## Preparing a Green + Blue Workforce

# Meeting the Demand for Green and Blue Economy Jobs:

## **Proceedings Report**





greenblueworkforce.edc.org

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#### **Acknowledgements**

#### Project team:

Andres Henriquez (PI) Josephine Louie (Co-PI) Jacqueline (Jackie) DeLisi (co-PI)

#### Advisors:

Svetlana Darche Taj Eldridge Joyce Malyn-Smith Frank Niepold

#### Convening support staff:

Kristen Boudreau Jesse Campbell Amy Lozen

#### **Content Support:**

Kim Elliott Burt Granofsky Jennifer Stiles Sarah Prusik

#### **Editing and Design:**

Kim Elliott Digital Design Group/EDC

#### **Evaluation:**

**Carrie Liston** 

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It is critical that our workforce of the future thinks about system change and not just sectoral [change], because the world is going to transition, [and that] means change in the next 20 years. Our world is going to change in a very vast way. We want people who are able to navigate the economy and lead in that economy.

-Ani Dasgupta, President and CEO, World Resources Institute

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The challenge ... is not just about identifying the right skills and the right investments to avert any workforce bottlenecks in the green transition, but also to identify the breadth of green skills and investments needed to ensure that the transition is a just transition. We're at a critical crossroads for humanity ... Business as usual and education as usual threatens to leave people and communities behind in the green transition.

-Christina Kwauk, Founder / Co-Founder, Kwauk & Associates and Unbounded Associates

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## I. Introduction

The United States stands at a pivotal moment in the worlds of education and workforce development. From the growing blue economies in the Southern and Northeastern coastal states to the use of new smart farming technologies in the Midwest, opportunities for well-paying jobs are growing. Across all industries from manufacturing to waste management to transportation systems employers need workers who can use new technologies to work smarter and conserve important natural resources.

Throughout the United States, exciting progress is being made to position our nation as a global leader in the use of these new technologies. However, to maintain a strong economy and be a global leader, the United States must take action to prepare both the current and future workforce for green and blue jobs. There is one fundamental question: Are our young people prepared for the future of work? As the economy shifts to new forms of manufacturing, new products and markets, and new technologies—especially in green and blue sectors—how can we ensure all youth have the opportunities to develop the skills and knowledge that employers need? Our systems of education and training need to keep pace to ensure economic prosperity for all.

This report summarizes the discussions from a convening that addressed these questions and focused on how we can build collective momentum toward meeting employers' urgent need to fill the rapidly growing number of jobs in green and blue economies.

### The "Preparing a Green and Blue Workforce" Convening

In February 2024, Education Development Center (EDC) led a two-day meeting in Washington, D.C., which brought together nearly 100 leaders and practitioners from industry, academia, high school administration, career and technical education, and government agencies to share knowledge and develop strategies to meet enormous needs—and opportunities—in this new and fast-evolving world of work. (See Appendix A for the agenda for the full convening.)

In presentations, panels, and discussions, participants focused on two fundamental questions:

- **1.** What skills and knowledge from STEM and other disciplines will youth need to fill the growing number of green and blue jobs?
- 2. What strategic partnerships are key to preparing youth for green and blue jobs?



In alignment with this vision, EDC assembled experts from across sectors (see participant list in **Appendix B**) to ensure comprehensive insights into the future of green and blue workforce development. The combination of expertise across a wide variety of sectors was intentional. We sought and secured presenters and participants who could identify the full landscape of emerging green and blue jobs and who understood the required skills and how to map out new educational and training pathways to these careers. Participants discussed the emerging workforce needs and challenges, shared employment trends and ways in which they are preparing workers, highlighted the need for including the youth voice, and expanded on crucial strategies for aligning the emerging workforce with current and future needs.

This report presents findings drawn from the authors' analyses of the transcripts of presentations and panels, breakout group discussion notes, and data from Mentimeter polls held during the meeting. (Mentimeter is an application used to create presentations with real-time feedback.) The following sections summarize the major ideas that participants shared during the two days of discussions on preparing a green and blue workforce:



SECTION II: Skills for a green and blue workforce



SECTION III: Education and training



SECTION IV: Strategic partnerships



SECTION V: Implications and next steps

## <mark>දිටු</mark> Our Work at EDC

EDC's commitment to preparing students for the future began with our founding in 1958. The launch of the Soviet Union's space program in 1951 and the Sputnik satellite in 1957 exposed critical gaps in U.S. math and science education, creating an urgent national challenge. In response, MIT physicists founded EDC and developed the innovative and successful curricula *PSSC Physics*, with funding from the National Science Foundation.

Today, EDC's future-ready youth programs feature partnerships with industry and education to foster employability nationwide and around the world. A few initiatives include creating and evaluating STEM pathways to mid-skill careers, using high-impact practices to strengthen education and workforce development systems, and supporting community colleges in developing robust certificate and degree programs. For decades, EDC has led innovative work to transform high schools and career and technical education (CTE), ensuring students have clear pathways to successful careers.



## () II. Skills for a Green And Blue Workforce

A primary question of the convening focused on the demand side of the green and blue economies. Over two days, multiple panelists and participants shared insights and ideas in response to the following question:

What knowledge and skills from STEM and other disciplines do students need to join or contribute to the green and blue economies?

Early on the first day, panelists helped to ground conversations by offering definitions of green and blue jobs and providing context for the green and blue economies. Panelists and participants in subsequent sessions then discussed examples of the skills needed for green and blue jobs, the education and training programs that may be required to promote these skills, and current questions for the field. Polling through Mentimeter revealed participants' perspectives on the sectors for emerging green and blue jobs and the skills that are and will be needed in these jobs (see Figures 1 and 2). Following are major themes that emerged from the presentations and discussions.

#### Figure 1. Emerging jobs

#### What are the Emerging Jobs Needed in the Green and Blue Economies? 100 responses



**Green and blue jobs exist in a wide array of economic sectors.** Panelists began the convening by sharing a set of definitions to help create a common language among participants. Chris Boone from Arizona State University defined *green jobs* as ones that "reduce negative environmental impacts or advance environmental goals, primarily in terrestrial ecosystems and contexts." He defined *blue jobs* as having the same objectives, but operating "primarily in marine, coastal, and aquatic ecosystems and contexts." He also introduced the concept of *sustainability jobs*. These are jobs that "improve human well-being for present and future generations while reducing environmental harms and strengthening environmentally positive outcomes."

