A Balanced Approach to Workforce Development in Benefit Cost Analysis

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ABSTRACT

A dramatic expansion in the clean energy workforce is needed to meet ambitious climate goals across North America. When programs attempt to incorporate more complex technologies, or rapidly scale existing technologies, there is often a corresponding investment required in workforce development (i.e. the costs to train, hire, and retain skilled labor to deliver new and efficient measures and services). If benefit cost tests treat those workforce development costs merely as market overhead or administrative burden without accounting for the corresponding benefits, then this understates the real impacts of these investments on program success and unduly limits program potential.

This paper presents a more balanced framework for the counting of both benefits and costs of workforce development. This includes an examination of impacts on marginal future costs, the accelerated capture of program benefits, and the treatment of certain cost components of workforce development programs. Taken together, this framework can be used by regulators and program administrators to more holistically assess and plan for labor resources impacts, and more closely align workforce needs with program outcomes.

Introduction

Utility and state demand-side management (DSM) portfolios have increasingly recognized workforce development (WFD) as a key constraint on program scale and performance. State policy and DSM program goals across the United States have become more expansive and the technologies, labor, and coordination needed to reach those goals has become more complex, rapidly increasing workforce constraints. When programs attempt to incorporate more complex technologies, or rapidly scale existing technologies, there is often a corresponding investment required in WFD (i.e. the costs to train, hire, and retain skilled labor to deliver new and efficient measures and services). As of 2022, New York State aimed to electrify or make "electrification ready" 2,000,000 homes by 2030, a pace which represents an approximate tenfold increase in electrification in the state (Hochul 2022). Statewide goals in Massachusetts are equally ambitious. State targets aim to install heat pumps in 500,000 homes from 2020-2030. Through 2025, half of the proposed period, just over 133,000 heat pumps have been installed in the state, meaning the labor force needed to support the Massachusetts heat pump market will need to consistently grow 33% every year for the next 5 years, quadrupling production over the period (Massachusetts Executive Office of Energy and Environmental Affairs 2022). Targets like these represent a historically unique growth in labor force, equivalent to that of early stage, market transformative technology like the mobile app economy (Mandel 2017). The U.S. Bureau of Labor Statistics ranks wind turbine service technicians and solar installers at the very top of its 2024 "fastest growing occupations" list. However, those occupations are expected to grow by only 40%-50%, in total, one quarter of the growth needed in heat pump associated trades in Massachusetts (BLS 2025). This means training, certifying, credentialing, and supporting new and incumbent workers cannot be an afterthought of program design and evaluation. It is a foundational hurdle to the success of DSM programs and the policy goals that surround them.

A number of significant WFD programs already operate within DSM portfolios. Massachusetts funds dedicated WFD initiatives through MassCEC and recently doubled program-level workforce spending to $24 million per year in its 2025–2027 plan (MassCEC 2024). NYSERDA operates a substantial Clean Energy Fund WFD program with its own impact and market evaluation framework (DNV 2022). California has run Workforce Education and Training (WE&T) programs alongside its core investor-owned utility efficiency portfolios for over a decade (Opinion Dynamics 2024a). These programs are typically justified and evaluated through an economic development or market transformation lens, which focuses on outcomes such as jobs created, trainings delivered, and businesses supported, rather than through the resource acquisition framing that governs the BCA tests used to approve core DSM spending. The result is a structural disconnect: workforce investment is undertaken and is widely understood to enable program delivery, but its benefits are not reflected in the cost-effectiveness tests that determine program scale and budget.

Although the significant constraint of WFD is widely acknowledged, integrating WFD costs and benefits into benefit-cost analysis (BCA) frameworks continues to represent a significant policy challenge. BCA frameworks account for WFD expenditures primarily as an administration cost and only indirectly recognize their benefits, if those benefits are recognized at all. This regularly places key workforce spending in a cost category alongside other "program overhead," overhead with limited, if any, identifiable resource benefit. If workforce challenges are understood as a real impediment to program effectiveness and scale, integrating new frameworks for quantifying and accounting for those investments and requisite benefits is key to the alignment of policy and outcome and critical to ongoing program success.

This paper does not propose new WFD programs. Instead, it offers a framework for more fully integrating the costs and benefits of existing WFD programs into the BCA tests that govern DSM portfolios. To do so, the paper surveys recent workforce studies, reviews the ways in which current BCA frameworks and incentive structures typically address WFD costs and benefits, describes the programmatic impacts of those treatments, identifies existing methods for realizing WFD benefit, and proposes a framework for categorizing and understanding WFD benefit and investment under existing BCA tests. Together, more agile cost and benefit frameworks can support programs and policymakers in rightsizing and justifying the WFD investment required to deliver on ambitious program goals.

