Bridging the Skills Gap: Workforces for Electrification

Charging Ahead Webinar

May 20, 2025

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Agenda and Housekeeping

Agenda

- Housekeeping and Introductions
- Drivers of Changes to Workforce Needs
- Workforce Impact Assessment
  - State Building Electrification
  - City Gas System Decommissioning
  - Utility 100% Renewable Energy Transition
  - State Decarbonization
- Workforce Solution Development
  - City Workforce Strategy
- Takeaways and Recommendations
- Next Charging Ahead Webinar

Housekeeping

This webinar is being recorded and distributed to all registrants along with this presentation

Add your questions to the chat. My colleague, Sara Gonzales, is monitoring the chat for the Q & A session

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Drivers of Changes to Workforce Needs

Federal, State and Municipal Targets

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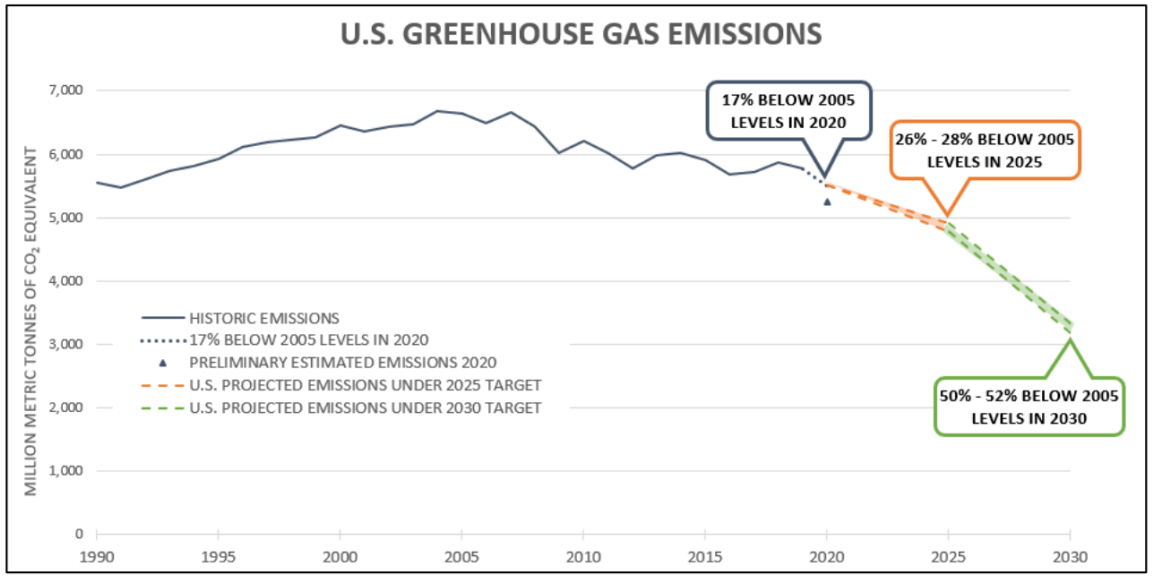
Paris Agreement and the US

US Historic and Projected Emissions Under 2030 Target



Source: United Nations Framework Convention on Climate Change (2022)

- The Paris Agreement targets limiting global warming below 2°C, with an additional goal to keep global temperatures below 1.5°C, from pre-industrial levels
- The current US targets include a 50-52% reduction in 2005-level (baseline) emissions by 2030, and a net-zero goal for 2050
    - Energeia notes that the United Nations Framework Convention on Climate Change (UNFCCC) has modeled US targets to be insufficient to achieve those temperature goals
- Every five years, each country must submit a climate action plan, known as a Nationally Determined Contribution (NDC), with the latest NDC submitted in December 2024 and the next NDC to be submitted in 2030
- While countries are not legally obligated to achieve their targets under the Paris Agreement, the current NDC submitted by the US remains active but NDCs can be revised at any time
- Under the current administration, the US has begun the process of withdrawing from the Paris Agreement, expected to take effect one year from the January 20th, 2025 submission
- Some US States, which are detailed later, have committed to more ambitious emissions reduction targets

Source: The Paris Agreement, United Nations (2015)

