Equitable Workforce Development in Decarbonizing Existing Buildings

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ABSTRACT

Decarbonizing the building sector is key in moving toward a clean energy future, and will require a multifaceted approach, including thoughtful design and planning for new construction. We must also address existing buildings, as it is estimated that 80% of the predicted building stock for 2050 already exists, and this existing stock is significantly contributing to greenhouse gas (GHG) emissions. As the urgency for climate action rises, many jurisdictions are adopting aggressive climate action plans targeting existing buildings' energy use. These plans include incentivizing the adoption of onsite renewables, mandating energy efficiency via building performance standards, and/or phasing out fossil fuel-based equipment. Thus, energy efficiency and electrification are increasingly a part of commercial building operations professionals' responsibilities.

A large portion of this industry's workforce is nearing retirement, leaving major gaps to fill. These factors present a substantial opportunity for providing accessible career pathways while also diversifying the workforce. This paper will identify required knowledge, skills and abilities (KSAs) to move the existing building operations industry toward decarbonization, as identified through job task analyses and skill standards. It will review existing training and certification programs currently meeting these emerging needs. It will explore barriers and solutions for enrolling a diverse pool of prospective workers into training programs, such as awareness of the availability and benefits of jobs in this industry, and access to funding. Finally, this paper will identify possible pipelines for moving prospective workers through training and into jobs providing sustainable economic opportunity, through partnerships between stakeholders such as labor and/or equity groups, government, training programs and employers.

Introduction

Our energy infrastructure is undergoing a major transformation, brought about by an effort to move away from fossil fuels. As the urgency to act on the climate crisis has increased, the U.S. has committed to transforming its electric grid to 100% carbon-pollution free energy by 2035 and a net-zero emissions economy by 2050 (Donohoo-Vallett, Ryan, and Wiser 2023, 3). (A net-zero emissions economy means that the amount of greenhouse gases emitted is balanced with the amount removed.) In response, many states, cities, and other jurisdictions are enacting aggressive climate action strategies that affect the building sector, including:

- Decarbonizing the electric grid
- Switching to all-electric equipment (in new construction and existing buildings)
- Increasing energy efficiency to help accommodate the larger electricity loads
- Incorporating renewable distributed energy resources (DER)

For example, the Washington State Clean Buildings Performance Standard (CBPS) was enacted in 2019, requiring buildings over 50,000 sq. ft. to meet energy use intensity (EUI) targets based on building use type. Buildings over 20,000 sq. ft. but less than 50,000 sq. ft. are not

currently required to meet the EUI targets, but are required to benchmark and report energy use, implement an operations and maintenance (O&M) program, and create an energy management plan (EMP). The stated objective of the law is to "lower costs and pollution from fossil fuel consumption in the state's existing covered buildings, multifamily buildings, and campus district energy systems" (WSDEC 2023).

Another example is Local Law 97, enacted in New York City in April 2019, in which "most buildings over 25,000 square feet are required to meet new energy efficiency and greenhouse gas emissions limits as of 2024, with stricter limits coming into effect in 2030" (NYC Sustainable Buildings 2024).

A map highlighting other building performance standards (BPS) enacted across the country can be found on the U.S. Department of Energy (DOE) Office of Energy Efficiency & Renewable Energy website at www.energycodes.gov/BPS.

To meet these goals, electrification (the process of replacing fossil-fuel powered technologies with technologies that use electricity as their energy source) is key. Electrification applies to many sectors, including industry, electrical generation, transportation, and operation of buildings. Electricity generation for the grid is increasingly becoming comprised of renewable clean energy sources, which typically provide an intermittent supply. Because fossil fuel-based sources of generation typically provide a more consistent supply, this shift introduces some challenges to meeting existing electrical demand. And the transition to electrification in other sectors is rapidly increasing demand. Implementing measures to reduce electrical demand, especially during peak times, will be necessary to accommodate the shifting landscape.