Workforce Development as a Program Barrier

Program-level workforce capacity development (i.e. the ability for employers to train, and bear the costs to train, certify, credential and support the workforce needed to deliver programs), has been increasingly viewed as a major market barrier to program success. A number of recent studies have shown that present hiring insecurity across the DSM landscape is both acute and persistent. A 2022 NYSERDA WFD impact assessment makes this challenge stark:

> The message from both participants and non-participants is clear: a shortage of a skilled workforce is a painful reality of running a clean energy business today. Employers are optimistic about the industry, forecasting that they will require 30-40% more staff to meet 2023 business plans, according to the employers surveyed in this study. When asked about how confident they were in finding staff to meet 2023 business plans, the respondents, on average, reported being 65% confident that they will find the staff (DNV 2022).

Participant statements from NYSERDA's assessment are telling. Contractors report key roles that remain unfilled for multiple years and view labor constraint as a protracted issue with little hope for near-term resolution. As one contractor reports, "We're finding it difficult to find qualified and reliable employees. I don't foresee this issue correcting itself within the near future" (DNV 2022).

Studies from Massachusetts are similarly stark. A 2021 WFD needs assessment for the Mass Save program reports that "ninety-two percent of employers reported hiring difficulty of the last 12 months, with 45 percent indicating that hiring had been very difficult" (BW Research Partnership 2020). These challenges are not unique to states with significant carbon reduction targets like New York and Massachusetts. A 2023 workforce needs report produced by the Pennsylvania Department of Environmental Protection, echoes these sentiments. There, two thirds of employers reported some or great difficulty hiring plumbers, energy auditors, electricians, and HVAC mechanics, installers or technicians (DEP 2023).

Notably, studies typically frame hiring questions around contractors' current staffing levels and near-term growth trajectories, not long-term program targets or broader market needs. As we have discussed, many state and regional targets require several orders of magnitude growth in the labor force, meaning continued sustained and compounding growth through the lifetime of plan periods. Additionally, contractors regularly meet their labor needs by pulling from the existing labor pools of their competitors, meaning specific confidence in intra-firm growth targets do not necessarily represent confidence in the adequate supply of net-new workers to support associated policy targets. This discrepancy in framing means that reported contractor labor perception may significantly underestimate market wide labor shortages and the associated increase in labor cost.

The Labor Challenge: Misaligned Incentives and Unmeasured Benefit

Underestimating the labor challenge is problematic as it threatens to mask continued underinvestment in WFD as a central tool in achieving resource acquisition targets. Additionally, existing incentive structures are not well designed to drive expansion of the labor pool. Incentives are designed to buy down the incremental cost of efficient measures. These costs have three major components, equipment, material and labor costs. Construction economics literature consistently finds that labor accounts for roughly 30–50% of total project costs, with materials typically representing 40–60% and equipment accounting for a smaller share (RSMeans 2023; Winskel, Heptonstall, and Gross 2024). Traditional BCA frameworks are well suited to understanding the costs, benefits, and incentive structures that drive adoption of efficient equipment and associated materials, but incentivization of the labor portion has been less well understood.

As we have discussed, current program targets require significant expansion of labor capacity. The historic shortfall of programs to sufficiently support this elasticity is evidenced by the hiring concerns regularly expressed by contractors across the industry. This is partially due to a lack of alignment between incentive payments and labor costs incurred by contractors. The cost to hire and train a new employee is a significant first cost to an employer. Meanwhile, program incentives are typically provided on a per-measure basis and seek to offset the incremental measure cost to the customer at time of installation (inclusive of its labor portion). Typical incentive structures buy down the incremental cost of labor at the time that cost is incurred to the *end customer*, not the employer. This means that incentives to offset incremental labor costs are recouped by the employer over the effective working life of the employee, not at the time they are incurred. This structure is ill-timed in supporting employers, the market actor asked to make and bear the risk of hiring decisions and investments, in the hiring and training of new employees.

Additionally, uncertainty around both the longevity of programs and employee retention in competitive labor markets multiplies real and perceived risk to employers of investing in training and hiring. Employers are in a double bind. Programs that drive market demand may no longer exist in the future, meaning costs cannot be recouped. If program funding does persist without commensurate WFD investment, increased labor demand against a constrained supply means trained employees can be poached by competitors before the original employer recoups training costs. While not directly applicable to program contractor networks, significant industry research exists on the target payback periods for small and medium businesses (SMB) and commercial and industrial (C&I) customers. The EPA suggests that these periods may be as short as two years or less for C&I customers. Payback periods may be even shorter for small and mid-size contractors that regularly report capital constraints (National Action Plan for Energy Efficiency 2008). With those short payback requirements in mind, the long and risky time horizon for training new employees may not be an attractive investment for many contractors.