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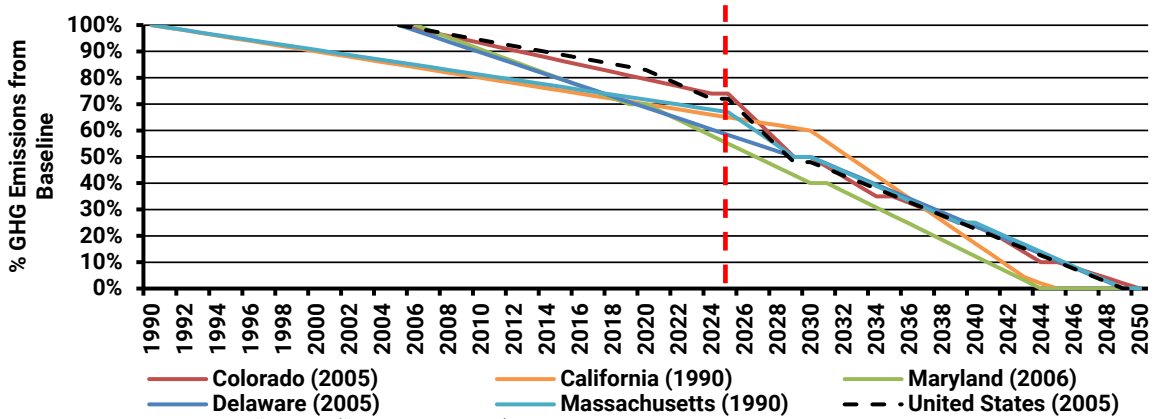
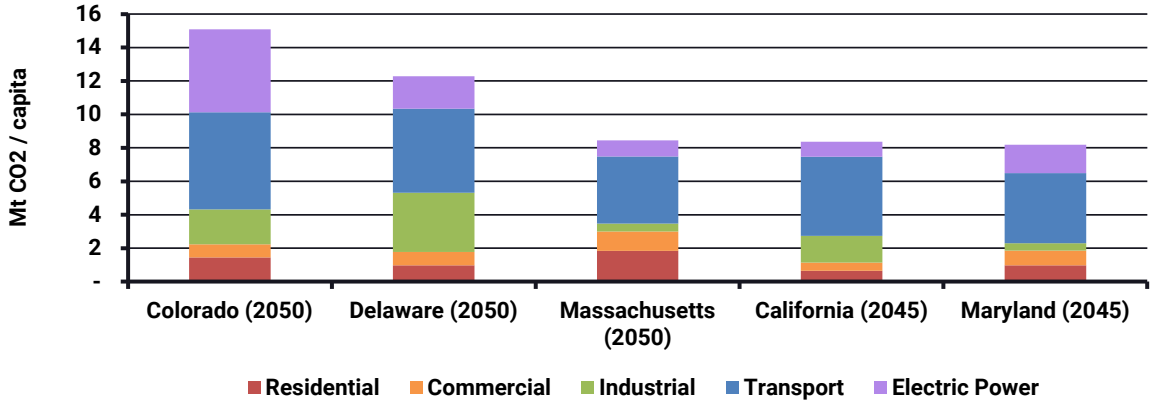
United States CO2 Targets by Key States

Leading State and Federal CO2 Targets



Note: legend includes "State" ("Baseline Year")
Source: Energeia Research, US EIA (2023)

Leading States Emissions per Capita by Sector



Note: labeling includes "State" ("Target Year")
Source: Energeia research and analysis, US EIA (2022)

- The United States had adopted a trajectory to reduce emissions by 50-52% of 2005 baseline levels by 2030 under its NDC to the Paris Agreement, but is expected to alter or scrap the targets per the withdrawal from the Paris Agreement
- State CO2 targets vary substantially in terms of:
  - Baseline year
  - Target sectors
  - Trajectory
- California (CA), Colorado (CO), Massachusetts (MA), and Maryland (MD) are undertaking some of the most comprehensive climate action plans, driven by state policy
  - Note: States with the most comprehensive CO2 roadmaps have been included, but may not represent the states with the most stringent targets
- The sources of emissions varies by state due to the economic mix, with varying workforce impacts across gas and electric utility, trade and other key workforce segments

A key question is how will these changes be enabled by and impact the workforce, and how can it be best positioned?

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Key Drivers of Changes in Workforce Needs

- Building electrification
- Transport electrification
- Gas sector decarbonization
- Gas system decommissioning
- Transport sector decarbonization
- Power sector decarbonization

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Workforce Impact Assessment

Building Electrification

Gas Sector Decarbonization

Electric Utility 100% Renewables Transition

Gas System Decommissioning

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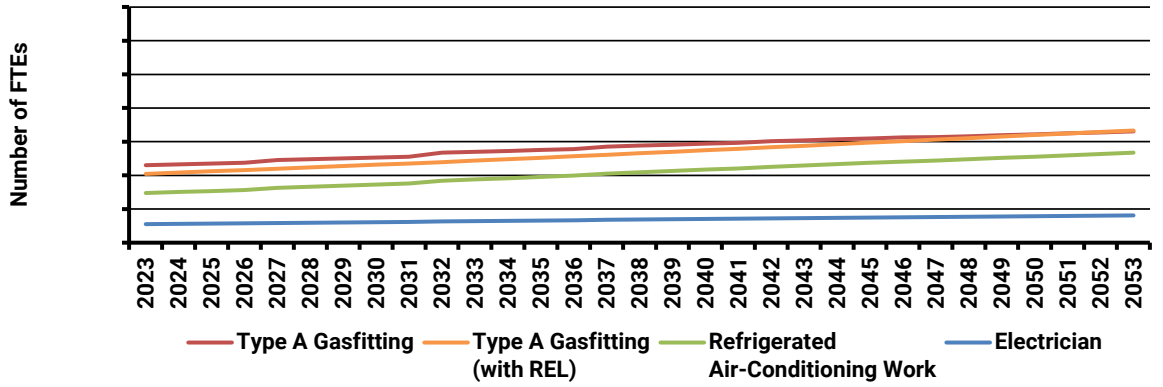
Building Electrification