#### Figure 2. Most important skills

## What skills would you consider most important for the green and blue workforce?



**Green, blue, and sustainability jobs are found in multiple sectors of the economy.** For example, Boone noted that such jobs are available in domains such as food systems and agriculture. Lilian Roth from JobsFirstNYC shared that by 2030, a majority of green jobs in New York City will be in infrastructure, housing, and construction. Taj Eldridge from Jobs for the Future emphasized that there is a need for workers not only in sectors such as solar energy and transportation, but also in climate mitigation and adaptation. Within the latter field, Eldridge highlighted the importance of the circular economy—that is, an economy that seeks to minimize waste and promote the sustainable use of natural resources—and the rise in jobs related to material recycling and reuse.

The green and blue economies are growing rapidly and offer broad workforce opportunities. Panelists on the opening day reported that green and blue jobs are multiplying and represent areas of expanding opportunity. Boone shared that "we've got a lot of good news on green, blue, and sustainability jobs," citing estimates from the International Labour Organization that, worldwide, "there will be 100 million new jobs associated with the transition to renewable energy and a circular economy." He noted that according to LinkedIn, the job of a "sustainability analyst" was the fifth fastest growing job in the United States over the last five years. Over the past 10 years, the field of sustainability has added "1.1 million green jobs, [and] a little under 300,000 [blue jobs] ... and it's accelerating" (LinkedIn, 2024).

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The good news is that green and blue jobs are not just for college graduates. In fact, there are jobs available for people with high school or GED, bachelor's, master's, PhD degrees and there are opportunities across the entire spectrum in terms of educational attainment.

—Chris Boone

Amid this growth are opportunities for people with a wide range of education levels. The "good news," Boone shared, is that green and blue jobs are "not just for college graduates." In fact, "there are jobs available for people with high school or GED, bachelor's, master's, PhD" degrees, and "there are opportunities across the entire spectrum in terms of educational attainment." Rachel Rosen from MDRC concurred, observing that emerging clean energy jobs in domains such as infrastructure, transportation, and heating and ventilation "do not require a four-year college degree," and "there are a variety of different pathways that students can take to get into those jobs, including apprenticeships, associate's degrees, and other kinds of training models."

The skills that are needed for green and blue jobs encompass an array of specialized and cross-disciplinary competencies and capacities. The rapid expansion of the green and blue economies has led to a skills gap, explained Boone. Although "we've got a lot of good news on green, blue and sustainability jobs," he observed, "the troubling part is that the number of people who are qualified to fill those jobs is not growing as rapidly." Some of these skills, Boone noted, are technical and specific to green, blue, and sustainability domains. These skills include the ability to

## **C** Growing a Career from the Ground Up

Offering an example, Roth from JobsFirstNYC described a young man looking for ways to advance his career, having spent a few years post-high school working in low-paying restaurant jobs with few opportunities for career growth. After applying for and joining the Green City Force's Service Corps program, he received a stipend and on-the-job training in different green industries and developed a keen interest in composting. When he saw an ad for a job as a compost manager at the local botanical garden, he applied. Although he did not have a four-year college degree and a driver's license—two key requirements for the job—"he knew more about composting than any of the other applicants because he had received the skills training for it." Roth explained that after his interview, "he was hired on the spot. That's launched his career. Now he's the CEO and founder of Compost Power… an incredible organization that builds accessible and sustainable composting sites across New York City."



conduct environmental risk analyses and to help organizations meet sustainability regulations and standards, such as Leadership in Energy and Environmental Design (LEED) requirements, Carbon Disclosure Project (CDP) guidelines, or Global Reporting Initiative (GRI) standards.

Other skills that panelists described as needed for green and blue jobs are cross-disciplinary and echo descriptions of 21st century skills (e.g., Taylor et al, 2024; Dede, 2009; Kennedy & Sundberg, 2020).

Skills that were cited prominently during the convening include the following:

• **Problem-solving skills and an ability to develop solutions for real-world challenges.** A recurring theme in panelists' remarks about the skills needed for green and blue jobs was the importance of problem-solving abilities and an orientation toward developing solutions to real-world issues. Nicole Ardoin from Stanford University acknowledged that "there's a tremendous diversity in the type of [sustainability] jobs available today, as well as those predicted to be available in the future, which makes it incredibly challenging to develop a definitive list of the skills and knowledge base that's appropriate for all learners and for all positions." However, she noted that "those who have thought about building the sustainability workforce emphasize several key aspects that are essential to a successful green workforce." These include "the importance of problem-solving and the ability to engage in non-routine activities."

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–Nicole Ardoin

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Students must demonstrate that they have the ability to tackle complex problems and not just talk about the nature of the problem, but how they can actually help to start moving towards solutions.

—Chris Boone

Citing a working group convened by the National Academies of Sciences, Engineering, and Medicine (NASEM) to support the development of sustainability curricula, Ardoin said that the group recommended helping students build links "between knowledge and action," as well as competencies that are "solutions-oriented, which is essential in sustainability [fields]" (National Academies of Sciences, Engineering, and Medicine, 2020). The working group focused on undergraduate and graduate levels, but linking knowledge and action and focusing on a solutions orientation are also important in K–12 settings, said Ardoin. Echoing these ideas, Boone explained that "because of the solutions orientation of work in green jobs," students must "demonstrate that they have the ability to tackle complex problems and not just talk about the nature of the problem, but how they can actually help to start moving towards solutions." Similarly, Sarah Bodor from the North American Association for Environmental Education (NAAEE) emphasized that strong environmental education is "solutions-oriented" as well as "hands-on" and "real-world."

- Data and critical-thinking skills. Because the world is now awash in data and information, data skills are essential for green and blue jobs. Boone noted that among employers in the sustainability field, the ability to work with data "shows up over and over again" as a skill set that they seek when hiring. Specifically, employers look for "people who can make sense of that information, be able to interpret it, be able to talk about it, be able to use that to define what the strategy is for the organization." Boone also said that in his work with employers in the green and blue economies, higher-level critical-thinking and analytic skills are highly sought among employees. When hiring, these employers often look for people with college degrees "because of the things that come with the college degree. The ability to think critically, the ability to interpret evidence, [to] find out what's valuable, what's not." Boone's findings suggest that efforts to build these fundamental skills among learners within college programs—as well as before and outside of college—will help to prepare a stronger workforce for green and blue jobs.
- **Broad cross-cutting competencies and dispositions.** Ardoin discussed important work she conducted with Boone, Arun Agrawal, and colleagues at Stanford to review and synthesize existing literature on *competencies* that educators in higher education should foster for people entering the sustainability field. She shared, "We were overwhelmed to find dozens of frameworks suggesting a variety of ways to think about sustainability competencies for higher education. And within those dozens of frameworks, well over 60 specific competencies were suggested."