The fact that typical program incentives are not well designed to support workforce capacity development does not mean WFD investments are not being made – it is a core reason why WFD programs are necessary. Massachusetts' recent 2027 Energy Efficiency and Decarbonization Plan doubles annual workforce funding from $12 million to $24 million dollars per year. These dollars are typically designed to support hiring and training when it matters, to defray the capital costs of expanding contractor businesses and to support the quantity of well-trained employees in the market. However, Massachusetts' expanded funding represents only 1.4% of the Mass Save's total budget (Massachusetts Energy Efficiency Program Administrators 2024). If labor costs represent 40% of incremental project costs, and workforce scaling is a significant known barrier to program success, that level of investment seems undersized. That impression is supported by the fact that 2023 workforce funding was oversubscribed by a ratio of three to one (MassCEC 2024).

Notably, the goals and targets for Massachusetts' workforce spending are not tied to resource acquisition. The plan looks to increase workforce diversity, grow the Heat Pump Installer Network, centralize training through a Heating and Cooling Learning Center, and expand training options for C&I participants. Importantly, the goals of these efforts are measured through a market transformation lens via specific outcomes for businesses and trainees and do not seek to assess direct impact on resource acquisition goals. These outcomes are not incorporated into Massachusetts' primary BCA test. While these are all valuable and important efforts, their costs and benefits lie outside program level cost and benefit strategies that are key to justifying and supporting central program budgets. It is telling that Massachusetts categorizes WFD under “Hard-to-Measure Initiatives” (MassCEC 2024).

While WFD is central to the success of efficiency programs, the incentives used to support it and the frameworks used to understand its impact have lagged. Understanding how to best incorporate WFD spending into these strategies is essential in rightsizing and justifying adequate WFD spending for ambitious program goals. Workforce barriers impact the real capacity of markets to flexibly respond to increased demand for energy efficient products and related services. These costs are first costs and are best supported at the time they are incurred by the employer. For efficiency projects, trained labor, like equipment and material costs, is a production input required to convert energy efficiency potential into realized savings. As such, workforce barriers directly impact the quantity and cost of energy efficiency measures delivered to market. With that understanding, WFD and training programs appear to be a key opportunity to support and reduce the cost of direct resource acquisition and are not merely a cost without any calculated or monetized benefit.

Standard Treatments of Workforce Development Costs and Benefits

The foundational document for much of the industry’s BCA tests is the California Standard Practice Manual (CSPM) (CPUC 2001), which does not mention WFD or technical assistance at all. WFD costs are typically included in “Program Administration” costs alongside other contractor or trade ally support costs like program marketing, program specific administrative training, and outreach. This is the case in more recent work on updating BCA frameworks such as in the National Standard Practice Manual (NSPM) by Woolf et al. (2020). The NSPM defines program administration costs as those “incurred by the utility related to the design implementation and evaluation of a [program or initiative]” (Woolf et al. 2020) and jurisdictions have regularly moved to reaffirm this cost designation. The 2022 Washington State UE-210804 straw proposal is explicit in adopting the NSPM definition of program administration costs to include “technical training” alongside “utility outreach to trade allies” marketing (UTC 2022).

In practice, WFD funding is typically delivered as a portion of the Program Administration budget or, alternatively, fully carved out into a dedicated WFD program that operates separately but alongside a core DSM program with separate goals and targets usually tied to economic development or job creation, not resource acquisition (see the MassCEC WFD program). While WFD costs are widely considered overhead or administrative costs, the benefits of these programs are typically quantified in terms of jobs created, or other “incremental economic impact.” This classification follows the general guidance of the NSPM and places the impact of WFD programs outside of the cost tests that typically guide program design, such as the Total Resource Cost Test (TRC), Societal Cost Test (SCT), or Program Administrator Cost Test (PAC).

Evaluation guidance supports the proposition that, to the extent WFD changes realized savings, persistence, or other resource impacts, it must be measured with an EM&V structure capable of isolating those differences (Massachusetts Energy Efficiency Program Administrators 2019). SEE Action’s Energy Efficiency Program Impact Evaluation Guide describes approaches for evaluating energy and demand savings and associated outcomes such as avoided emissions and non-energy benefits, illustrating the type of rigor needed to defensibly link WFD to BCA inputs (SEE Action 2012).