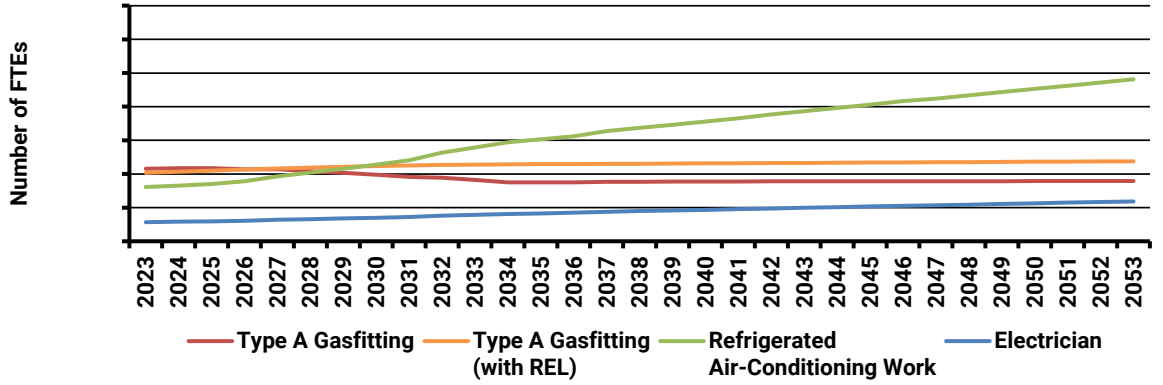
Business as Usual



Source: Energeia analysis

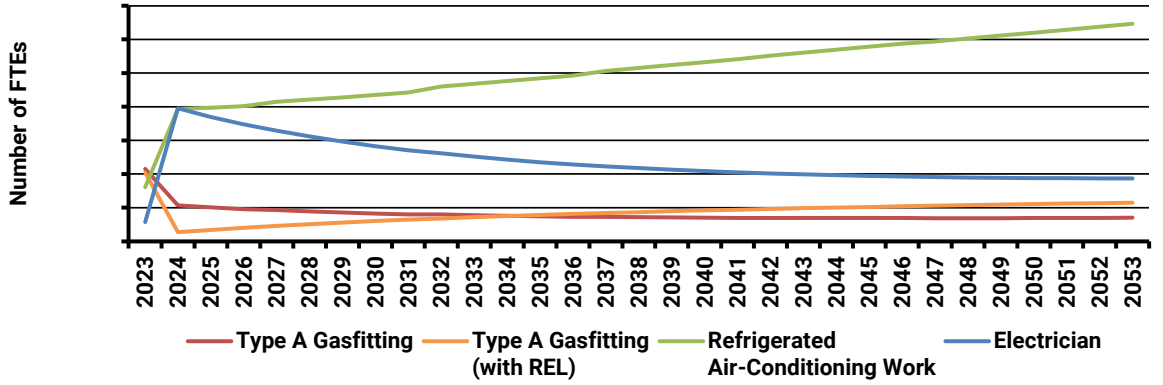
- A state government was considering policy options to achieve faster gas system decarbonization
- We analyzed the impact of banning gas in new premises, as well as at end of life (i.e., no more gas appliance sales in the state)
- The modeling showed that bans would have significant impacts on trade jobs
- A key recommendation was to set bans far enough in the future to allow the market to adjust, and to stagger bans
  - For example, start with residential water heaters, followed by space heaters, then commercial water heaters, then space heaters, etc.

No Gas in New Premises from 2023



Source: Energeia analysis

No New Gas Appliances Sold from 2024



Source: Energeia analysis

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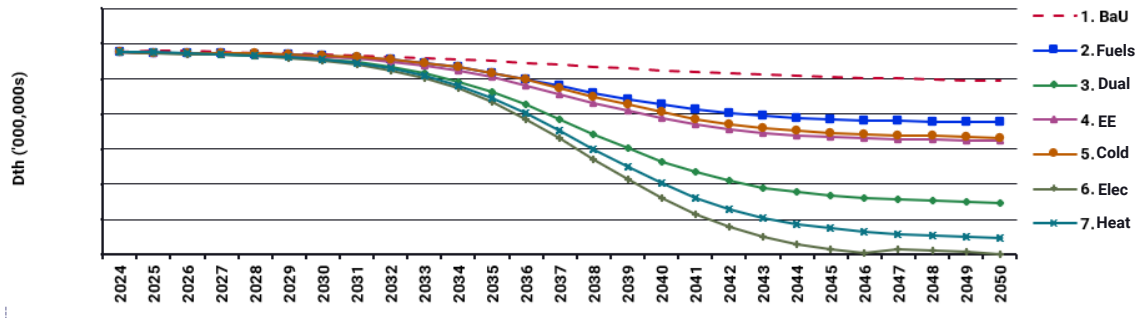
Gas Sector Decarbonization (1 of 2)

Gas Consumption by Scenario



Source: Energeia analysis, Note: Dth = Dekatherms, BaU = Business as Usual, Fuels = Clean Fuels, Dual = Dual Fuel, EE = Energy Efficiency, Cold = Cold Climate Heat Pumps, Elec = Electrification, Heat = Thermal Utility