Buildings account for about 38% of U.S. total end-use energy consumption (including electrical system energy losses), which breaks down to about 21% from residential and 17% from commercial buildings (EIA 2024). According to the Information Technology and Innovation Foundation (Chong 2022), GHG emissions from the building sector (including electricity use) account for 34% of total U.S. emissions. Total emissions from the building sector are falling, but direct emissions (not including electricity use) from this sector were responsible for 14% of U.S. greenhouse gas emissions as of 2019, which is up from 8% in 2005. It is the only energy-related end-use sector in which GHG emissions rose. This increase can be attributed to the growing use of high global warming potential (GWP) refrigerants in air conditioning and other refrigeration equipment, in addition to water heating, cooking, and clothes drying. The burgeoning market transformation of refrigerant-based electrification technologies such as heat pumps toward low-GWP refrigerants is also a key aspect of reaching GHG emission reduction goals.

Buildings are significant consumers of energy and producers of greenhouse gas emissions, but at the same time buildings also represent a great potential contribution to the transition to a clean energy economy. According to the U.S. Environmental Protection Agency (EPA 2023), an average of about 30% of the energy used in commercial buildings is wasted, primarily due to inefficient operational practices, many of which can be corrected via no- or low-cost measures. This presents an enormous opportunity for reduction in energy use and the associated reduction in GHG emissions. Inherent in this opportunity is the expansion of the energy efficiency workforce. According to the U.S. Energy and Employment Report in 2023, jobs related to energy efficiency grew by 7.4% between 2020 and 2022, totaling around 2.2 million jobs (DOE 2023, ix). Yet according to this same report, when energy efficiency employers were asked about their experience finding qualified workers, 92.2% reported difficulty in filling positions (DOE 2023).

Buildings are also potential sources for distributed renewable energy, and for grid-interactive services such as demand reduction, that can help buffer the increasingly fluctuating supply of the modern electricity grid. Energy efficiency measures can also help to reduce demand.

To realize this potential to contribute to the clean energy transition necessary to move toward our climate goals, buildings will need to operate much more efficiently. They will increasingly have to rely on non-fossil-fuel-based equipment and will need to provide interactive services with the grid. Planning for this transition in new construction is an important piece of achieving our aggressive climate goals. But it is estimated that about 80% of the buildings that will exist in 2050 already exist today, according to the World Economic Forum (Grainger 2022). Thus, it is crucial for building operations professionals to have the skills necessary to reduce their existing buildings' energy consumption and underlying GHG emissions (including energy accounting, data analysis, and documentation), plan for electrification retrofits using low-GWP refrigerants, and operate and maintain electrified equipment. These required skills for success for future building operations professionals encompass a much broader scope than the skill set required for success in the past.

With an increasingly aging workforce that is heading toward retirement, the building operations industry has an opportunity to diversify the incoming workforce with accessible, thriving wage careers while supplying the skills needed to transition to a clean energy economy.

Workforce Gaps

The building operations profession encompasses a wide variety of roles and job titles, including facility directors, facility managers, building engineers, building operators, maintenance technicians, controls technicians, HVAC technicians, energy managers, resource conservation managers, property managers, commissioning agents, energy auditors, energy services professionals, etc.

As the field of building operations evolves, the issue of a skilled workforce becomes more complex. More is being asked of those who manage and maintain facilities than ever before. New technologies are coming to market, and new policies are being implemented requiring building operators to increase efficiency and reduce or eliminate carbon. Occupants and lessees' standards are getting higher. In response, training programs are evolving to include topics like electrification, decarbonization, and smart buildings technologies to fill these skill gaps.

The issue of an aging and retiring workforce in the trades is a significant challenge facing many economies and industries, including building operations. The shortage of skilled tradespeople is exacerbated by an increasing number of retirements among baby boomers who dominate these professions. According to the International Facility Management Association (IFMA), the average age of a Facility Manager is approximately 49, and half of the existing Facility Management workforce will retire within the next 5-15 years (Levine 2019).

This trend not only threatens the sustainability and growth of these vital industries but also underscores the need for strategic investments in career pathways and accessible education to attract and retain the next generation of tradespeople.

Required Knowledge, Skills, and Abilities

A job task analysis was performed in 2020 by the Building Operator Certification (BOC), a national building operations credentialing program. In response to the question 'Given technological advances for the built environment, what type of knowledge do you think you need in order to provide the best service?' the majority of 186 survey respondents said a solid technical background; understanding of building systems and controls, building energy usage and associated costs, and opportunities for savings; and a broad base of mechanical and computer knowledge including programming. Respondents also stressed the importance of training and certification programs, like the Building Operator Certification Program, in preparing building operators for the evolving building technology landscape.

