Identifying and Defining High Priority Commercial Building Energy Efficiency and Electrification Jobs and Skills for a Growing and Diverse Workforce

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ABSTRACT

The emerging building decarbonization workforce is key to achieving a net-zero carbon economy. From educating building owners to designing, installing, and maintaining efficient, all-electric technologies, there must be a supported, skilled, and effective building decarbonization workforce in place. Investing in workforce provides traditional benefits (e.g., access to good careers, regional economic development) and supports the environmental, climate, and equitable energy transition goals of the U.S. Department of Energy. To successfully decarbonize the commercial buildings sector, workforce programs must simultaneously upskill the current workforce to ensure they can install and maintain energy-saving technologies while encouraging new, diverse entrants to the field, as many existing members of the skilled trades are approaching retirement age.

To this end, we identify and define emerging high-priority commercial buildings jobs and skills necessary for the buildings workforce to support adoption of energy-saving technologies at scale. These jobs and skills could hire workers for newly defined positions or result in upskilling workers in traditional jobs. Once identified and defined, these new jobs and skill standards could help inform the curricula of educational and training organizations and serve as the basis of programs or campaigns to accelerate the development of innovative ways to relay technical content and increase desirability to a new and diverse workforce.

This paper covers the methodology and findings of research, outreach, and engagement to identify and define the high-priority commercial building jobs, skill standards, and barriers to workforce development.

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Introduction

In 2024, the U.S. Department of Energy (DOE) published a national blueprint for decarbonizing the buildings sector, which established goals of reducing U.S. building emissions by 65% by 2035 and 90% by 2050 compared to 2005 levels and to enable net-zero emissions economy-wide, as well as four goals related to workforce development, summarized in Table 1 (DOE 2024). To achieve the stated emissions reductions, a skilled, diverse, and capable workforce in critical areas such as energy efficiency, demand flexibility, and building electrification is needed. Achieving DOE's ambitious goals is projected to invest an additional $1 trillion in high-quality energy jobs (DOE 2024). This investment poses the opportunity to ensure that communities that have been disproportionately facing the environmental harm and economic burdens of the energy system are prioritized in receiving new benefits, economic and career opportunities, and equitable access to decision-making processes (DOE n.d.a).

Table 1 - Workforce related goals established in DOE's Decarbonization Blueprint

Workforce Related Goals Found in DOE's *Decarbonizing the U.S. Economy by 2050: A National Blueprint for the Buildings Sector*
1. "Before 2030, federal action must focus on catalyzing the transition", including through supporting the development of "robust networks of contractors and installers with the skills needed to deploy the low-carbon technologies incentivized by recent legislation."
2. By 2035 "all building decarbonization education and training programs follow equitable workforce development best practices that seek to engage underrepresented populations in clean energy careers."
3. Support the adapting and scaling the transition during 2030-2040, by ensuring "marketing and training resources address emerging solutions and deployment challenges."
4. By 2050, the building decarbonization workforce is representative of the nation's diversity, and the building decarbonization transition is completed by focusing on "enabling low carbon retrofit deployment in segments with low adoption" from 2040-2050.

A skilled workforce matching the demand for labor is critical to turn these goals into action. The ideal workforce will educate building owners and design, install, and maintain efficient electric solutions in commercial buildings. To ensure DOE supports successful workforce development strategies with the greatest impact, a prioritization exercise is necessary, and the authors of this paper and project team wanted to ask the commercial buildings industry directly: What are the high-priority jobs that are critical to meeting DOE goals and most needed skills for the workforce of the future? What are the barriers that individuals face when trying to enter the field of commercial building energy efficiency and/or improving their skills to stay relevant and keep up with technology (also known as upskilling)?

The effort described in this paper leveraged research and stakeholder engagement to identify high-priority commercial energy efficiency jobs for which workers may already exist and need to be upskilled or may represent an emerging area for new worker occupations. Reaching out to stakeholders at the strategy level (e.g., DOE, Department of Labor, national and regional organizations, utilities, and nonprofits), the industry level (e.g., industry groups, unions, and training organizations), and the hands-on workforce (field practitioners) informed the project

team on where gaps exist in workforce development that are or could be holding back commercial energy efficiency, as well as barriers to overcome.

This paper highlights the immense opportunity to leverage the surge of public and private sector focus on decarbonization goal setting and funding to advance energy sector workforce opportunities. The authors explore characteristics of the future energy sector workforce and outline barriers for both new workers entering the workforce and existing workers who may benefit from upskilling. The authors summarize insights from a series of outreach activities with public and private sector industry experts to identify high-priority commercial building careers and skills for the future energy sector workforce.