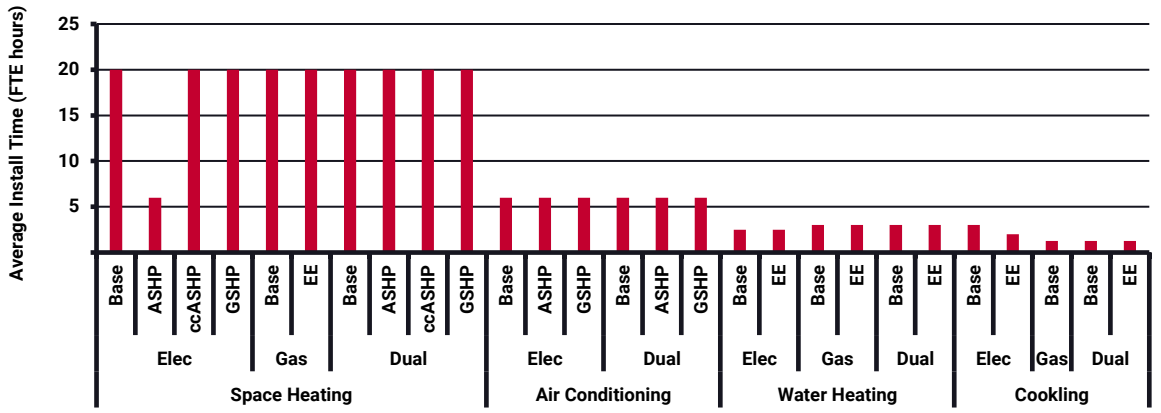
- A state is considering options to decarbonize its gas sector across a range of pathways, and not just electrification
- Energeia modeled the impact of each pathway on the sector, including utility and trade jobs
- Impacts were mainly estimated using state FTE, throughput and installation labor estimates
- Workforce development was not part of the scope
- The analysis highlights the significant differences in potential impact depending on the pathway chosen

Total Gas Utility Sector Employment

Target Sector	NAICS Mapping	NAICS Description	2023 Count
Gas			
Upstream Jobs	21113	Natural Gas Extraction	
Midstream Jobs	4862	Pipeline Transportation of Natural Gas	
Distribution Jobs	2212	Natural Gas Distribution	
Electric			
Generation Jobs	22111	Electric Power Generation	
Transmission Jobs	221121	Electric Bulk Power Transmission and Control	
Distribution Jobs	221122	Electric Power Distribution	

Source: Energeia analysis

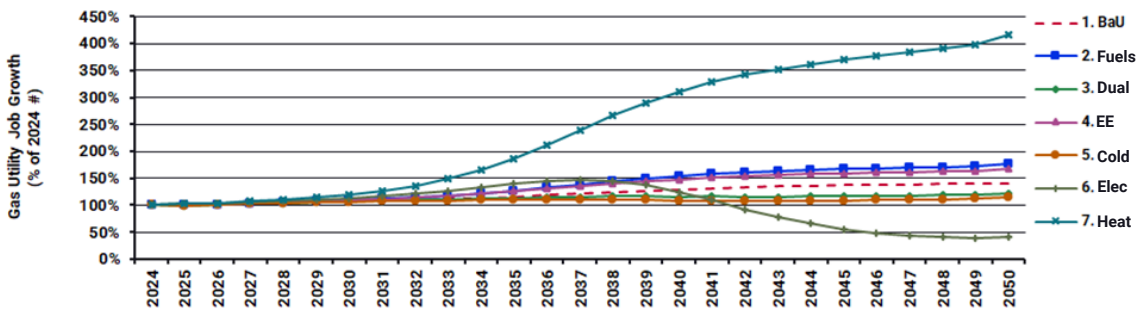
Average Installation Effort (FTE hours)



Source: Energeia analysis

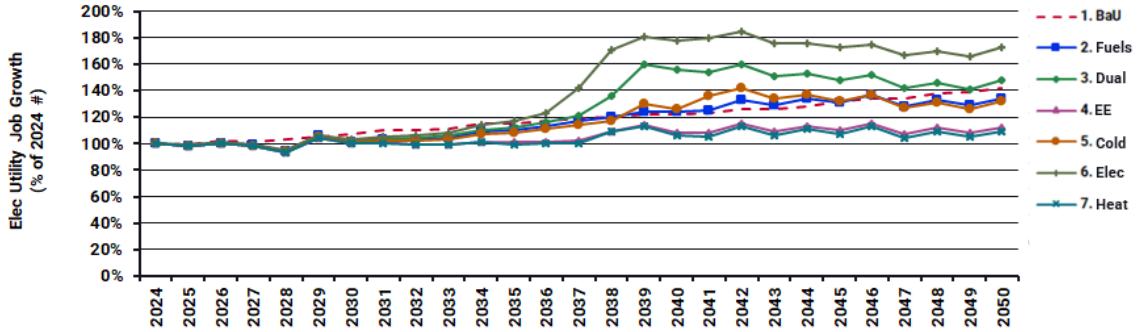
Gas Sector Decarbonization (2 of 2)

