distance learning, especially for communities where broadband internet service is neither reliable nor affordable or for fields of study that require more hands-on learning and/or working with equipment. Nevertheless, all options should be explored based on community needs.

27   President Biden's Build Back Better Plan, which did not pass through Congress, included a strong emphasis on "human infrastructure" investments: investments in people and the care economy, including child care, health care, home care, and education—the latter including universal preK and 2 years of free community college.

28   Specifically, more tax credits are available to companies for whom a certain threshold of labor hours are performed by registered apprentices.

29   For instance, the $200 million made available by the IRA for the Home Energy Efficiency Contractor Training program translates roughly into $1 million per state per year for 4 years to provide training for contractors. However, at the time of writing, the Department of Energy has not yet provided details as to how the program will operate or whether funds will be delivered to states through a competitive process or through a formula grant.

30   Although, even these tools, specifically the CEJST, are limited due to their failure to include race in their methodology. See Jennings, S. (2023).

31   To calculate green employment by state, state employment statistics for the year 2021 was used.

32   Crosswalk retrieved from https://www.onetcenter.org/crosswalks/cip/Education_CIP_to_ONET_SOC.xlsx.

33   To our knowledge, there are sustainability-oriented networks of postsecondary institutions (like the Association for the Advancement of Sustainability in Higher Education or Second Nature), curated lists of sustainability-oriented higher education institutions (like the Princeton Review Guide to Green Schools), and an online career finder resources that identify green occupation-related education and training programs, and related industry associations and state licensing and certification requirements (like the CareerOneStop sponsored by the Department of Labor).

34   The 10-mile radius was an approximation of the average daily commuter distance a student can travel.