After identifying high-priority jobs and skills, the next step is to explore activities such as strategies for recruitment and retention of skilled trades professionals, improving access to training and career advancement opportunities, and developing engaging skills training. Although not covered in this paper, the next phase of this work will explore workforce development strategies for the identified high-priority commercial building careers.

Opportunities

The end-use (site) energy consumption of U.S. commercial buildings in 2018 was over 6.8 quads, representing almost 17% of U.S. primary energy consumption (EIA 2022). Commercial buildings consume as much as 30% more energy through inefficiency (e.g., Katipamula et al. 2021), and therefore improving their operating efficiency represents a significant opportunity to achieve energy and decarbonization goals, and environmental and energy justice priorities. A skilled workforce will be critical to meeting these goals, not only in terms of designing, installing, commissioning, and maintaining energy systems and technologies, but also to communicating the benefits to building owner and operators.

Energy sector employment in the United States has outpaced economy-wide employment recently, growing by 3.8% compared to 3.1% between 2021 and 2022. Clean energy sector employment, including both renewables and energy efficiency, outpaced the energy sector average, growing 3.9% (DOE n.d.b). At the end of 2022, there were 2.2 million jobs in the energy efficiency technology category of the energy sector, an increase of 7.4% since 2020 (DOE n.d.b). According to a June 2022 study by Decarb America Research Initiative, which analyzed a suite of policy and technology pathways for the United States to reach net-zero greenhouse gas emissions by 2050, decarbonizing the U.S. economy will create a net increase of over 2 million jobs by 2050 (Chan et al. 2022). The energy efficiency sector will be a key employment driver, especially in the first decade because there are existing technologies and methods that can be deployed now.

In commercial buildings, space heating is the largest single energy end use at 32%, followed by ventilation (11%) and lighting (10%) (EIA 2018). Numerous strategies and technologies are currently available that can help improve overall building efficiency. These include heating, ventilation, air-conditioning, and refrigeration (HVACR) system improvements (e.g., heat pumps, heat pump water heaters, prioritizing maintenance of existing systems and optimizing new ones), adopting smart building technologies (e.g., automatically adjusting lighting and HVAC systems, managing miscellaneous loads, integrating systems such as HVAC and lighting), upgrading to LED lighting, and energy auditing and retro-commissioning. In addition to energy end uses, actions like installing or upgrading the building envelope (e.g., windows and window attachments, insulation, and air sealing), also play a role in energy

efficiency. To achieve their energy-saving potential, these strategies and technologies will require a skilled workforce to properly design, install, operate, and maintain them. This skilled workforce will be key to helping ensure that buildings are operating at peak performance, and to improving building performance while keeping operation and energy costs low.

Furthermore, recent federal legislation such as the Inflation Reduction Act (IRA) and the Bipartisan Infrastructure Law (BIL) is poised to bolster the energy efficiency workforce, with investments in DOE clean energy projects, including in buildings, weatherization, and state and community energy programs. For example, the IRA expanded the 179D tax deduction, which is an energy efficiency incentive for commercial buildings, and added workforce provisions where a project is eligible for five times the maximum deduction amount if it meets prevailing wage and apprenticeship requirements (IRS 2024). The BIL includes more than $62 billion for DOE clean energy initiatives (DOE 2021). Together, these investments are likely to be an important driver for demand for skilled tradespeople in energy efficiency.

An opportunity also exists to improve equitable access to workforce development opportunities, upward career mobility, and economic advancement of historically underrepresented populations by understanding and addressing barriers to entering the workforce and upskilling current workers from underrepresented groups, as well as designing workforce development programs to be appealing and accessible to populations that need the most help securing training, employment, and career advancement opportunities.

Workforce of the Future

Upskilling and Recruiting

It is important to consider who will be working to turn DOE's decarbonization goals into action. The first goal, reducing building emissions by 65% by 2035 compared to 2005 levels, will need to be realized in 11 years as of the writing of this paper. This means that many members of the critical workforce needed to meet this goal are currently employed but may need to be upskilled on emerging energy-saving technologies. For example, the typical plumber knows how to size, install, and maintain a traditional natural gas water heater. However, heat pump water heaters are quickly gaining traction and to take advantage of their energy savings, they need to be sized, installed, commissioned, and maintained properly. The typical plumber may need to upskill on concepts such as siting requirements, electrical components, refrigerant flow, condensate plumbing, and utility integration for heat pump water heaters. Upskilling will ensure members of the existing energy sector workforce can meet rising demand and remain relevant with changing demands and regulatory environments.