In response to the question 'How do you see the work, tools or role of the facility manager changing over the next 5 years?' the majority of 207 survey respondents said there will be an increased focus in data analytics as it relates to building performance, technologies, automation and advanced system controls. Respondents said there will also be an increased focus on energy use/cost and maximizing efficiency. Further, some respondents believe facility managers will need to have more technical skills and the ability to understand new technologies, systems, and controls.

The skills needed for building operations professionals ushering in the clean energy transformation are diverse, building upon the traditional mechanical skills required to operate and maintain physical equipment. Some of these additional skills are highlighted below.

Refrigerant-Based Equipment

The equipment itself is evolving, with heat pumps and variable refrigerant flow (VRF) becoming the dominant electrification technologies for space heating, cooling, and domestic hot water (DHW) heating due to their high efficiency capabilities.

These technologies are seeing rapid growth in the development of solutions suitable for most climates and environments (Cox 2024). Rapid market expansion has contributed to economies of scale and the inherent benefits of affordability and availability. These refrigeration-based technologies require specialized skills for operation and maintenance. Importantly, the refrigerants used in this type of equipment have come under increased scrutiny because of their potentially significant contribution to global warming due to leaks, which are common. Building operations professionals must have the knowledge to discern the best options when replacing or upgrading equipment, as well as the ability to check for leaks and perform proper maintenance of these systems.

Building Electrical Considerations

Operations professionals must be aware of electrical capacity constraints when electrifying equipment, which may require efficiency measures to reduce demand requirements and to avoid costly service upgrades. Awareness of local utility rate structures, e.g., demand charges, and programs, such as demand response, are also needed, as is awareness of equipment controls and strategies for minimizing utility costs.

Energy Accounting and Data Analytics

With many jurisdictions enacting benchmarking requirements and/or building performance standards, energy accounting is a key skill set. Data analytics skills are also highly desired in scoping systems for operational improvement opportunities.

Communication

A related skill set is communication/presentation skills. Building managers and operators need to not only be able to identify opportunities for improvements, but they also need to be able to convincingly communicate those opportunities to financial decision makers, especially when capital upgrades are involved.

Opportunities

Within the various conditions discussed, many opportunities exist, as described herein.

Federal investment

The U.S. has made historic investments to address the climate crisis in three large, distinct pieces of legislation: The Infrastructure, Investment and Jobs Act, The CHIPS and Science Act, and, most recently, the Inflation Reduction Act (IRA), establishing funding that will contribute to electrification efforts nationwide in the transportation, electricity generation, and buildings sectors. The IRA is considered by some to be the most significant climate legislation ever passed in the U.S.

The investments being made toward this clean energy transition may provide an opportunity to expand job training and credentialing programs, mount awareness campaigns for careers in the building operations field, and help to develop and expand public/private partnerships for career pipelines between labor/equity organizations, government agencies, training and credentialing programs, and employers.

Diversifying the workforce

The building operations profession has traditionally been disproportionately white and male. According to a profile of 2021 data from Data USA, Facility Managers were 79.9% men and 20.1% women. 77.8% identified as White, 9.27% identified as Black, and 5.51% identified as Two or More Races. Other races made up the remaining 7.42% (Data USA 2024). A report from the Seattle Jobs Initiative (Carson 2021) documents that Building Operations workers in the Seattle Metropolitan Statistical Area reflected a similar disparity in racial diversity, as seen in Figure 1 below. The report also notes that diversity in the sector declined between 2014 and 2020.