Reclassifying Some Costs as Incentives or Transfer Payments

If labor costs are a significant portion of overall measure cost and if they are key to a program's ability to scale, understanding more effective ways to defray those costs is essential to program and policy success. Participant or market-actor costs can be relevant when contractors, trainees, or firms incur uncompensated time and expenses to obtain credentials or attend training (e.g., opportunity cost of time, tuition, equipment). Under traditional TRC/SCT concepts, such non-utility costs are theoretically includable when they are incremental to the program resource and borne by relevant parties; NSPM presses jurisdictions to decide these inclusions based on policy goals and perspective, documented transparently (Woolf et al. 2020).

Transfers and subsidies become central when WFD is implemented through stipends, scholarships, wage supports, or incentive adders that shift who pays rather than changing real resource costs. The NSPM guidance on transfers focuses on identifying "offsetting transfers" is directly relevant to clean energy training designs that combine utility funds, state/federal grants, and employer contributions (Woolf, Whited, and Lane 2025). Working on classifying WFD subsidies as a transfer payment or incentive may not change the outcome under some commonly used BCA tests, but it does make a difference if accounted for under NSPM guidance or when looking at other benchmarks that are used, such as a percentage of non-incentive costs.

Marginal Future Cost Impacts

Like energy efficiency program interventions, WFD has a fixed upfront cost that reduces a long-term variable cost. For energy efficiency measures this upfront cost is usually an incentive, and the long-term variable cost reduction comes from energy savings. For WFD, the upfront fixed cost is training and technical assistance costs with the long-term variable cost reduction coming in the form of lower marginal costs for resource acquisition. Microeconomic theory explains that the market price for the acquisition of resources follows a supply cost curve, where each additional unit of resources is priced at the next marginal cost to produce those resources. The following figure is a hypothetical illustration of this marginal cost curve to acquire a kWh of energy savings, but a similar graph could be shown for costs to acquire emission reductions.

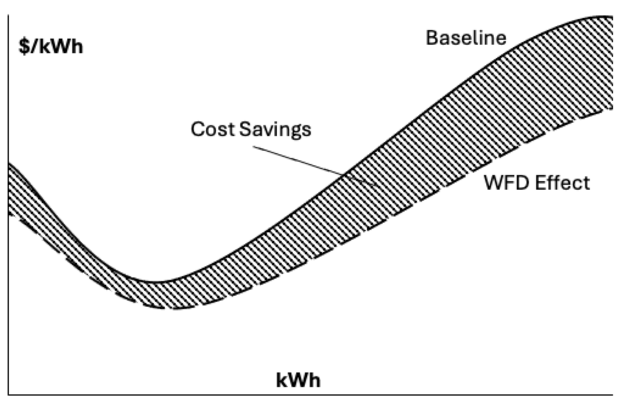

Figure 2. Illustrative Example of WFD Marginal Cost Curve Reduction Effect

WFD can be thought of as pushing down this marginal cost curve to acquire energy savings or emission reductions through:

1. labor supply expansion that increases competition and lowers pricing; and
2. improvements to work quality that enhance outcomes and/or lowers costs.

In a world where pressure to reduce rate impacts is a driving force in goal setting and acquisition costs are rising steeply, deploying interventions to reduce future marginal acquisition is increasingly important. WFD can lower that future cost curve, especially for portfolios that have aggressive ramp up targets. Making sure that planners can account for this future benefit will be crucial for both projecting accurate costs, and for ensuring that resources can be adequately deployed. WFD programs are specifically well positioned to support net-new projects (i.e. projects that would not happen without program intervention, or projects that happen sooner because of increased contractor capacity).

Labor Supply Expansion and Pricing Reductions

Many of the labor fields in the DSM space are generally inelastic, meaning they have a tight supply with expensive or lengthy requirements to bring additional labor resources online. Professions such as electricians or building auditors require significant credentials, investment in training, and on-the-job experience to perform well. The dynamics of inelastic supply leading to higher wages when demand rises is a fundamental economic concept. While labor is always a cost input, reducing that cost on the margin has value. Additionally, the effects that less demand via DSM programs have on driving down resource prices are included in many BCA frameworks as wholesale market price effects (Woolf, Whited, and Lane 2025). WFD programs that focus on net-new job creation directly increase the elasticity of the labor supply and can help reduce sharp upward movement in resource costs. Anecdotal evidence from the authors' experience in the Mid-Atlantic states has shown significant differences in wages between similar roles across state borders where different policy regimes have led to wide differences in demand for incremental DSM resources. The impact of labor shortages on rising project costs is well studied and understood in the wider construction industry, with one study showing a 13% increase in cost for projects in areas facing labor shortages (Karimi et al. 2018). While we are not aware of any specific studies that explore this in the DSM space, it is an area that warrants further empirical research to establish the magnitude of WFD effects on easing labor cost. Estimates from the general construction industry could be used as a proxy value until more direct information is available.