Forecast Change in Gas Utility Jobs



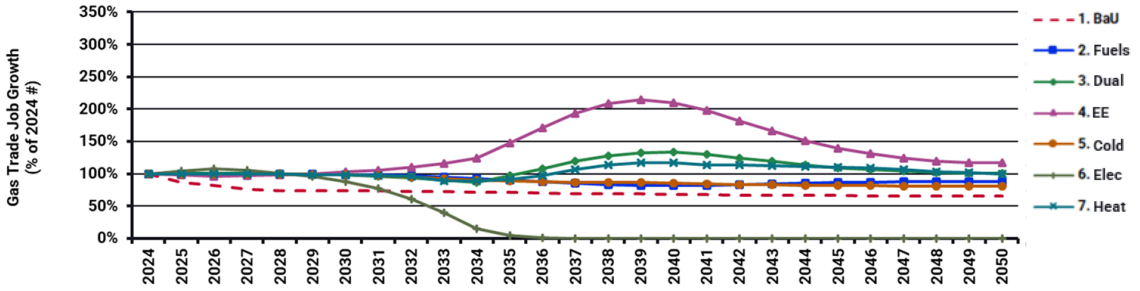
Source: Energeia analysis, Note: BaU = Business as Usual, Fuels = Clean Fuels, Dual = Dual Fuel, EE = Energy Efficiency, Cold = Cold Climate Heat Pumps, Elec = Electrification, Heat = Thermal Utility

Forecast Change in Electric Utility Jobs



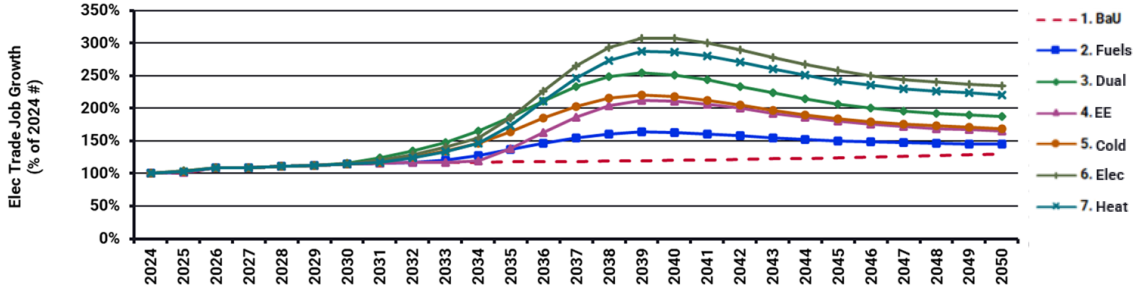
Source: Energeia analysis, Note: BaU = Business as Usual, Fuels = Clean Fuels, Dual = Dual Fuel, EE = Energy Efficiency, Cold = Cold Climate Heat Pumps, Elec = Electrification, Heat = Thermal Utility

Forecast Change in Gas Trade Jobs



Source: Energeia analysis, Note: BaU = Business as Usual, Fuels = Clean Fuels, Dual = Dual Fuel, EE = Energy Efficiency, Cold = Cold Climate Heat Pumps, Elec = Electrification, Heat = Thermal Utility

Forecast Change in Electric Trade Jobs



Source: Energeia analysis, Note: BaU = Business as Usual, Fuels = Clean Fuels, Dual = Dual Fuel, EE = Energy Efficiency, Cold = Cold Climate Heat Pumps, Elec = Electrification, Heat = Thermal Utility

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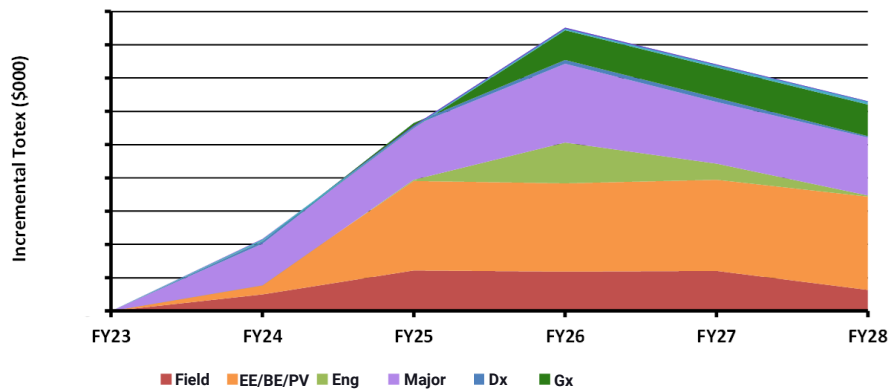
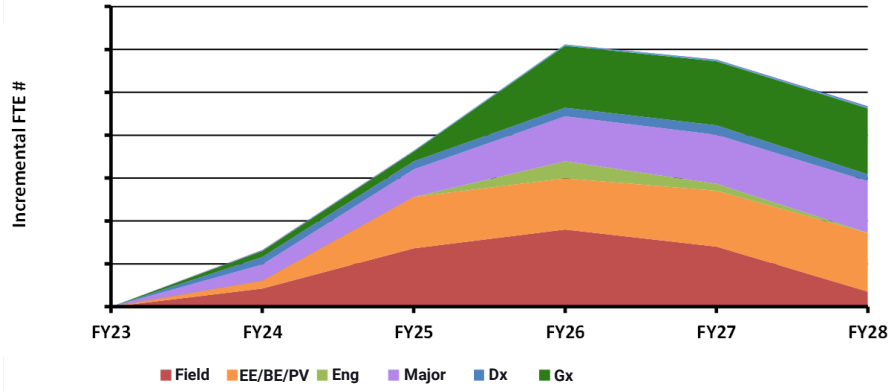
Electric Utility 100% Renewables Transition