The second DOE decarbonization goal is to reduce building emissions by 90% by 2050 from 2005 levels. This goal will need to be met in 26 years as of writing this paper. This means that many members of the critical workforce needed to meet this goal are currently children and will need to be recruited into the workforce. Arguably a harder task, recruiting the next generation into the commercial building energy efficiency workforce will require a large-scale strategy to create demand for career paths with historically low desirability (see the section, *Barriers to Entering and Upskilling the Workforce*). It is critical to change current perceptions to help shape the younger generations' view of skilled labor to show that energy efficiency jobs are high-quality, well-paying, and good for the environment. This effort can begin in grade school and be presented as a clear career path throughout their education, as an alternative and equally admirable option to a four-year college degree pathway.

Critical Aspects of the Future Workforce

As we embark on this exploratory effort to define high-priority jobs of the future, there are critical aspects of the future workforce that will define the scope of the conversations with stakeholders. This section describes five of these aspects considered critical by the authors as well as stakeholder responses about how they envision the workforce of the future.

More Abundant. When stakeholders are asked about what they see as critical issues in the workforce, "worker shortage" is a common answer, as one stakeholder we engaged noted: "Most, if not all, skilled trades face workforce shortages, especially skilled trades with clean energy certifications." A recent survey (PR Newswire 2022) found that 40% of the 12 million people in the skilled trades workforce are over the age of 45, with nearly half of those workers over the age of 55, and less than 9% of workers aged 19-24 entering the trades. When fewer young people enter skilled trades, the workforce will inevitably shrink. To meet the need for energy efficiency, it is critical that workforce programs not only focus on upskilling current members of the workforce to ensure they can install and maintain energy-saving technology, but also focus on bringing new people into the commercial building workforce.

More Skilled. Well-maintained and operated building systems are often the most energy efficient. To keep up with technology and ensure that buildings are operating as efficiently as possible, the workforce must have the proper skills to perform their jobs well. This is why education and training are such a critical part of workforce development programs.

More Diverse and Equitable. According to the *United States Energy and Employment Report (USEER) 2023* (DOE n.d.b), 75% of the energy workforce is white and 73% is male, leaving women and people of color vastly underrepresented. To achieve larger goals around social equity and to better meet the critical aspects of the workforce of the future, workforce development programs must reach diverse talent pools that better align with the country's demographics.

Better Paid. To create demand for any job, the pay must be commensurate with the responsibilities and duties, as well as competitive with other career paths. This is critical to encouraging young people to enter this workforce and to retaining current workers. A comparison of wages of careers discussed in this paper (bolded) to other common professions is presented in Table 2.

Table 2 - Median Annual Wages of all Major Standard Occupational Classification (SOC) Occupations, May 2023, with jobs relevant to this paper bolded (BLS).

SOC Code	SOC Occupation	Median Annual Wage
11-0000	Management	$116,880
15-0000	Computer and Mathematical	$104,200
15-1244	**Computer Network Support Specialists**	**$ 71,530**
23-0000	Legal	$99,220
17-0000	Architecture and Engineering	$91,420
29-0000	Healthcare Practitioners and Technical	$80,820
13-0000	Business and Financial Operations	$79,050
19-0000	Life, Physical, and Social Science	$78,280
25-0000	Educational Instruction and Library	$59,940
27-0000	Arts, Design, Entertainment, Sports, and Media	$58,920
47-0000	Construction and Extraction	$55,680

SOC Code	SOC Occupation	Median Annual Wage
47-2111	**Electricians**	**$ 61,590**
47-4011	**Construction and Building Inspectors**	**$ 67,700**
49-0000	Installation, Maintenance, and Repair	$53,920
49-9021	**Heating, Air Conditioning, and Refrigeration Mechanics and Installers**	**$ 57,300**
21-0000	Community and Social Service	$52,000
33-0000	Protective Service	$47,760
43-0000	Office and Administrative Support	$44,480
51-0000	Production	$43,630
53-0000	Transportation and Material Moving	$40,050
41-0000	Sales and Related	$36,760
31-0000	Healthcare Support	$36,140
37-0000	Building and Grounds Cleaning and Maintenance	$35,990
45-0000	Farming, Fishing, and Forestry	$35,520
39-0000	Personal Care	$34,260
35-0000	Food Preparation and Serving	$32,240

More Fulfilling. Many interviewed stakeholders stated that there are negative perceptions around skilled labor as a career path, which can lead to poor recruitment and retention of workers. Additional efforts should be allocated towards altering these perspectives. For example, in the energy efficiency industry, skilled labor positions could be more accurately marketed as environmentally positive, or "green" careers. As energy efficiency in commercial buildings is critical to reducing carbon emissions, the importance of emphasizing how these careers can help mitigate climate change cannot be overstated. Similarly, the trades included in the energy efficiency industry exhibit advanced skills and technical ability. This could be a pull factor for new workforce entrants, especially considering that a key aspect of fulfillment is developing and using one's skill and abilities to successfully carry out duties and responsibilities.