Drawing particularly on the work of Wiek and colleagues (2011a, 2011b, 2015), Ardoin highlighted five core competencies needed for sustainability work: "systems thinking,

futures thinking, values thinking, strategic thinking, and collaborative thinking." These core competencies, she explained, are important sets of knowledge, skills, and abilities that enable people to address the types of problems central to sustainability fields. In addition, core capacities, or what Clark & Harley describe as "the intention and ability to accomplish a task or achieve an outcome," may be needed among individuals and in systems to achieve sustainability (Clark & Harley, 2020). Such capacities may include the resources and commitments to acquire new knowledge and skills, navigate and adapt to changing conditions, and evaluate and assess progress, among others.

As complementary attributes, these competencies and capacities need an orientation and effective leadership to move sustainability efforts beyond discussion to actionable efforts that achieve the intended outcomes.

In addition, other speakers reiterated the need for these skills and highlighted additional orientations and dispositions for green and blue work. Kevin Rabinovitch of Mars International noted that in his corporation's climate and sustainability program, "We don't actually need people to do a different job. We just need them to have a different "why" for doing it right."



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—Kevin Rabinovitch



# III. Education and Training

Throughout the two days of the convening, panelists and participants highlighted opportunities and challenges in building a green and blue workforce.

# Young peoples' significant interest in this sector was one of the most cited opportunities.

Skills for green and blue jobs are in demand, and both students and early career professionals want to learn the skills that will enable them to work in these industries. However, speakers noted that green and blue skills development has not yet been integrated into K–12 schools, and relevant skills and training programs in grades K–12 and community colleges have not yet been aligned with institutions of higher education and industry.

Through the use of Mentimeter, participants were polled on two questions regarding preparing students in grades K–16 for green and blue jobs. Overall, there was widespread agreement among participants that schools only prepare students for green and blue jobs "a little." Participants also generally agreed that these skills need to be developed in high schools, or through career or technical schools or community colleges (see Figures 3 and 4).

Figure 3. Degree that schools prepare students for green and blue jobs

To what degree do you think schools in your region help students build the knowledge, skills, and dispositions needed for green and blue jobs?



Figure 4. When to prepare students or people for blue and green jobs

When should we prioritize preparing people for jobs in the green and blue economies?





Students **want to learn** about sustainability. The idea that environmental education can be integrated into other programs and disciplines was also mentioned as a way to benefit student learning more broadly.

Following are some themes that emerged from participants' discussions on how education and training systems need to change to meet employers' needs.

**Interest in green and blue fields is soaring in higher education.** Panelists suggested that institutions of higher education have been responding to an increase in demand for green and blue skills. Ardoin noted that while there were only 13 sustainability-specific programs available across higher education in the 2007-2008 academic year, nearly 700 were available in 2023-2024. "And in addition to those, there are more than 1,300 programs in environmental studies and sciences, which often include an emphasis on sustainability as well," Ardoin added.

Ardoin also said that at Stanford University, where she is a faculty member, students, academic departments, and schools are integrating preparation for sustainability work into both new and existing programs. Speaking of the nearly 100 Stanford students each year who are pursuing joint MBAs and MS degrees in Environment and Resources, for example, she observed, "Those students aren't necessarily only going to jobs titled as 'sustainability jobs.' Rather, they are bringing their sustainability orientation to a range of positions in policy and in companies—at Apple, at Google, at Amazon, and beyond."

**Students want to learn about sustainability.** The idea that environmental education can be integrated into other programs and disciplines was also mentioned as a way to benefit student learning more broadly. Bodor from the NAAEE shared that the benefits of environmental education go far beyond environmental knowledge. "We see increased test scores across all subject areas," Bodor said. "It contributes to the development of critical thinking, problem-solving, leadership, collaboration."



Drawing on findings from a recent Smithsonian Science Education Center study conducted by Gallup, Carol O'Donnell shared that U.S. teachers believe that teaching sustainable development is important and that their students want more lessons in this area, too. According to O'Donnell, "Teachers said, 'We really believe that it makes a difference connecting students to their world, to their communities. It makes them more engaged in STEM'" (Smithsonian Science Center, 2023, 2024).

**High school is an appealing venue for teaching green and blue skills.** High school is a focal point for innovation, as many of the jobs in green and blue industries, such as clean energy technologies, building and infrastructure, transportation, and HVAC, do not require a four-year college degree. Patti Curtis, former senior STEM advisor for the U.S. Department of Education, highlighted the importance of work-based learning opportunities, such as internships, apprenticeships, and industry-related credential programs beginning in high school. But she also spoke of the need for career advising and navigation, saying, "We need to really make sure our career counselors are prepared to advise students." Rosen from MDRC added that high school CTE programs can play an essential role in training young people to fill these important, engaging, and in-demand jobs. CTE programs "prepare students for a variety of jobs that have advancement opportunities and high wages and real career growth opportunities," she said.

Ardoin echoed this sentiment, calling vocational and technical education in schools "a great opportunity." However, she indicated that there is a need to document more of the rich programs that currently exist, saying, "There is very little writing exploring this incredibly rich vo-tech sector and what's happening in sustainability education."

**High school is a focal point for innovation**, as many of the jobs in green and blue industries, such as clean energy technologies, building and infrastructure, transportation, and HVAC, do not require a four-year college degree.

Summing up many of these ideas, Frank Niepold, senior Climate Education and Workforce Program manager for the National Oceanic and Atmospheric Administration (NOAA), said, "Workforce without education is impossible."