Planned Expenditure Over Time



Source: Energeia analysis

Forecast FTEs Needed Over Time



Source: Energeia analysis

- A vertically integrated utility is aiming for 100% renewable energy in the next 10 years
- They identified that workforce development was a key risk to achieving their strategic goal
- Energeia was part of the team that developed estimates from strategic plans, Human Resources and finance datasets
- Future FTEs by class were estimated over time, based on planned investments in the distribution, transmission, generation and BTM program capacity and capabilities
- The project identified the workforce needs vs. supply gap based on current recruitment and training capacity, as well as potential strategies for addressing them
- Key recommendations from this work included the need to enhance their understanding of:
  - Future changes in job and skills mix
  - Strategies to increase capacity and capability
  - Strategies for optimizing make vs. buy decision

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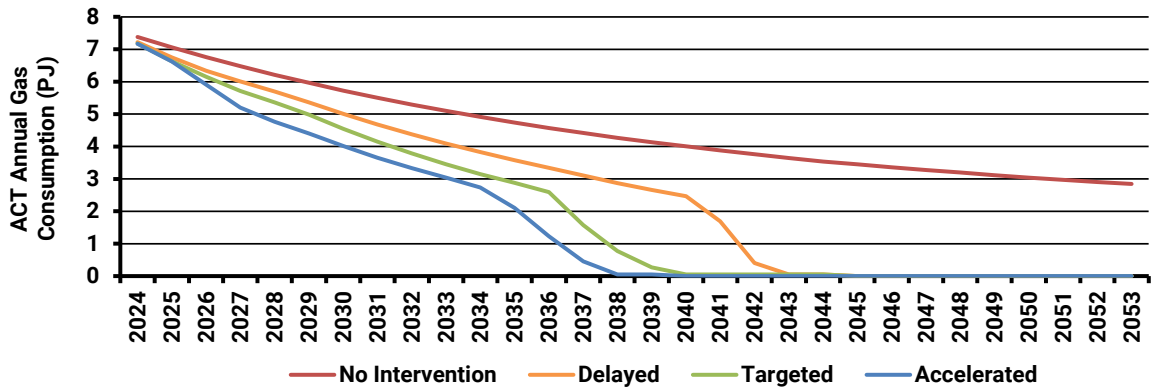
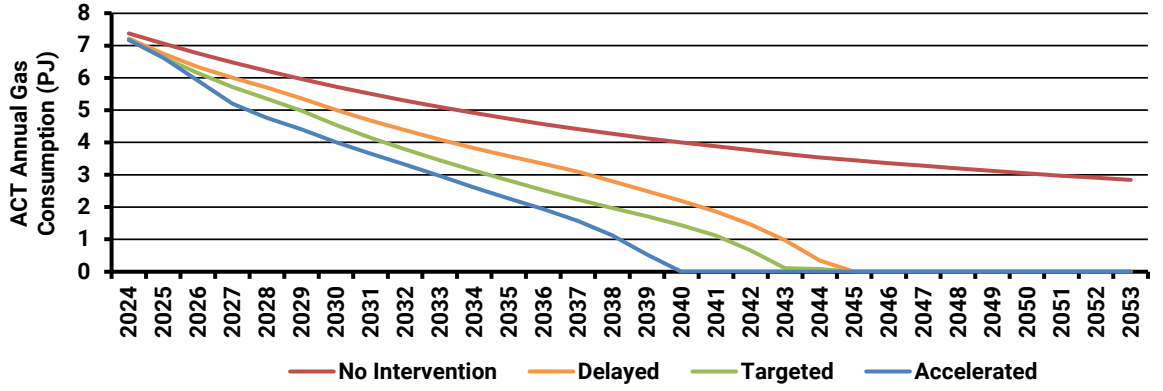
Australian Capital Territory (ACT) Gas System Decommissioning

Gas Consumption (30% Shutdown Threshold)



Source: Energeia analysis

Gas Consumption (Phased)