Barriers to Entering and Upskilling the Workforce

There are barriers that a new entrant or current member of the workforce might face when trying to gain the skills and/or credentials to advance their career, and understanding these barriers and addressing them in workforce development programs is key to overcoming them. Barriers may include confusing career pathways, negative perception of job types, regulatory burdens, lack of access to training, difficulty taking time off work, cost, and more. This section summarizes recent literature published on barriers to career initiation and advancement. It is important to note that various workforce stakeholders (e.g., employers, local governments, training organizations, energy efficiency advocates) may face barriers, but this section is limited to discussing barriers faced by members of the workforce (i.e., those seeking to develop their skills and advance their careers).

The paper "Completing the Circuit: Workforce Development for Advanced Building Construction and Grid-Interactive Efficient Buildings" (Truitt et al. 2022a) explores barriers that represent experiences of the more general construction and building operations sectors. These barriers include:

- Negative perception of and low interest in building industry careers, where younger people are more interested in digital careers rather than skilled trades and consequently fewer younger people are entering the building industry workforce, so the current workforce continues to increase in average age, approaching retirement.
- Insufficient skills that are hindering workforce development: 1) understanding the relationship of buildings, energy, and climate; 2) critical thinking and problem solving; 3) data analysis; and 4) information and communication technology skills.
- Lack of alignment and shared knowledge across professions, where there is a need for more connections in adjacent sectors and shared understanding of practices.

In their American Council for an Energy-Efficient Economy (ACEEE) publication, Shoemaker and Ribeiro (2018) discuss uncertainty of funding for workforce development programs, which leads to a lack of access to training. Additionally, the lack of coordination and shared knowledge among stakeholders (government, unions, industry, utility) makes for a confusing career and skills-development pathway.

In an especially relevant paper from the 2022 ACEEE Summer Study on Energy Efficiency in Buildings titled "Building Workforce Capacity in the Green Economy," Capps et al. (2022) present successful examples of urban and rural workforce programs focused on "green" jobs and describe five market barriers to overcome:

1. *Unclear career pathways*: skilled labor careers are not often presented as clear options to young people, especially when compared to four-year degree pathways.
2. *Worker shortage*: recruitment does not surpass retirement.
3. *Inadequate pay*: workers receive low pay for strenuous and skilled work.
4. *Market instability* causes volatility in hiring and job retention.
5. *Workforce housing shortages* lead to higher housing costs and/or long commutes.

The following year, Guo et al. (2023) wrote an article for the *Proceedings of the 2023 ACEEE Summer Study on Energy Efficiency in Industry* that collected feedback from DOE's Better Plants Program approach to workforce development and reported a critical barrier related to credentials: "Some participants indicated that they need a map to guide them through all the available credentials on the market so they can find credentials that can better serve their goals and match their backgrounds; they would also like to find information on how to obtain these credentials" (p.10). This echoes a barrier listed above: career pathways are unclear, especially when it comes to the numerous and expensive credentials marketed to the workforce.

Systemic barriers are an ever-present challenge to workers' ability to start and advance careers, and the energy efficiency field is no exception. Miniard et al. (2023), as well as Truitt et al. (2022b), find that discriminatory practices in recruitment, hiring, and pay may cause individuals to leave the workforce or to not have the opportunity to participate at all. These studies contain long lists of disadvantages faced by marginalized communities that can impact careers, like lack of transportation, housing, healthcare, childcare, and more. Table 3 summarizes this brief literature review.

Table 3 - Summary of barriers found in recent literature.

Barrier to individual	**Source**
Negative perception and low interest	Truitt et al. 2022a

Insufficient skills	Truitt et al. 2022a
Lack of alignment and shared skills	Truitt et al. 2022a
Unclear career pathways	Guo et al. 2023, Capps et al. 2022, Shoemaker and Ribeiro 2018
Low pay for hard work	Capps et al. 2022
Market instability	Capps et al. 2022, Shoemaker and Ribeiro 2018
Housing shortage	Capps et al. 2022
Systemic barriers	Miniard et al. 2023, Truitt et al. 2022b

In addition to high priority jobs and skills, this project team also asked about barriers during workshops, interviews, and surveys. The following summarizes the findings from this outreach and engagement effort.