Scale and standards remain potential barriers. While some panelists shared stories of innovative high school and university programs that were teaching green and blue skills, others discussed the barriers to profound changes in what is taught in K–16 classrooms. Rosen highlighted the work of New York's Clean Energy Technologies P-Tech school, which has partnered with Hudson Valley Community College to teach students how to do heat audits and install solar arrays. But while the programming is impressive, the reach was minimal. "That's one school, and I think they serve a couple hundred students," she said. Rosen also noted that while there has been federal investment in growing the green and blue workforce sector, most of that funding has gone toward job development—not toward training. This imbalance threatens to exacerbate the challenge of job growth within the sector and outpace the ability of industry to find trained workers.

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### School Charts a Course for Green and Blue Careers

In New York City, The Harbor School, now in its 20th year, runs various programs related to New York's maritime experience, which distinguishes the school from other public high schools in New York City. The school's curriculum prepares students for green, blue, and sustainable jobs in the maritime sector—everything from scientific research to underwater welding. Students also care for aquatic organisms and study animals that inhabit both aquatic and land-based ecosystems. The school, located on Governors Island in New York Harbor, features an outdoor laboratory. Through their CTE programming, students are engaged in the Billion Oyster Project to restore oyster reefs to the New York Harbor. So popular is the school among New York City students that there are plans for it to more than double in size—from 500 students to over 1,000 students—by 2026.

O'Donnell and Heidi Schweingruber noted that assessing students' learning in innovative programs can pose challenges. While assessments can drive what is taught in the classroom, developing assessments for green and blue skills is difficult because they are transdisciplinary topics. "They require not just your scientific knowledge, but your history, art, culture, math, engineering skills," said O'Donnell. In an education system where many topics are taught in isolation, it is essential to design effective cross-disciplinary standards, assessments, and curricula.

Likewise, "educators are often in search of materials that reflect their local contexts," said Bodor. While many general resources may be available to teach about sustainability and green jobs, there is currently a dearth of materials designed for local contexts. "[Teachers] really want things that are relevant to their own students, and they don't necessarily have the capacity to take something that was built for a national audience and sort of adapt it to their local context," Bodor said.

New methods of accreditation are necessary. As more opportunities for green and blue jobs emerge in industry, there is a growing need for an accrediting body to define and inform the specific skills that are needed for success in the field. Ardoin suggested that accreditation would help bring more consistency to the way that green and blue skills are taught in K–16 settings. Likewise, accreditation would help increase the flow of workers that are prepared for the demands of industry. Those tasked with developing a new accreditation model must make it flexible, adaptive, and "take into account that these things change and that they change super, super quickly," said Boone. The green and blue jobs sectors' constant evolution, innovation, and growth means that accreditation systems will also need to change. Echoing Ardoin, Boone added that accreditation systems will need to be specific and define certain skills needed for success. This will help move toward ongoing identification of the hard and soft skills that must be taught.

**Employers have a role to play.** With so many industries beginning to integrate sustainability and environmental concerns into their business practices, there is a considerable opportunity for employers to create training programs that provide employees with green and blue skills. "This is where we see the opportunity for certificates, short courses, workshops, and other credentialing programs," said Ardoin. She identified KPMG, Deloitte, and Schneider Electric as large companies that are already providing corporate training around sustainability reporting, sustainable finance, and climate science. Likewise, she indicated that Microsoft, Salesforce, and Starbucks are using on-the-job training to provide employees with more knowledge about sustainability. This training is needed because there are very few workers with content-specific knowledge in sustainability and green and blue skills.

Some participants mentioned that employer-based skills training programs do not have to focus only on retraining workers. Rabinovitch suggested that businesses can be thoughtful about how they identify the core skills that people in their specific industry already have and figure out how to use those skills to achieve green and blue outcomes and objectives—a process he described as "twisting five degrees to the left or the right."





# ↓ IV. Strategic Partnerships

Across the two days of the convening, speakers emphasized that effective partnerships are essential for building and sustaining progress toward preparing youth for current and future green and blue jobs. In panels and discussions, participants drilled down deeper to examine the question:

# What *types* of partnerships among educators, industry, already exist and what can we learn from them?

Attendees mentioned many partnerships, sometimes providing details about the development and goals of the partnerships and their own roles, and at other times mentioning partnerships in passing as examples of efforts designed to support green initiatives or workforce training. Partnerships ranged from shorter-term or individual connections to deeper and longer collaborations that either emerged or were intentionally created. There was widespread agreement that preparing youth for current and emerging jobs in green and blue sectors requires a wide variety of expertise, with organizations and individuals across disciplines and sectors working closely together to build and sustain momentum. Following, we explore participants' perspectives on the essential components and rationales for effective partnerships in more detail.

Multi-sector, interdisciplinary, and multi-funder collaborations are critical for shaping the field of workforce development to align with green and blue job skills. Multi-sector partnerships also referred to during the convening as "cross-sector partnerships"—have the potential to create opportunities for knowledge sharing and capacity building. Eldridge of Jobs for the Future noted that it's vital to ensure that all key partners are involved: "How do we ensure we're talking to the right people, not just workforce development boards, but the industry individuals, the investors who are in the job creation space, the educators? There needs to be all these other players at the table to ensure that we're building this quality workforce for everyone, and that also we are looking at not only just people in the urban areas, but people in the rural areas."

In one panel, Boone and Ardoin explained that the gaps in skills development in K–12 and postsecondary education and the needs of employers require that *all sectors* be involved and working together. Boone put it well when he said, "There can't be a monolithic approach to how we deal with this transition... we need engagement from K–12 education, colleges, universities, employers, labor unions, churches, faith-based groups. I mean, everyone needs to be engaged." Both speakers described the need for systemic approaches and "the ecosystem of opportunities," referring to the many sectors and types of institutions that need skilled workers with varied levels of educational attainment. It was clear from these speakers and others that more voices from varied industries, geographic areas, and expertise can lead to a greater understanding of the skills and pathways that already exist and the skills and employment gaps that need to be filled. Involving cross-sector stakeholders will also amplify their work, result in even more opportunities and greater momentum toward addressing the challenges of the transition to green and blue economies.

Community organizations, certificate programs, and community colleges are also important partners, and can play a key role in providing direct access to nontraditional learners and workers. Fostering and supporting these collaborations will require a greater understanding of the funding landscape and career opportunities. For example, Elise DeGeorge from the National Renewable

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—Taj Eldridge



Energy Laboratory (NREL) spoke about creating career maps and informing career pathways and educational opportunities through partnerships with postsecondary institutions and industry. As she spoke about efforts and funding from the Department of Energy, she stated, "There are lots of different programs that really lend itself to being multi-sector—having a multi-sector approach." For example, understanding and preparing workers for career opportunities in hydro power requires partnerships between community colleges, career and technical schools, and employers across multiple technologies and sectors.