Source: Energeia analysis

- The ACT was considering policy options around decommissioning its gas system, which it partly owned
- Energeia analyzed the impact of different decommissioning strategies, including different:
  - Timings, e.g. 5 or 10 years, i.e. 15 or 10 year durations
  - Triggers, e.g. < 20% or < 30% of current demand, and
  - Cost allocation approaches, e.g. front loaded, as incured, etc.
- The modeling showed that different decommissioning strategies would have very different impacts on demand for gas and electricity, as shown to the left
- Key recommendations from the work included banning new appliances to avoid future asset stranding costs, pushing out decommissioning as far as possible to minimize stranding of existing assets, and managing price increases to avoid uneconomic switching over time
- Workforce impact analysis was not in scope, but the difference in network shutdowns by scenario show the potential for rapid change in utility and trade jobs between the gas and electric systems
- Energeia's detailed report can be found here

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Workforce Solution Development

Workforce Dynamics

Key Barriers

Wage Competitiveness

Best Practices

Key Strategies

Development Roadmap

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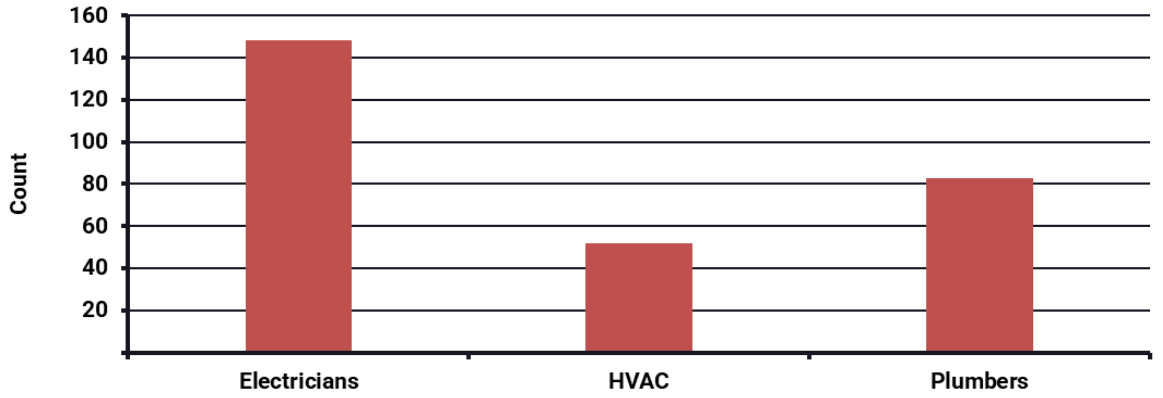
Workforce Dynamics

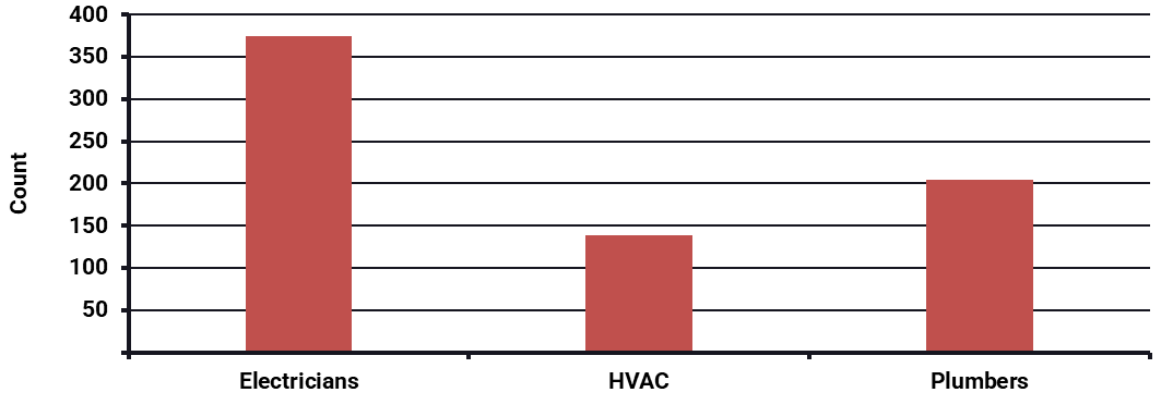
Annual Retirements to 2030



Source: Employment Development Department, Employment Projections

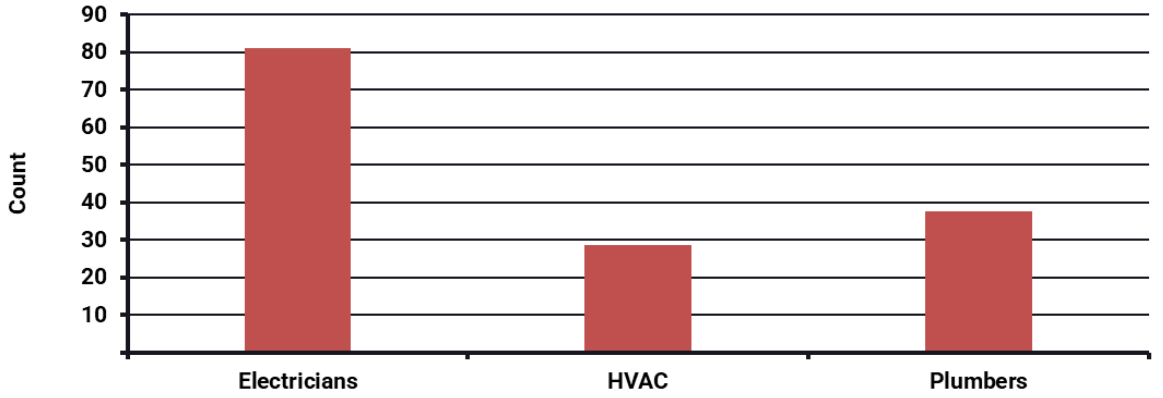
- Workforce dynamics reflect changes in the workforce due to retirements, transfers from other jobs, and workforce entry
- This type of data provides a baseline against which the necessary development can be benchmarked
- Additional information needed is the mix of licenses and experience needed for organizational functions, e.g. field installation teams
- Energeia's analysis found that most trade and utility job training is done on the job, with very little training provided commercially
- Training timelines and capacity are a key input into any workforce development strategy