Identifying High-Priority Commercial Buildings Careers and/or Skills

In 2024, Pacific Northwest National Laboratory (PNNL), on behalf of the DOE Building Technologies Office, embarked on an effort to help identify and define emerging high-priority commercial buildings careers, skills, and barriers in the commercial building workforce. To do so, the PNNL team incorporated three methods of outreach to engage key stakeholders: workshops, interviews, and surveys[2]. These methods complement one another and allow for a mixed methods approach to data collection. Qualitative data, through workshops and interviews, provide in-depth information that elaborates on the nuances within this topic, whereas quantitative data collection through surveys enables key findings from a broader audience. If the jobs identified are aligned, this work may update and build upon the job task analyses developed by the National Institute for Building Science on behalf of the DOE, which undertook a two-year project to comprehensively define five commercial buildings jobs.[3]

Key stakeholders in our study include participants in the following groups: field practitioners (i.e., members of the workforce who are employed in the identified jobs), staffing agencies, workforce development organizations, unions, local or state government workforce staff, and others deemed to have knowledge and expertise relevant to understanding our project objectives. To allow for the broadest engagement possible across the three methods, participants will be offered equitable compensation for their time. Additionally, demographic data collected from participants will be aggregated and deidentified in our results.

Two workshops are planned for 2024, with the first workshop (March 2024) designed for the beginning of our study and the final workshop (planned for August 2024) to conclude our study's data collection. Workshops will be conducted virtually with approximately 30-50 participants. The first workshop had three primary objectives: 1) connect stakeholders supporting the commercial building energy workforce of the future; 2) review the current state of the commercial buildings energy workforce and how it will change in the future; and 3) discuss the gaps that exist in the commercial building energy workforce of the future and the challenges to overcoming those gaps. The final workshop is designed to share the findings from our study with the engaged stakeholders and to provide an opportunity for final feedback and reflections on our

[2] Surveys will be completed after submitting this paper to ACEEE; findings from surveys are not yet available.
[3] See the National Institute for Building Science webpage for more information and to access the Better Buildings Workforce Guidelines Job Task Analyses: https://www.nibs.org/fmoc/bbwg_jtamat.

findings. This will allow stakeholders involved to give additional insight that may have been missed or to allow for new conversations prompted by these findings.

Interviews have been conducted with key stakeholders following the first workshop. We used a purposive sampling technique to determine which participants were included in our interview study sample based on their expertise (occupation and skills), geographic location, and other demographic characteristics that helped ensure diverse representation in our interview sample (e.g., race/ethnicity, gender). Interviews intended to understand more in-depth information about preliminary findings from the workshop. Semi-structured interview questions allowed for flexibility in the prompts and follow-up questions to garner additional information from participants based on the topics discussed (Merriam and Tisdell 2016). Interviews included questions about skill gaps in the workforce, challenges to overcoming these gaps, barriers to upskilling, and what has been successful in addressing skill gaps in the workforce. Interviews were conducted virtually with participants over one hour. Findings from these interviews will inform survey protocol.

Surveys will be conducted with approximately 100-200 participants using the Qualtrics SM Survey Tool. Surveys allow for data collection from a larger sample to identify broader findings. Survey protocols will be informed by workshop and interview results. Participants will include additional stakeholders in the categories described above and will be sampled to ensure diverse representation across areas of expertise, geographic location, and other demographic characteristics. Data will be gathered on barriers to recruiting new entrants for commercial building decarbonization workforce, upskilling, and other aspects of workforce development. Surveys will gather data on skills required for jobs as identified through earlier workshop and interview outreach. Surveys will be administered virtually and provided to contacts via email.

Findings from the workshop, interviews, and survey will inform high priority decarbonization jobs and the skills emerging and needed to carry out the identified jobs. The next sections identify these key findings of the workshop and interviews.

Findings from Outreach and Engagement

Workshop

The workshop, titled “Commercial Building Energy Efficiency Workforce Workshop” was held on March 5, 2024, with 51 participants, not including staff. Table 4 shows the attendee breakdown by sector. To guide the discussion during the workshop, three general questions were asked; each is presented in subsections below, along with key findings.

Table 4 - Workshop Attendees by Sector (non-staff).

Sector Group	Percent of Workshop Attendance
Workforce Development Organization	24%
State Government	14%
Academia	12%
Industry Groups	12%
Service Provider	12%
Unions	8%
Federal Agencies	6%
Regional Energy Efficiency Organization	6%

Utilities	4%
National Labs	2%
Program Implementer	2%

1. What does a thriving and decarbonized commercial building workforce of the future look like? What new jobs will appear? How will current jobs evolve?