Other panelists provided examples of multi-sector collaborations that can serve as "bright spots" and be shared through networks for potential replications and scaling. For example, Lilian Roth from JobsFirstNYC spotlighted New York City's Green Economy Network, a sector-based partnership that JobsFirstNYC launched in 2020 alongside three leading skills training agencies in New York City. By bringing together over 100 nonprofits, government agencies, and employers, the Green Economy Network is building a robust and sought-after regional workforce development system for the demands of the rapidly expanding green jobs market. The network leverages its collective voice to advocate for policies that overlap workforce development and climate, resiliency, and circular economy priorities. According to Roth, "We believe that collective genius is central to solving some of these large-scale problems. And partnership is really the core of what we do."

**New approaches are needed to align education and workforce.** Although there were examples of K–12 efforts to build skills for green and blue economies, there was also an acknowledgement that more needs to be done to build partnerships with schools and that to date, most partnerships focus on upskilling the current workforce, with less clarity of opportunities for building the next generation of the workforce. Boone explained that systemic changes need to include youth and that "education has to be an absolutely critical and core component for what we think about for the future of the planet." However, as Schweingruber from the Board on Science Education at the NASEM pointed out, public schools are stressed financially and teachers have limited time, so "we have to think about solutions that help them and help that system."

Partnerships with industry, postsecondary education, and community organizations can be a crucial part of the needed support for public schools. To that end, panelists and participants discussed the implications of the Next Generation Science Standards for what is currently taught in grades K–12. They identified the need to develop and sustain partnerships between school systems, scientists, industry, and funders to enable greater clarity for building pathways and skills for green and blue economies.

MDRC's Rosen described the need for partnerships between the K–16 education sector and industry workplaces to align what is taught in middle school and high school with the skills for green and blue economies through vocational, work-based learning, or pre-apprenticeship programs. Jeffery Chetirko from New York City Public Schools provided an example of how a partnership with the Billion Oyster Project and the Harbor School resulted in stronger CTE programs focused on maritime careers. The Billion Oyster Project, which is described on **page 15**, partners with local companies, nonprofits, museums, and others with a focus on cleaning the New York Harbor by restoring oyster populations. This cross-sector partnership results in educational programming for New York City Public Schools, including teacher professional development, opportunities for field trips, and materials for student activities that focus on understanding the marine environment through data collection and restoration.

Attendees also highlighted the need for partnerships focused on deepening learning and strengthening curriculum. DeGeorge called out the need for partnerships between industry and educators or others who can write curricula to ensure alignment between sectors. O'Donnell from the Smithsonian Institution described one example of their partnership with Inter Academy,

Panelists identified the need to develop and sustain partnerships between school systems, scientists, industry, and funders to enable greater clarity for building pathways and skills for green and blue economies.



Panelists and speakers agreed that it's key to ensure partnerships **fully engage community members** to ensure those who most need these economic opportunities help create solutions.

which is creating video resources for classrooms that highlight the work of research scientists in sustainable energy fields and can connect youth to scientist mentors. Two additional examples were briefly highlighted during the convening: "Study Hall" at Arizona State University (ASU), which is a collaboration between CrashCourse, YouTube, and ASU for navigating a green/blue pathway to college, and the National Sustainability Society, which builds networks and capacity to support sustainability education.

Partnerships need to include and emphasize the perspectives of low-income communities, including rural communities and others most likely to be impacted by shifting economies. As convening participants discussed the present state of the workforce and the needs in K–12 schools, there was widespread acknowledgement of the need for building fair and just green and blue economies. According to Boone, "Those ideas of just transition ... have to be baked in, not afterthoughts. They have to be baked into the strategies that we're developing." Roth noted that the Green Economy Network (GEN) in New York City is one example of this. GEN intentionally includes and centers community-based organizations and those who will be most impacted by economic shifts. The network emphasizes understanding and including their experiences and perspectives, with an acknowledgement that increasing access to green and blue jobs for workers in low-income communities requires that community members help shape solutions. Panelists and speakers agreed that it's key to ensure partnerships fully engage community members to ensure those who most need these economic opportunities help create solutions.

It is crucial not only to build but to sustain partnerships, especially with involvement from K–12 education and community leaders. Participants in the convening noted the importance of a sustained commitment for enabling any of the efforts described above, and especially for efforts that create pathways to good jobs for people in low-income communities. It is vital for private and public funders to be at the table as part of cross-sector partnerships and collaborations. Building partnerships takes time and requires intentional inclusivity, with time for relationship building and continued funding. As Ardoin stated, we need to recognize that "we're all part of this sustainability transition—and within that, we need to think about how we see this as an inclusive space where everyone can envision themselves as part of it." Eldridge added, we need multiple "players at the table to ensure that we're building this quality workforce for everyone."

The second day of the convening highlighted the goals of government and private funders, making it clear that funding opportunities are emerging. Yet participants recognized that many funding commitments are short in duration and not enough to build longer-term commitments to address the current gaps in K–12 education systems and career opportunities. More conversations will be needed to build effective partnerships, and ongoing funding will be needed to sustain and grow more collaborative efforts.

## ۲ Rising Professionals Share Their Journeys into the Green Economy

The second day of the convening included a panel of young professionals, all early career or recent postsecondary graduates, moderated by Michelle Armstrong, president of the Ares Charitable Foundation. These panelists inspired the meeting participants with their insights, experiences, motivations, and civic engagement. They clearly possessed the collaborative spirit, skills, and ability to form the strong partnerships that are essential for a well-prepared green and blue workforce. One panelist, Kenzie Winslow, a Climate Corps Fellow from Strategic Energy Innovations (SEI), explained that her accidental enrollment in a required course on sustainability led to an undergraduate degree in environmental science, with additional coursework in organizational studies, environmental psychology, and education. These courses prepared her for her current work engaging businesses in Raleigh, North Carolina, to support the development of Electric Vehicle (EV) infrastructure in pursuit of a more sustainable city. Another panelist, Adriana Embus-Figueroa, illustrated the need for multisector, collaborative, and interdisciplinary thinking when she described her transition from an early career professional in banking to working with the Los Angeles Cleantech Incubator (LACI). Embus-Figueroa now works as an investor with Include Ventures, which provides funding for clean energy start-ups. She said, "I get to merge my love for social impact with the critical need for capital, for founders and fund managers, and get to be both in rooms with a lot of different folks that are speaking about capital needs and allocation, but also rooms like this, where we think more about the integration of and the collaboration between all of the different types of sectors that exist within this room."