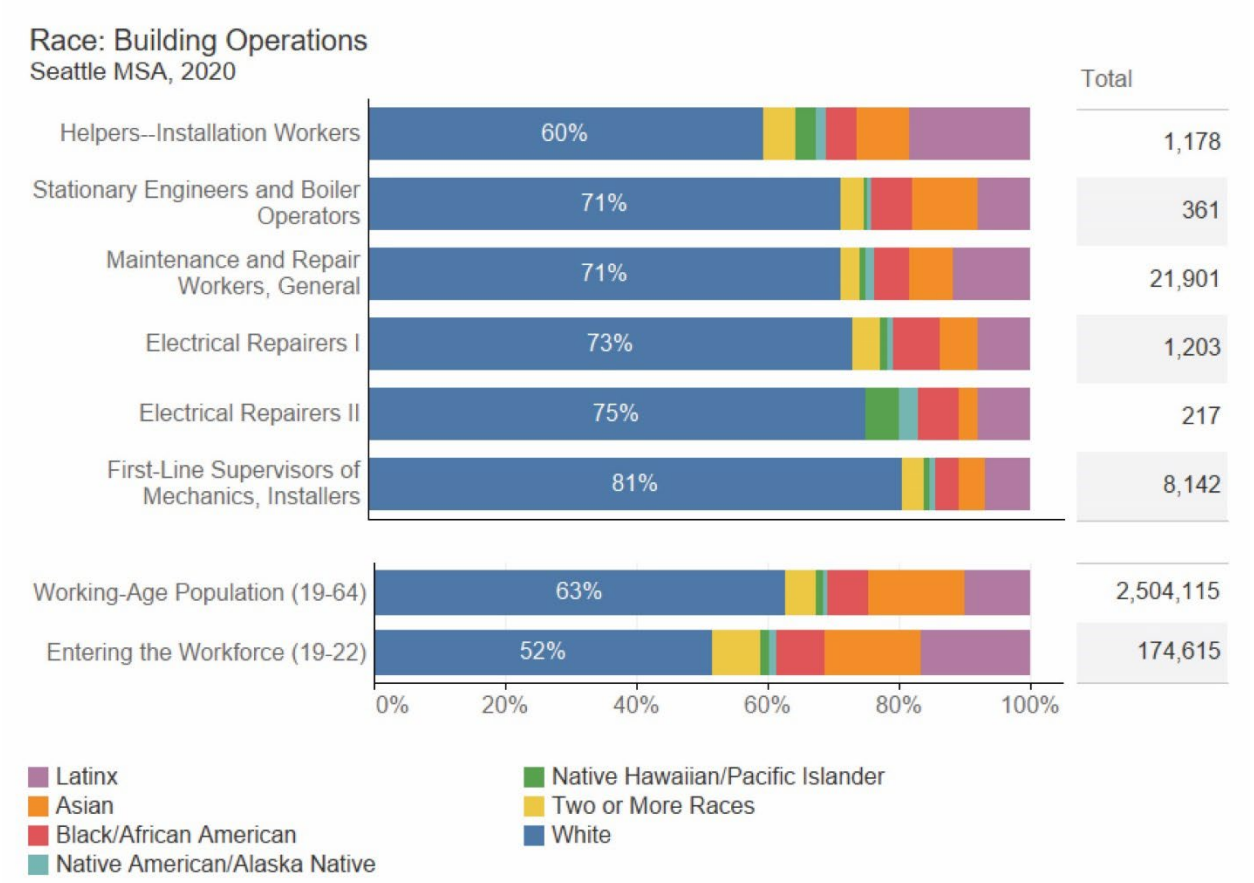

Figure 1: Demographics of Building Operators in Seattle, WA

With the high need for incoming skilled building operations professionals, there is an opportunity to diversify the workforce and provide stable, thriving wage careers to more women and minorities.

In addition to increasing social equity, research has shown that diversity in the workplace results in many other benefits that can contribute to the clean energy transformation, including driving creativity and innovation. For example, research spearheaded by Dr. Valerie Purdie Greenaway of Columbia University, who heads of one of the world's leading diversity, equity, and inclusion research labs, has identified workplace activities such as troubleshooting processes, planning for the future, and responding to crises as especially likely to benefit from diverse teams. These are all activities that are integral to many building operations professionals' jobs. The benefits result "because diverse teams are particularly good at exposing and correcting faulty thinking, generating fresh and novel ideas, and accounting for a wide array of variables in planning" (Rock 2021).

It is worth noting that many of these same benefits of diversity that can positively affect individual facility workforces can also apply to the larger decarbonization movement, such as in policymaking, designing and implementing utility programs, technology development, etc.