Four job areas were identified as emerging in the commercial building workforce of the future: 1) *Buildings and controls workers* who will install, operate, and maintain efficient building management systems. This includes electricians focused on electrification and fuel switching, HVAC-related trades focused on healthy and energy efficient thermal comfort systems, and building controls integrators who will enable connected building systems. 2) *Consultants and analysts* to prepare existing buildings for upgrades, including financial planners, demand response analysts, and service upgrade specialists. 3) *Environmental quality and performance monitors* to ensure buildings are healthy spaces for occupants. These include energy auditors, resource conservation managers, regulatory inspectors, and air quality experts. 4) *Information technology (IT) specialists* who support new software-based technologies that will enable smart and optimized buildings, including building-focused IT support, artificial intelligence (AI) specialists, data reporting, collection, and processing analysts.

Four areas of industry evolution related to workforce were also identified: 1) *Increased focus on building health and performance*. For example, greater needs to balance energy efficiency with indoor environmental quality and safety integrating energy efficiency into general contracting, and management of time-of-use energy performance. 2) *Growing need for education and training to enable a modern workforce*. This includes how to best incorporate remote/hybrid work; complying with new and evolving building code requirements and addressing downward pressure to commoditize work and convert roles to gig economy. 3) *Expanding scope of on-the-job knowledge*. Stakeholders stressed the importance of understanding the relationship between buildings and climate and the need for individuals to have holistic industry knowledge (i.e., more general knowledge is needed in more connected and integrated buildings), and adaptability as new building materials change how work is approached (e.g., low carbon cement). 4) *New technology and software utilization*. While not much detail is known at this point, workshop attendees were certain that AI would play a role in energy efficient buildings and related skills will be needed to fully enable advanced technology in buildings and electric grids. Along with this new technology and software focus come cybersecurity concerns, which will be a needed evolution of the buildings industry.

2. If we needed these jobs of the future today, what skill gaps exist?

Table 5 presents four main skill gap areas identified during the workshop: Business & Analytical Skills, Deep Industry / Sector Knowledge, Energy Policy & Programs, Information Technology & Systems, as well as bulleted descriptions and examples of each.

Table 5 - Skill Gaps Identified During Workshop.

Skill Gap Area	**Description and Examples**

Business & Analytical Skills	• Soft/employability skills (e.g., communication, showing up on time, sales & customer service, change management) • Strategic problem solving and critical thinking (diagnosing complex issues between technology, installation, and contracts, making long-term recommendations & valuations) • Statistics-based data analysis • Linguistic diversity
Deep Industry / Sector Knowledge	• Understanding of methods for upgrading energy performance of existing/older buildings & high-performance systems • Building operators skilled in high-performance systems • Disconnect between "design community" and installation and service • Balancing health, safety, and wellness with energy efficiency
Energy Policy & Programs	• Net zero code and green building certification compliance/credentials; code enforcement officer knowledge • Energy knowledge with a focus on decarbonization and district energy (not solely energy efficiency) • Climate knowledge and mitigation/adaptation strategies • Need for green jobs ambassadors (i.e., professionals in these careers that can communicate the value of these careers to the next generation)
Information Technology & Systems	• Disconnect between technology requirements, people doing installation/implementation, and service/repair people in the field • Basic computer skills, database management, software programming • Electrical theory and quality installation software • Systems integration and combined system UX design • Cybersecurity, artificial intelligence, and smart systems

3. What challenges / barriers keep people from entering the workforce or seeking upskilling opportunities?

Awareness and appeal of skilled trades and jobs in commercial buildings was a barrier discussed at length during the workshop. Stakeholders noted a general lack of awareness of types and availability of clean energy and energy efficiency jobs, especially for younger people looking to enter the workforce. Some noted the ubiquitous emphasis on four-year degrees for many middle and high school aged people, as well as the perceived stigma of jobs in the trades (i.e., if you don't go to college, you won't be successful). The lack of recruitment of younger people into the workforce combined with high retirement rates exacerbate workforce shortages.

Equity and compensation were also raised as barriers both for the workforce and for the industry seeking to increase workforce resources. Workshop attendees discussed the need to address systemic barriers to workforce entry and culturally responsive management programs to grow a more diverse workforce, such as valuing cultural characteristics, experiences, and perspectives of prospective candidates. Similarly, there is a need to improve pay and benefits standards across the industry to promote the value of energy efficiency work and to pay competitive wages to quality trainers and educators. Finally, language barriers were identified as pervasive in the skilled trades, in terms of both linguistic diversity (i.e., the spoken language) and in oversaturation of industry jargon that produces feelings of exclusion.