# V. Recommendations for Next Steps

The two-day convening explored two domains:

- **1.** Identifying jobs projected to grow significantly over the next decade, including the necessary skills and proficiencies (demand side)
- 2. Understanding appropriate delivery mechanisms and the current state of educational and funding opportunities (supply side) to prepare the next generation of workers

This comprehensive approach aims to align education and workforce development with future labor market needs.

Following, we summarize several concrete recommendations that panelists and participants identified as sensible next steps.

(+) Create strategies that meet the demand for labor and skills. The rapidly expanding sustainability and energy sectors are creating unprecedented demand for specialized talent and transferable expertise. Our nation's economic competitiveness hinges on developing a workforce equipped with the technical knowledge and adaptable skills required across emerging green and blue industries. Young people are increasingly motivated by environmental purpose, as evidenced by the proliferation of sustainability programs at colleges and universities nationwide and the rising enrollment in these fields. This convergence of economic opportunity and values-driven career aspirations presents a strategic moment to align workforce development with both market demands and the interests of the next generation of workers.

#### 🕀 Expand mentorships and apprenticeships in green and blue sectors, including

**manufacturing.** Mentorship and apprenticeship programs create powerful pipelines connecting education to industry and providing students with real-world experience while building tomorrow's workforce. These partnerships between schools, industries, and community organizations offer students hands-on experiences, develop critical skills, and illuminate career pathways, including the rapidly growing careers in green and blue industries. Some examples and potential initiatives that could align with this focus follow.

#### Work-Based Learning Programs

- **Industry-embedded high school experiences:** Partner local manufacturers with high schools to create hybrid programs in which students divide their time between academic coursework and supervised on-site training, earning both credits and industry certifications.
- Summer manufacturing immersions: Develop intensive 8- to 12-week paid summer programs where students work alongside skilled technicians while completing structured learning modules.

#### Advanced Education-Industry Collaborations

- Strategic co-op programs: Design university partnerships with industry leaders where STEM students alternate full-time study with full-time paid work experiences directly relevant to their field of study.
- **Research apprenticeships:** Create opportunities for undergraduates to join research and development (R&D) teams at technology companies, working on cutting-edge innovations while receiving mentorship from senior researchers.

#### **Specialized Technical Training**

• **Micro-credential pathways:** Develop stackable credential programs co-designed by community colleges and regional employers that allow students to build qualifications while working part-time in the industry.

#### **Comprehensive Mentorship Networks**

- **Career navigation partnerships:** Establish structured mentorship programs pairing professionals from aerospace, automotive, biotech, and other sectors with students for ongoing guidance through education and early career decisions.
- STEM ambassadors: Create a network of industry professionals who provide regular exposure to STEM careers through classroom visits, site tours, and virtual exchanges, with an emphasis on engaging groups that are currently underrepresented in STEM careers.

#### **Cross-Sector Collaboration**

- **Regional STEM ecosystems:** Form community-wide collaborations between K–12 schools, higher education, industry, and workforce development agencies to coordinate apprenticeship opportunities and ensure alignment with regional economic needs.
- ← Expand engagement in building a green and blue workforce. The meeting revealed that we need to involve many other key players—including chambers of commerce, industries, workforce development organizations, K−16 education, and youth-led organizations—in creating effective solutions to build a strong green and blue workforce. The absence of K−12 education representatives from green and blue workforce development efforts is particularly concerning as they represent a foundational component of the talent pipeline.

Current programs, literature, and funding mechanisms disproportionately focus on postsecondary institutions and adult workforce initiatives (upskilling/reskilling). This narrow approach fails to address the complete educational continuum necessary for sustainable talent development. To create truly transformative outcomes, we must integrate interest holders from the entire K–16 education pathway, ensuring seamless transitions and aligned objectives across all educational stages and into the workforce.

( Strengthen regional workforce development. The impact of changes in Earth systems that affect local industries vary by region. For example, coastal communities face rising sea levels and storm intensification that can disrupt fisheries, shipbuilding, port operations, and shipping. Inland regions face heat and drought that can halt agricultural productivity. In each region, there is the opportunity to act proactively to create a more resilient, sustainable green or blue economy by developing and using tailored workforce development strategies that prepare people to use new technologies to build on each community's strengths and address geographic challenges.

Robust regional and cross-sector partnerships must be established between educational institutions, industry leaders, and government agencies at all levels. These collaborations should function as dedicated green or blue workforce hubs that coordinate comprehensive training initiatives, align curriculum with emerging needs, and create direct pathways to employment in climate resilience sectors.

Implementation of systematic knowledge sharing through structured communities of practice is essential to enable effective cross-regional learning and collaboration. These networks must facilitate rapid transfer of best practices, innovative solutions, and lessons learned to accelerate workforce development and climate adaptation capacity across diverse geographic contexts.

- **Build new certification and accreditation programs.** As industries increasingly integrate sustainability practices, employers have a valuable opportunity to develop comprehensive training programs that equip employees with essential green and blue skills. Organizations should establish credentialing systems that can become part of broader learning and employment records—portable credentials that document an individual's skills, educational background, and work experience. Additionally, there's a critical need to foster stronger connections between K–12 education, higher education, and industry to create seamless pathways for developing sustainability expertise.
- Expand funding to include K–12 and apprenticeship programs. Local and national funders are essential for building and sustaining this work. Funders can create vital pathways between school systems and industries looking to build capacity in emerging green and blue economy jobs. They can strengthen these programs by (a) advocating for expansion of the Perkins Career and Technical Education Act, (b) supporting tax incentives for apprenticeship programs, and (c) increasing federal investment in regional STEM hubs and ecosystems where students develop manufacturing skills alongside local industry partners. In our conversations with private funders who aren't directly funding green and blue workforce preparation but who do support related activities, we identified opportunities to increase education program funding in schools and to strengthen connections between educational systems and industry partners.