Barriers

A report published by the National Clean Energy Workforce Alliance identified that two key challenges in finding and recruiting workers are lack of applicants/awareness of careers, and lack of skills/knowledge/credentials/experience. The report further identified that some of the biggest challenges in recruiting diverse workers are a lack of current workplace diversity and the perception that diverse applicants lack skills/knowledge/credentials/experience (NCEWA 2022a). A greater awareness among employers of the benefits of a diverse workforce is key to breaking down some of these barriers.

A related barrier is the perception among younger people that trades or "blue collar" jobs are less secure or require hard labor, and that to become part of the middle class, one needs to have a bachelor's degree or higher (Rugaber 2023). A greater awareness among prospective workers is needed about the wide variety of roles available in the building operations industry, as well as the unique blend between physical, mechanical, and technological skills that can make for an interesting, engaging day's work.

Funding required to enroll in training and credentialing programs is often a major barrier to funneling prospective workers into new career paths.

Solutions

Funding

With the historic investments mentioned previously come potential opportunities to fund solutions for creating an equitable transition to the clean energy economy. Table 1 below lists some examples of potential funding for supporting these types of initiatives.

Table 1. Examples of funding opportunities for training building operations professionals

Federal Infrastructure Law and IRA

- *Department of Energy: Workforce Development and Business Owner Training Programs*
  Over $250 million in grants to prepare a qualified and diverse clean energy workforce to implement energy efficiency and electrification projects.
  www.energy.gov/scep/workforce-development-and-business-owner-training-programs
- *Department of Labor Employment and Training Administration: Critical Sector Job Quality Grants*
  Demonstration grants intended to expand job quality and availability in climate resiliency and clean energy transition for marginalized communities.
  www.dol.gov/agencies/eta/grants/apply/find-opportunities

State and Local Training and Development Boards

- *Washington State*
  Opportunity Partnership Program
  Administers grants to Workforce Development Councils who partner with local businesses and colleges to connect students with mentors and/or internships.
  wtb.wa.gov/planning-programs/opportunity-partnership-prog/

Trade Associations and Industry Partnerships

- *International Facility Managment Association (IFMA) Foundation*
  Scholarships ranging for $1,500 to $10,000 for undergraduate and graduate students inrolled in facility management or related programs.
  https://foundation.ifma.org/students-academics/scholarships/
- *Apprenticeships in Clean Energy (ACE) Network*
  No-cost technical assistance and financial incentives for industry organizations to develop and implement Registered Apprenticeship (RA) programs for U.S clean energy industries.
  https://irecusa.org/programs/ace-network/guide-to-incentive-funding-for-registered-apprenticeships/

Training Programs

Several national certification programs provide the skills needed for building operations professionals to successfully navigate the clean energy transition. Organizations offering relevant certification programs include:

- Building Operator Certification (BOC)
- Building Performance Institute (BPI)
- Association of Energy Engineers (AEE)
- International Facility Management Association (IFMA)

And increasingly, sustainable building operations-specific curriculum is being integrated into college programs. Some examples include:

- Bates Technical College - Tacoma, WA
  Facilities Maintenance Engineer, Associate of Applied Science (A.A.S.), offering a combination of academic and hands-on training with the option to earn certificates and credentials such as:
    - Building Care and Maintenance Certificate of Competency
    - Maintenance Technician I and II Certification
    - Boiler Operations Certificate of Training
    - EPA 608 Universal Certification (Refrigeration Technician)
- Lane Community College – Eugene, OR
  Energy Management with Building Controls Technology, Associate of Science (A.S.), with coursework including:
    - Energy accounting
    - Analysis of commercial HVAC and lighting systems
    - Troubleshooting control systems
- South Seattle College – Seattle, WA
  Sustainable Building Science Technology, Bachelor of Applied Science (B.A.S.), with upper-division coursework including:
    - Building science
    - Energy/building codes
    - Energy accounting
    - Facility Management
- Bismarck State College – Bismarck, ND
  Energy Management, B.A.S.
- Roxbury College Center for Smart Building Technology – Boston, MA
  Building Fundamentals Program
  100 hour program including certifications in:
    - BPI Building Science Principles
    - BOC Fundamentals of Energy Efficient Building Operations (FEEBO)
    - Urban Green Council Green Professional (GPRO)

Pipelines/Partnerships

The investments being made toward this clean energy transition may also provide an opportunity to help develop and expand public/private partnerships for career pipelines between labor/equity organizations, community-based organizations, government agencies, training and credentialing programs, and employers who can offer apprenticeships. Some examples of existing partnerships are listed below.