Interviews

Demographics of Interview Participants

As of the time of this publication, our team has interviewed 19 professionals in various fields within the commercial building energy efficiency workforce. Interviewees were purposefully sampled and recruited to provide diverse perspectives across stakeholder categories, area of expertise, region of the US, and demographic characteristics. Our interviewees represent consulting (21%), community-based organizations (16%), training/education (16%), unions (11%), industry (or service providers) (5%), government (5%), program implementation (5%), utilities (5%), and tradespersons in the general workforce (5%). Areas of expertise from our interviewees include energy efficiency and management, lighting, HVACR, building controls, energy codes, sheet metal, and welding. Our participants represent all regions of the US and vary in demographic characteristics (See Table 6, where values are rounded to the nearest whole percent, and thus may not add to 100%).

Table 6 - Interview participant demographic characteristics.

U.S. Region	Race/Ethnicity	Gender	Socioeconomic Status	Age
Northwest (16%) Southwest (16%) Southcentral (16%) Southeast (16%) Midwest (11%) National (11%) Northeast (11%) Northcentral (5%)	White (68%) Black (5%) Mixed race (11%) No response (16%)	Female (47%) Male (42%) No response (11%)	Low (0%) Low-middle (5%) Middle (53%) Upper-middle (11%) High (11%) No response (21%)	20s (11%) 30s (5%) 40s (26%) 50s (26%) 60s+ (21%) No response (11%)

The following are preliminary interview results in terms of the high priority jobs and skills that interviewees describe, as well as existing barriers to the workforce and training or recruitment programs, and draft recommendations for overcoming those barriers.

Jobs

The priority jobs described by interviewees include: HVACR positions, other trade positions (e.g., electricians, plumbers), energy efficiency professionals, information technology (IT) and artificial intelligence (AI) specialists, and building controls / operations positions. Several interviewees mentioned the shortages of *HVACR technicians*, particularly those who are highly trained (e.g., journeypersons or qualified trainers). There are also concerns that current HVACR technicians may not possess all the necessary skills to complete jobs involving new technologies (e.g. heat pumps and advanced refrigerants) optimally, and interviewees see a need for a more comprehensive understanding of building systems. *Other trade jobs* were the second most commonly mentioned high priority job that is needed in this workforce. Specific trade jobs mentioned include electricians, plumbers, carpentry, and glazier jobs. Many participants described the need for more comprehensive knowledge and training across the trades for more effective installation of energy efficient technologies.

Energy efficiency professionals were the next most commonly described high priority job for this existing and transitioning workforce. Other terms and related jobs, such as energy efficiency professionals, energy auditors, energy managers, resource conservation managers, and

energy raters were also used to describe jobs that would be needed to understand electricity usage, savings, and optimizing systems to be more energy efficient. These professionals would have high levels of knowledge across a variety of sectors and be able to see big picture solutions for improving the efficiency of new and existing commercial buildings. *IT and AI-related jobs* were mentioned as a high priority, especially when considering the future of the workforce and the transition to more smart building designs. Although IT and AI-related skills might overlap other positions mentioned as being high priority, jobs in this area are and will continue to be a need. Lastly, many interviewees mentioned *building controls and operations* positions as high priority jobs in this workforce.

Skills

The primary skills described by interviewees include IT and AI-related skills, comprehensive knowledge of systems, building science, energy efficiency, and HVACR. Many of these skills are relevant to a variety of high priority jobs and are not necessarily specific to one role. Our survey will be used to identify more skills across the high priority jobs mentioned.

Barriers to workforce and training

Participants were asked about the barriers, challenges, and gaps for the existing workforce and challenges with training and recruitment programs. The primary barriers mentioned include diversity, stigma, and lack of awareness of available jobs, financial barriers to entering the workforce, and a lack of prioritization for energy efficiency in the industry.

Diversity: The barrier most addressed by interviewees related to diversity in the workforce. Participants described the need for more women (mentioned frequently) and individuals from underserved groups including race/ethnicity, sexual orientation, and individuals formerly incarcerated. Although some interviewees mentioned that while the workforce is slowly becoming more diverse, there is still much to be done to make the workforce more inclusive and to break down systemic barriers that continue to prevent individuals from engaging in these spaces. Participants emphasized the importance of diversity toward bringing in new perspectives to this field. They also described the challenges that have prevented and continue to deter women and those from underserved groups from participating in this workforce, including discrimination and sexism. This also includes the need for wraparound services to ensure that women and underserved groups are getting the resources they need and to break down the barriers to starting training, engage in ongoing training, and for overall entry into the workforce. Participants describe the need to purposefully engage underserved communities to help diversify the workforce and address the systemic barriers.