Funders can create <u>vital pathways</u> between school systems and industries looking to build capacity in emerging green and blue economy jobs.

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## Appendix A. Agenda

#### Preparing a Green and Blue Workforce Convening Agenda

Education Development Center 2445 M St NW, Suite 530 Washington, DC 20037 Ground Floor Classroom

Day 1: February 7	
8:15–9:00 a.m.	Continental Breakfast/Registration
9:00–9:45 a.m.	Welcome & Overview Liesbet Steer: President and Chief Executive Officer, EDC Ani Dasgupta: Chief Executive Officer, World Resources Institute
9:45–10:40 a.m.	Panel 1: Future Jobs & Skills for the Green and Blue EconomiesModerator—Nicole Smith: Research Professor and Chief Economist, Center on Education and Workforce, Georgetown UniversityChristopher Boone: Professor, Arizona State University School of SustainabilityNicole Ardoin: Associate Professor, Stanford Doerr School of SustainabilityArun Agrawal: Samuel Trask Dana Professor, University of Michigan School for Environment and Sustainability
10:40–10:50 a.m.	Break
10:50–11:45 a.m.	Panel 2: Industry PerspectivesModerator—Josephine Louie: Principal Research Scientist, EDCCrystal Bridgeman: Senior Director, Workforce Development Programs, Siemens FoundationElise DeGeorge: Project Leader, National Renewable Energy Laboratory Kevin Rabinovitch: Global Vice President of Sustainability and Chief Climate Officer, Mars, Incorporated
11:45 a.m.–12:30 p.m.	Facilitated Discussions: Finding Common Language Frank Niepold: Senior Climate Education and Workforce Program Manager and Coordinator, National Oceanic and Atmospheric Administration
12:30-1:30 p.m.	Lunch

The titles listed reflect those held at the time of the convening.

1:30–2:25 p.m.	<ul> <li>Panel 3: Climate Change and Education: What Do the Data Show?</li> <li>Moderator—Heidi Schweingruber: Director, Board on Science Education, National Academies of Sciences, Engineering, and Medicine</li> <li>Sarah Bodor: Senior Director of Capacity Building, North American Association for Environmental Education</li> <li>Carol O'Donnell: Senior Executive, Smithsonian Science Education Center</li> <li>Rachel Rosen: Senior Research Associate, Center for Effective Career and Technical Education, MDRC</li> </ul>
2:25–2:30 p.m.	Break
2:30–3:30 p.m.	<ul> <li>Panel 4: Education and Career Pathways</li> <li>Moderator—Cyane Dandridge: Executive Director, Strategic Energy Innovations</li> <li>Sarah Sterling-Laldee: Senior Advisor on Climate Change Education, New Jersey Department of Education</li> <li>Jeffrey Chetirko: Senior Advisor of High School Innovation, NYC Public Schools</li> <li>Marjorie Parker: President and Chief Executive Officer, JobsFirstNYC</li> <li>Taj Eldridge: Managing Director, Climate Innovations, Jobs for the Future</li> </ul>
3:30–4:15 p.m.	Breakout Discussions: Education Partnerships and Equity
4:15–4:30 p.m.	Reflections on Day One Melanie Sany: Director of Youth, Workforce, and Green Economies, EDC
Day 2: February	8
8:15-9:00 a.m.	Continental Breakfast/Registration
9:00–9:45 a.m.	*Welcome to Day Two: Equity in the Climate Workforce and Voices from Our Youth and Philanthropy Sarita Pillai: Vice President and Chief Equity Officer, EDC Christina Kwauk: Founder / Co-Founder, Kwauk & Associates / Unbounded Associates
9:45–10:45 a.m.	<ul> <li>Panel 1: Learning from Youth</li> <li>Moderator—Michelle Armstrong: Head of Philanthropy and Executive Director, Ares Charitable Foundation</li> <li>Kenzie Winslow: Climate Corps Fellow, Strategic Energy Innovations</li> <li>Elsa Mengistu: Director of Programming, Black Girl Environmentalist</li> <li>Adriana Embus-Figueroa: Investor, Include Ventures</li> <li>Zanagee Artis: Founder and Executive Director, Zero Hour</li> </ul>

10:45–10:55 a.m.	Break
10:55 a.m.–12:05	Panel 2: Public Agencies and the Policy Context
p.m.	Moderator—Sarita Pillai: Vice President and Chief Equity Officer, EDC
	Frank Niepold: Senior Climate Education and Workforce Program Manager and Coordinator, National Oceanic and Atmospheric Administration
	Asli Sezen-Barrie: Program Director, National Science Foundation
	Maya Goodwin: Senior Advisor, Workforce and Economic Opportunity Policy, U.S. Department of Energy
	Patti Curtis: Senior STEM Advisor, U.S. Department of Education
	Rachel Zuckerman: Special Advisor for Implementation, U.S. Environmental Protection Agency
	Stephanie Rodriguez: Senior Workforce Fellow, U.S. Department of Labor
12:05–12:55 p.m.	Lunch and Networking
12:55–1:55 p.m. Panel 3: Private Funding and Current Initiatives	
	<i>Moderator</i> —Andrés Henríquez: Director of STEM Education Strategy, U.S. Division, EDC
	Michelle Armstrong: Head of Philanthropy and Executive Director, Ares Charitable Foundation
	<b>Crystal Bridgeman</b> : Senior Director, Workforce Development Programs, Siemens Foundation
	Janet Coffey: Program Director, Science Learning and Engagement, Gordon and Betty Moore Foundation
	Kristin Wegner Guilfoyle: Project Leader, National Renewable Energy Laboratory
	Alessandra Digiusto: Head of CSR Americas and Executive Director, Deutsche Bank Americas Foundation
	Cecilia Martinez: Chief of Environmental and Climate Justice, Bezos Earth Fund
1:55–2:00 p.m.	Break
2:00–2:45 p.m.	*Breakout Group Discussions: Themes and Priority Questions
2:45–3:00 p.m.	Reflections, Next Steps, and Adjourn Liesbet Steer: President and CEO, EDC Andrés Henríquez: Director of STEM Education Strategy, U.S. Division, EDC

<sup>\*</sup>Day 2 discussions shifted in response to feedback from attendees and organizers' reflections. The initial welcome session at the start of Day 2 became a longer discussion and reflection on panels and speakers from Day 1. In addition, the planned breakout sessions on Day 2 were substituted with a second whole-group discussion to surface participants' reflections on implications and next steps.