Improvements to Work Quality and Savings Outcomes by Participants

The savings attributable to WFD are produced in two ways, via the upskilling of existing workers already engaged in the market and via the development of net-new employees in the workforce. Existing methodologies to recognize savings for training do exist in various parts of the industry. The Illinois Technical Reference Manual includes a measure for Building Operator Certification (BOC) training that assigns energy savings to buildings where operators complete a certification program (SAG 2024). The measure is based on studies of operational improvements implemented by trained operators, including adjustments to schedules and setpoints, identification and correction of simultaneous heating and cooling, improvements in ventilation control, and preventive maintenance that restores equipment to efficient operation. Because these operational changes affect multiple systems within a building and may occur incrementally over time, the TRM does not attempt to meter each action individually. Instead, it applies deemed electricity and natural gas savings values per trained operator or per participating building, reflecting the expected aggregate impact of improved operational practices. In this way, the TRM treats training as a measure that enables a predictable set of operational improvements across building portfolios.

New York's programs employ a similar framework through NYSERDA's Building Operations and Maintenance workforce initiatives. These programs provide training for facility managers, building engineers, and maintenance staff with the expectation that improved operational practices will lead to persistent reductions in building energy use. As in Illinois, savings are not tied to a single operational adjustment but to the cumulative impact of improved building management. Evaluations of these programs often rely on benchmarking and portfolio-level analysis to estimate savings associated with trained operators, comparing energy consumption in buildings with trained staff to comparable buildings without such training.

Other efforts to quantify the impact of training have been less fruitful. 2024 evaluations of California's Workforce Education and Training (WE&T) programs and a WE&T enabled Workforce Standards Initiative both found limited to no measurable savings for program efforts. The evaluation of WE&T programs attempted to track and tie the training of HVAC technicians to on-site behavioral changes and subsequent site-specific energy savings. The study was only able to directly measure intermediate outcomes such as participant satisfaction, knowledge gain, and observed diagnostic behaviors rather than realized energy savings resulting from those effects. Even within controlled observation exercises, technicians often demonstrated improved diagnostic reasoning but still failed to resolve system faults completely, meaning the expected energy savings would not necessarily materialize in practice. As the report notes, technicians sometimes improved their understanding of HVAC systems and communication with customers, but the inability to consistently diagnose and correct faults meant that "a typical residential customer would not have realized the energy savings that could have resulted" from the training intervention (Opinion Dynamics 2024a).

The Workforce Standards Initiative Evaluation faced a separate set of challenges in quantifying impact. The initiative requires certain energy-efficiency projects, particularly large non-residential HVAC and lighting control installations receiving program incentives, to use technicians with specified credentials or training to improve installation quality and reduce energy savings lost due to poor workmanship. The evaluation team found that institutional and data structures needed to link workforce credentials to project-level savings were largely absent. Workforce standards were implemented through multiple actors, utilities, third-party implementers, contractors, and customers, making it difficult to attribute changes in installation quality or energy savings directly to credentialing requirements. Data systems did not consistently track technician credentials, and verification often required information such as social security digits that implementers did not collect, making reliable linkage between workforce qualifications and installed measures infeasible. In addition, enforcement responsibility for workforce standards was unclear, and many implementers lacked the capacity to collect technician-level data needed for an impact evaluation. As a result, the evaluation concluded that the available program data and governance structure made a rigorous impact analysis of workforce standards on energy savings extremely difficult (Opinion Dynamics

2024b). Trying to measure the activity of specific actors in the near term is complex and time intensive. The WE&T evaluation observed technicians approximately six months after training to assess behavioral changes. While appropriate for identifying short-term knowledge application, this time horizon may be insufficient to capture the longer-term diffusion of improved installation practices across contractors' portfolios of projects. Extending the examination period may have improved the study's ability to capture training impact. However, as we will see with the WFD impact on market effects, when methodologies look at the long-standing and aggregate impacts of training, savings appear.

The positive effect of training on quality of work should also be studied and quantified for other residential programs with labor intensive industries where outcomes are dependent on worker skill and efficiency. Some examples of this include insulation, where installation time is a major factor in job costs. Air sealing, where worker skill in identifying and addressing leaks in the building envelope has direct results on energy savings outcomes and lost opportunities abound. Heat pump installations are another area where properly sizing equipment has real impacts on future usage and grid reliability.