Examples:

- Center for Smart Building Technology at Roxbury Community College (Boston, MA) – Provides hands-on training through certificate programs with tuition paid for by sources such as the Massachusetts State Employment and Training Fund. This partnership leverages connections with community-based organizations that serve targeted

populations to create awareness about career pathways in the building operations field. The Center also works directly with Boston Public Schools to perform outreach and tailor curriculum to the needs of high school students to facilitate a direct pathway into certificate programs. The Center's employer partner, Automated Logic, provides internship opportunities that can lead to employment (K. James, Assistant Director, Center for Smart Building Technology, pers. comm., July 9, 2024).

- Strategic Energy Innovations (SEI) Climate Corps Fellowships – Helps public agencies, nonprofits, businesses, and educational organizations attract early-career professionals from a diverse pool of candidates. SEI has seen impressive outcomes, with 85% of fellows hired either by their fellowship site organization or other organizations. These workers often enter the workforce with high-wage jobs, which is attributed to the year-long experience and industry certifications such as BOC that are gained through the fellowship programs. SEI has also been successful in serving diverse populations; for example, 60-70% of its fellows are women. Funding varies between sources such as federal/state governments and/or utilities (J. Pollack, Consulting Director, SEI, pers. comm., July 9, 2024).
- FM Pipeline – Partners with trade associations, employers, and career technical student organizations (CTSO) such as Skills USA to get high school students engaged and informed about career pathways in Facility Management and related fields.
- Bates Technical College – A.A.S. Facilities Maintenance Engineer program graduates can articulate directly into South Seattle College's B.A.S. degree in Sustainable Building Science Technology program. Both programs have robust employer partnerships that provide many graduates with career opportunities upon completion of their programs.
- Lane Community College – A.S. Energy Management program articulates into B.A.S. programs at South Seattle College and Bismarck State College.
- California Community Colleges Energy, Construction & Utilities Sector – a "single point of contact for industry to meet its workforce needs."

A report from the National Clean Energy Workforce Alliance, *Cultivating a Diverse and Skilled Talent Pipeline for Equitable Transition* (NCEWA 2022b) identifies some key actions that can apply to diversifying the building operations workforce, including:

- Providing resources and technical support to develop workforce ecosystems
- Conducting recruitment campaigns highlighting the importance of clean energy workers
- Developing and promoting career pathways for an inclusive workforce, including career exploration resources and apprenticeship opportunities, and investing in credentials and industry standards
- Deploying standardized curriculum and supporting training providers with resources and technical assistance
- Prioritizing funding of effective training programs
- Integrating clean energy into existing education and professional development pathways
- Driving recruitment and retention
- Including workforce provisions in climate and energy policy
- Promoting inclusion through coordination of local, state, and federal resources
- Supporting comprehensive workforce data collection and analysis

Conclusion

With the increased focus on decarbonization initiatives in the existing building operations sector to meet aggressive targets for GHG reduction and to mitigate the worst effects of climate change comes great challenges. But it also comes with great opportunity for transforming the building operation workforce into one that is more diverse. The benefits of diversifying this workforce include filling existing workforce needs while equitably facilitating career paths that can provide thriving wages, and driving creativity and innovation to support a brighter, cleaner energy future.

Leaders across the spectrum of the decarbonization movement have the opportunity to leverage recently introduced financial investments from federal, state, and local governments to shape policies and programs that equitably promote clean energy career pathways in the existing building sector. These should be crafted with consideration toward expanding awareness of the many opportunities in the building operations field, increasing access to training, and facilitating partnerships that connect prospective workers with employers who understand the benefits of diversity and can provide viable, thriving wage jobs. Recruitment strategies that involve direct outreach targeting under-represented groups by leveraging existing community-based organizations can help to diversify the candidate pool. As more of these partnerships are formed and succeed, others will follow suit, further helping to break down misperceptions and accelerating progress toward building a thriving workforce that can significantly contribute to meeting decarbonization goals.

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