## Appendix B. Meeting Attendees

Name	Title	Organization
Mimi Alemayehou	Senior Advisor	Three Cairns Group
Viviana Alvarez	Executive Director	cDots
Nicole Ardoin	Associate Professor	Stanford Doerr School of Sustainability
Michelle Armstrong	Head of Philanthropy and Executive Director	Ares Charitable Foundation
Zanagee Artis	Executive Director	Zero Hour
Nada Berrada	International Project Coordinator	Education Development Center
Lauren Birney	Professor of STEM Education	Pace University - New York City
Sarah Bodor	Senior Director of Capacity Building	North American Association for Environmental Education (NAAEE)
Christopher Boone	Professor	School of Sustainability, Arizona State University
Kristen Boudreau	Project Coordinator	Education Development Center
Kerry Brenner	Senior Program Officer	National Academies of Sciences, Engineering, and Medicine
Crystal Bridgeman	Senior Director, Workforce Development Programs	Siemens Foundation
David Byer	Strategic Advisor	Education Development Center
Beth Cady	Senior Program Officer	National Academies of Sciences, Engineering, and Medicine
Jesse Campbell	Educational Technologist	Education Development Center
Rebby Carey	Vice President	Education Development Center
Jeffrey Chetirko	Senior Advisor of High School Innovation	NYC Public Schools
Janet Coffey	Program Director	Gordon and Betty Moore Foundation
Josh Connelly	U.S. Policy and Economic Graph	LinkedIn
Bryce Coon	Director of Education	Earthday.org
Haley Crim	Climate Engagement and Capacity- Building Coordinator	National Oceanic and Atmospheric Administration
Patti Curtis	Senior STEM Advisor	U.S. Department of Education
Cyane Dandridge	Executive Director	Strategic Energy Innovations
Svetlana Darche	Senior Research Associate	WestEd
Aniruddha (Ani) Dasgupta	President and Chief Executive Officer	World Resources Institute

The titles listed reflect those held at the time of the convening.

Name	Title	Organization
Elise DeGeorge	Project Leader	National Renewable Energy Laboratory
Jackie DeLisi	Senior Research Scientist	Education Development Center
Alessandra Digiusto	Executive Director and Head of CSR Americas	Deutsche Bank Americas Foundation
Taj Eldridge	Managing Director, Climate Innovations	Jobs for the Future
Adriana Embus-Figueroa	Investor	Include Ventures
Michelle Faggert	Senior Program Associate	PlanetEd
Maggie Fay	Senior Research Associate	Community College Research Center
Maya Goodwin	Senior Advisor, Workforce and Economic Opportunity Policy	Department of Energy
Ed Greene	Research Fellow	Knology
Blaine Grimes	Chief Ventures Officer	Gulf of Maine Research Institute
Meghan Groome	Senior Vice President, Education	New York Academy of Sciences
Andrés Henríquez	Director of STEM Education Strategy, U.S. Division	Education Development Center
Dan Hinderliter	Associate Director, State Policy	Advance CTE
Jessica Juliuson	Project Director	Education Development Center
Eugene Kirpichov	Executive Director	Work on Climate
Asli Koksal	Director of Business Development, U.S. Division	Education Development Center
Christina Kwauk	Founder / Co-Founder	Kwauk & Associates/Unbounded Alliance
Brigitta Lambertz	Head of the Competence Centre Education, Vocational Education and Training and Labour Markets	GIZ
Rebecca Lewis	Managing Project Director	Education Development Center
Josephine Louie	Principal Research Scientist	Education Development Center
Amy Lozen	Meeting Planner	Meeting Services LLC
Marc Lucht	Director of Programs	Clean Valley Council
Nandika Madgavkar	Chief Growth Officer	Chief Executives for Corporate Purpose (CECP)
Joyce Malyn-Smith	Director of Strategic Initiatives in Workforce and Human Development	Education Development Center
Cecilia Martinez	Chief, Environmental and Climate Justice	Bezos Earth Fund
McKinzie McGuire	Senior Program Specialist	National League of Cities (NLC)
Elsa Mengistu	Director of Programming	Black Girl Environmentalist

Name	Title	Organization
Jennifer Moffatt	Art Director	Education Development Center
Tiffany Mrotek	Director of Energize Careers	Sustainable Energy Innovations
Frank Niepold	Senior Climate Education and Workforce Program Manager and Coordinator	National Oceanic and Atmospheric Administration
Chris Normile	Senior Regional Manager, Strategic Partnerships	Western Governors University
Carol O'Donnell	Senior Executive	Smithsonian Institution
Shelley Pasnik	Senior Vice President, External Affairs	Education Development Center
Sarita Pillai	Vice President & Chief Equity Officer	Education Development Center
Portia Polk	Senior Policy Analyst	National Governors Association
Kevin Rabinovitch	Global Vice President of Sustainability	Mars, Incorporated
Katherine Roboff	Deputy Director, External Affairs	Electric School Bus Initiative
Stephanie Rodriguez	Senior Workforce Fellow	Department of Labor
Rachel Rosen	Senior Research Associate	MDRC
Lilian Roth	Manager, Research and Practice	JobsFirstNYC
Rachel Rush-Marlowe	Executive Director	ResearchEd
Melanie Sany	Director Youth, Workforce and Green Economies	Education Development Center
Heidi Schweingruber	Director, Board on Science Education	National Academies of Sciences, Engineering, and Medicine
Asli Sezen-Barrie	Program Director	National Science Foundation
Liesbet Steer	President and Chief Executive Officer	Education Development Center
Sarah Sterling-Laldee	Senior Advisor on Climate Change Education	New Jersey Department of Education
Rebecca Stoeckle	Senior Vice President	Education Development Center
Jessica Valenti	Climate Change Education Specialist	New Jersey Department of Education
Kristin Wegner Guilfoyle	Project Leader	National Renewable Energy Laboratory / Joint Institute for Strategic Energy Innovations
Kenzie Winslow	Climate Corps Fellow	Strategic Energy Innovations
Angelica Zamora-Duran	Science and Technology Policy Fellow	U.S. Department of Energy
Rachel Zuckerman	Special Advisor for Implementation	U.S. Environmental Protection Agency

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