Increasing Spillover Effects

Many DSM BCA frameworks calculate program effects net of free-ridership and spillover effects. Free-ridership captures the concept that a portion of program participants would have undertaken an action even without the incentive. Spillover accounts for non-participants that undertook the action without directly participating in the program, but that were still influenced by program-related activity, such as marketing. These two effects are captured in a net-to-gross (NTG) ratio. Free-ridership drives down the net effect of resource acquisition programs, since it disallows the attribution of those participants actions to program activity. Free-ridership is also simpler to evaluate, since it is easier to survey participants than it is to identify non-program participants that also performed an efficiency action based on program activity. Many WFD activities, on the other hand, are a clear driver of spillover effects.

The successful quantification and application of spillover has been present in residential new construction (RNC) programs for many years. NMR has provided years of significant research into the market effects of new construction programs in Mass Save's RNC program. When subcontractors provide services related to energy efficiency projects, they and their employees are effectively trained to build more energy efficient buildings, install insulation more effectively, air seal with attention, understand new framing techniques, wall assemblies, and efficient equipment. This training spills over into homes they build outside of DSM programs. NMR describes the process of quantifying this effect in Connecticut and Massachusetts in a 2019 paper, "[Contractors described] the program having created a pool of well-trained market actors whose knowledge had spread outside the confines of the program, resulting in substantial non-participant spillover." These savings can be at least as significant as savings attributable to the core program. NMR found market effects savings of between 55% and 125% of core program savings across Massachusetts and Connecticut markets (Tyler and Powell 2019, 7).

These findings are supported by evaluations in other jurisdictions as well. A 2021 RNC market effects study from Wisconsin's Focus on Energy's energy efficiency program found annual savings from market effects that drove program net-to-gross from 13% to 116%, suggesting that the training impact of the program, via spillover market effects, well outstripped the direct impact of the efficiency program itself. (Focus on Energy 2024, 67). Focus on Energy describes the impact of a well-trained local workforce as follows:

> Proximity to program homes appears to be a factor in nonprogram home energy consumption. Statewide billing data for new homes shows that nonprogram homes constructed in zip codes with little to no program activity consume 8% more energy than nonprogram homes built in the same zip codes as program homes. Because contractors tend to work in concentrated areas, this geographic difference in consumption suggests that nonprogram homes built away from program homes do not benefit from the program's market effects drivers, such as contractors learning new skills from program representatives (Eckstein, Krueger, and Hicks 2021).

In other words, homes built in geographic areas with a preponderance of well-trained contractors were more efficient than homes built in areas without a preponderance of contractors who have received direct or indirect program training. Market effects studies in both Massachusetts and Wisconsin show that training drives quantifiable, significant, and persistent energy savings. Where possible, regulators and evaluators should seek to quantify and include the spillover effects from WFD initiatives.

Accelerated Capture of Program Benefits

The time value of money is a well understood concept in BCA models. A dollar of benefit that is realized a year from now is worth less than a dollar of benefit received now. The difference in these values is called the discount rate. Discount rates vary depending on the perspective that the BCA test takes, with the PAC generally looking at the weighted average cost of capital (WACC) for the administrator at 5% to 8% and TRC and SCT utilizing a lower societal discount rate at 3% or below (Borden, Gyalmo, and Havumaki 2023). Given a discount rate of 5%, in the middle of the range, helping a program to realize $1 million in benefits one year earlier would be worth $50,000. Given the significant challenge and cost to meet many climate goals, such Massachusetts' 2030 targets, there are potentially hundreds of millions to billions of dollars in benefit that could be accelerated by WFD programs. This acceleration would then represent tens of millions of dollars in additional value that could be used to pay for WFD efforts.

This concept can also be considered from another perspective. There are programs that have already had budgets or funding approved but may not have been able to spend the allocated funds, partially due to barriers in the labor force. For example, as of the third quarter of 2025, New York's Clean Energy Fund had acquired or committed 62% of its cumulative 2025 electric acquisition target and projects to underachieve its cumulative 2030 targets by 21% (NYSERDA 2025). Every year that those funds are unused, there is a loss in benefits that can snowball into significant lost opportunities. There are also rate impacts for overcollection that can lead to large rate swings that make it difficult for ratepayers to forecast energy costs and can lead to eroding stakeholder support for achieving higher levels of DSM due to missed targets.

Capturing these effects in planning may be difficult, but not impossible. Planners often use adoption curves when estimating achievable potential by year. Having some idea of natural market turnover and labor pools would allow estimates of the additional labor force needed to reach projected production targets. If DSM portfolios do not provide incentives and support for reaching those additional employment levels, then their natural expansion will be much slower, and achievable potential will have a much slower adoption curve. Modifying adoption curves in the planning process via interactive effects with WFD investments can be a way of modeling some of the benefits of these programs.