Stigma and lack of awareness: The second most addressed barrier described by interviewees was stigma of jobs in the commercial building energy efficiency workforce (particularly in trade-related positions). Interviewees described these positions as “not glamorous” and often overlooked by individuals entering the workforce, particularly those from underrepresented backgrounds. Although there is a perception that the trades do not pay well and require manual labor, participants emphasized that especially with the focus on energy efficiency, many positions in the technology and AI space do not require physical labor skills and positions in this field often pay competitive salaries. Additionally, participants emphasized that for those entering the workforce who value careers in decarbonization and climate change, the opportunity to have an impact through a career in this workforce should be emphasized.

Financial barriers to entering the workforce: Participants also mentioned financial barriers that prevent existing members of the workforce from upskilling and those that prevent

new entrants into the workforce from taking trainings. For example, many members of the existing workforce may be in fields that are underemployed with little time and resources devoted to upskilling. Though they may be interested in new trainings to expand their skillset, they may not be offered the compensation necessary to complete the training. Employers may be unable or unwilling to provide employees with funding to cover their time. For those entering the workforce, wraparound services are often needed to provide financial support such as childcare, transportation, and food for participants. These services are especially critical for effectively recruiting individuals from underrepresented groups in this workforce. Training programs may need to consider offering wrap-around services, along with financial incentives strong enough to address this challenge.

Lack of prioritization for energy efficiency: Another primary challenge identified in our preliminary findings is a lack of prioritization for energy efficiency in some sectors and/or areas of the country that make it more difficult to engage the workforce. Some of this stems from a traditional mindset where long-time members of the industry be more reluctant to change. Although the current political administration highlights the importance of energy efficiency, some policies and existing regulations may be preventing the industry from effectively advancing in this space. For example, financial resources may not be provided to effectively transition to energy efficient methods in certain sectors and geographic locations. This may also stem from the demand side; building owners may be risk averse to adopting new, efficient technologies. Many participants mentioned much of this goes back to money and the cost-benefit perceived by building owners. While there are programs that provide building owners with financial incentives to make this transition, much still needs to be done to prioritize this shift.

Overcoming barriers

Interviewees offered recommendations on ways to overcome barriers described above. Two recommendations were primary: improve awareness with better marketing of these jobs and providing wraparound services to individuals looking to enter or upskill within the workforce.

Awareness: To address concerns with a lack of diversity and general lack of awareness of careers in this industry, many participants highlight the need for more efforts to market these positions to the public. Some organizations have already taken on this challenge by actively engaging in underserved communities to recruit a more diverse workforce. Marketing efforts ought to break down some of the assumptions about careers in this industry and educate the public on their many benefits (e.g., high paying careers, addressing climate change).

Wraparound services: To overcome the barriers that prevent individuals from entering the workforce and engaging in trainings and upskilling, many participants mention the need for wraparound services that address many of the logistical challenges of the workforce. Childcare services are one area often mentioned to provide support for parents. Financial incentives are another way to provide the workforce the means to engage in trainings. This might involve funding programs that waive the fees for taking trainings and compensating workers for their time, such as overtime wages since participants may have to give up overtime hours and pay for attending trainings. Another wrap-around service often mentioned is transportation. Workers, particularly those from underserved communities, may lack transportation resources to reach training centers. Providing training services that move locations or provide participants with transportation options (e.g., compensation to cover transportation costs or providing their own busing services) may alleviate these challenges. Lastly is the need for wrap around services that help address language barriers which may be preventing non-English speaking U.S. and non-U.S. citizens from participating in this workforce.

Conclusion

To define high-priority jobs in commercial building energy efficiency, the authors conducted stakeholder engagement through hosting a workshop and conducting interviews. From this engagement, the following jobs were identified as high priority: positions related to building equipment and electrification, such as HVACR and electricians, staff that influence energy efficiency and healthy buildings, such as energy auditors and energy managers, and technical IT professionals who can monitor and manage networked buildings. Skills critical to efficiency for these positions will be identified through surveys conducted in the summer of 2024. However, general skills were identified during the workshop and include business and analytical skills, holistic building science knowledge that cuts across building trades to optimize overall building performance, energy policy and climate impacts of buildings, and computer and IT skills.

Additionally, critical barriers to entering and upskilling the workforce were identified, as well as strategies to overcoming these barriers. Barriers include lack of diversity, stigma, and lack of awareness of available jobs in buildings, financial barriers to entering the workforce, and a lack of prioritization for energy efficiency in the industry. These barriers may be overcome by raising awareness of the availability and impact of energy efficiency jobs in commercial buildings and providing wrap-around services to individuals looking to enter or upskill within the workforce, such as childcare, financial services, transportation, and language services.

Next steps include conducting surveys to identify skills specific to the critical jobs and designing workforce development programs around the high-priority jobs, specifically addressing the identified barriers.

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