Conclusion

WFD programs are necessary to meet aggressive climate and energy efficiency goals within the timeframes required by current policy commitments. DSM portfolios across the country are increasingly tasked with achieving rapid and sustained growth in resource acquisition while supporting the deployment of more complex technologies and projects. These objectives require a corresponding expansion in the skilled labor force. Without sufficient workforce capacity, program funding and policy ambition cannot be translated into realized energy savings. Despite this central role, WFD is typically treated in BCA frameworks as an administration cost rather than as a production input necessary to acquire resource savings. As a result, the economic value of WFD is often understated in program planning and evaluation.

The evidence discussed in this paper suggests that workforce development influences program outcomes through several pathways that are already partially recognized in the industry. Portions of workforce spending may be more appropriately classified as incentives or transfers when they directly offset hiring and training costs borne by contractors. Marginal resource acquisition costs can be brought down by expanding the labor supply can reduce upward pressure on installation costs in markets with inelastic labor supply, while improved training can increase installation quality, generate spillover effects, and accelerate the capture of program benefits. Training programs for building operators are credited with operational savings, and market effects studies demonstrate that contractor learning and knowledge diffusion can generate significant spillover. The following table summarizes the ways that WFD impacts can be brought more wholistically into BCA analysis.

Table 1. Summary of Workforce Related BCA Component Improvements

Benefit	Technique	Details
Cost	Reclassifying costs as incentives	Examine whether portions of WFD costs are actually incentives, and whether they should be treated as a transfer payment.
Cost	Reducing labor market pricing	An expanded labor pool reduces pricing via competitive market forces. Many DSM fields are inelastic, and net-new job creation efforts help reduce sharp increases in price as demand for additional resources increase.
Benefit	Increased work quality and outcomes	Trainings can lead to direct improvements in savings outcomes for program participants. This is already measured in some C&I programs, but should be expanded to other areas of DSM.

Benefit	Increasing spillover effects	Accounting for significant spillover effects from increasing contractor skills can increase NTG ratios and benefits for various programs and can be directly attributable to workforce development programs.
Benefit	Acceleration of benefits	WFD efforts can bring future benefits forward in time or help avoid unspent budgets and lost opportunities.

Accounting for all of these effects more directly in program planning and evaluation would better align benefit cost frameworks with the realities of resource acquisition and help ensure that sufficient labor capacity exists to achieve ambitious efficiency and electrification targets.

References

BLS (U.S. Bureau of Labor Statistics). 2025. "Fastest Growing Occupations." Occupational Outlook Handbook. Washington, DC: U.S. Department of Labor. bls.gov/ooh/fastest-growing.htm.

Borden, E., T. Gyalmo, and B. Havumaki. 2023. Application of Discount Rates for Assessing Cost-Effectiveness of Utility Risk Related Investments. Cambridge, MA: Synapse Energy Economics. cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/meeting-documents/discount-rates-and-risk-modeling_synapse_101123.pdf.

BW Research Partnership. 2020. Massachusetts Energy Efficiency Workforce Development Needs Assessment: Career Profiles. Prepared for the Massachusetts Energy Efficiency Advisory Council. ma-eeac.org/wp-content/uploads/Massachusetts-Energy-Efficiency-Workforce-Development-FINAL-REPORT-CAREER-PROFILES.pdf.

CPUC (California Public Utilities Commission). 2001. California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects. San Francisco, CA: California Public Utilities Commission.

DNV. 2022. Clean Energy Fund Workforce Development Program: Impact and Market Evaluation Report. Prepared for the New York State Energy Research and Development Authority (NYSERDA). September. nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/Program-Evaluation/2022-12-MatterNo-16-02180-NYSERDA-WFD-Impact-and-Market-Report.pdf.

Eckstein, J., J. Krueger, and A. Hicks. 2021. Residential New Construction Market Effects. Madison, WI: Focus on Energy. s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/Potential_Study-Market_Effects-Residental_New_Construction.pdf.

Focus on Energy. 2024. Focus on Energy Calendar Year 2023 Evaluation Report, Volume II: Program Evaluations. Madison, WI: Focus on Energy. assets.focusonenergy.com/production/inline-files/Evaluation_CY_2023_Vol-II_final.pdf.

Hochul, K. 2022. "Governor Hochul Announces Plan to Achieve 2 Million Climate-Friendly Homes by 2030." January 5. governor.ny.gov/news/governor-hochul-announces-plan-achieve-2-million-climate-friendly-homes-2030.

Illinois Energy Efficiency Stakeholder Advisory Group (SAG). 2024. Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 13.0, Volume 2: Commercial and Industrial Measures. ilsag.info/wp-content/uploads/IL-TRM_Effective_010125_v13.0_Vol_2_C_and_I_09202024_FINAL.pdf.

Karimi, H., T. R. B. Taylor, G. B. Dadi, P. M. Goodrum, and C. Srinivasan. 2018. "Impact of Skilled Labor Availability on Construction Project Cost Performance." Journal of Construction Engineering and Management 144 (7). doi:10.1061/(ASCE)CO.1943-7862.0001512.

Lane, C., and T. Woolf. 2022. Washington Cost-Effectiveness Test for Distributed Energy Resources: Straw Proposal. Cambridge, MA: Synapse Energy Economics. nationalenergyscreeningproject.org/wp-content/uploads/2023/02/UE-210804-WA-Test-Straw-Proposal-11_7_22.pdf.

MA EEAC (Massachusetts Energy Efficiency Advisory Council). 2019. Action Plan for Measuring Market Effects. Boston, MA: MA EEAC. ma-eeac.org/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf.

Massachusetts Clean Energy Center (MassCEC). 2024. Appendix M: MassCEC Equity Workforce Funding Levels (FY25–FY27). In Exhibit 1: 2025–2027 Three-Year Energy Efficiency and Decarbonization Plan. Filed with the Massachusetts Department of Public Utilities, D.P.U. 24-140 through 24-149. Boston, MA.

Mandel, M. 2017. The U.S. App Economy Update. Washington, DC: Progressive Policy Institute. progressivepolicy.org/wp-content/uploads/2017/05/PPI_USAppEconomy.pdf.

Massachusetts Energy Efficiency Program Administrators. 2019. Action Plan for Measuring Market Effects. Prepared for the Massachusetts Energy Efficiency Advisory Council. ma-eeac.org/wp-content/uploads/Action_Plan_Measuring_Market_Effects_FINAL_2019.02.15.pdf.

Massachusetts Executive Office of Energy and Environmental Affairs. 2022. Clean Energy and Climate Plan for 2025 and 2030. Boston, MA: Commonwealth of Massachusetts. mass.gov/doc/clean-energy-and-climate-plan-for-2025-and-2030.

National Action Plan for Energy Efficiency. 2008. Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers. Washington, DC: EPA and DOE.

NYSERDA (New York State Energy Research and Development Authority). 2025. Clean Energy Fund Quarterly Performance Report through Quarter 3, 2025. Albany, NY: NYSERDA.

Opinion Dynamics. 2024a. WE&T and Installation Improvement Evaluation: Final Report. Oakland, CA: Opinion Dynamics.

Opinion Dynamics. 2024b. CPUC Workforce Standards Evaluation: Final Report. Oakland, CA: Opinion Dynamics.

Pennsylvania Department of Environmental Protection. 2023. Pennsylvania Energy Efficiency Workforce Needs Report. Harrisburg, PA: Pennsylvania Department of Environmental Protection.

RSMeans. 2023. RSMeans Building Construction Cost Data. Norwell, MA: Gordian.

SEE Action (State and Local Energy Efficiency Action Network). 2012. Energy Efficiency Program Impact Evaluation Guide. Washington, DC: U.S. Department of Energy and U.S. Environmental Protection Agency.

Tyler, Z., and J. Powell. 2019. Pushing the Market: Measuring Market Effects in Residential New Construction. Westford, VT: NMR Group, Inc. nmrgroupinc.com/wp-content/uploads/2019/09/Pushing-the-market.pdf.

Washington Utilities and Transportation Commission (UTC). 2022. Washington Cost-Effectiveness Test for Distributed Energy Resources: Straw Proposal. Docket UE-210804. Olympia, WA: Washington Utilities and Transportation Commission.

Winskel, M., P. Heptonstall, and R. Gross. 2024. "Reducing Heat Pump Installed Costs: Reviewing Historic Trends and Assessing Future Prospects." Applied Energy 375.

Woolf, T., C. Lane, M. Whited, C. Neme, M. Alter, S. Fine, K. Rabago, S. Schiller, K. Strickland, and B. Chew. 2020. National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources. Lexington, MA: E4TheFuture.

Woolf, T., M. Whited, and C. Lane. 2025. Accounting for Federal Tax Incentives and Other Transfers in Benefit-Cost Analysis of Distributed Energy Resources. Washington, DC: National Energy Screening Project.

AI-assisted tools used: Claude, ChatGPT, NotebookLM
Used for: literate review assistance, citation
Extent: assistance with scan of existing literature, organization of research, and development and formatting of citations
Human review: The authors reviewed and verified all content, calculations, and citations.