Annual Transfers to 2030



Source: Employment Development Department, Employment Projections

Annual New Entries to 2030



Source: Employment Development Department, Employment Projections

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Key Barriers to Workforce Development

Key Workforce Barriers	
Barrier	**Source**
Competitiveness of wages	Interviews, Research
Blue collar stigmas	Interviews
Lack of incentive stability	Interviews, Research
Declining interest in energy sector jobs	Research
Shrinking pool of workers (birthrate)	Research
Lack of accessibility to training	Research
Entry requirements	Research
Cost of transition to alternate trades	Research

- Key workforce barriers shown are from both contractor interviews and best practice desktop research
- Interviewees cited barriers such as competitiveness of wages, blue collar job stigma, retraining incentive availability and uncertainty around demand for green jobs
- Research identified barriers such as a decline in energy job interest, small pool of workers, lack of training access, and high entry requirements

Source: Interviews, Energeia Research

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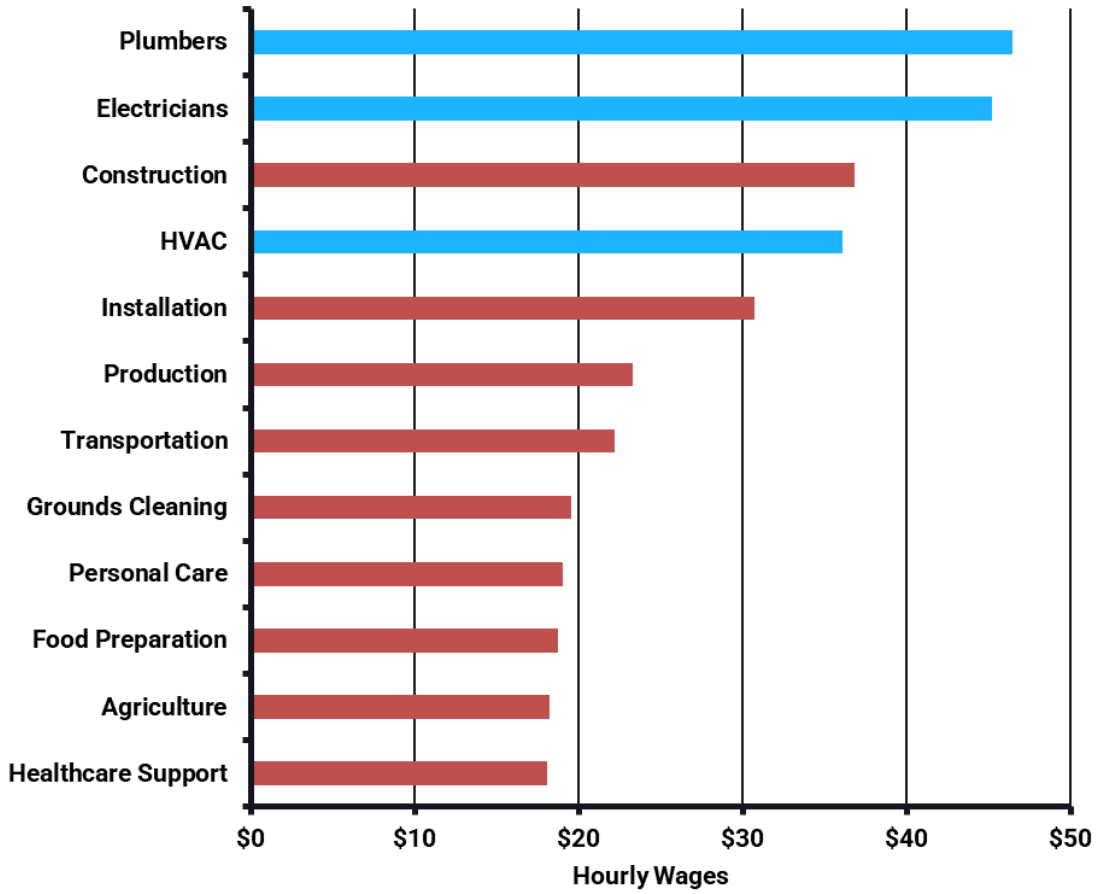
Contractor Wages – Career Attractiveness

Contractor Wages Compared to Blue Collar Trades



Source: Employment Development Department (EDD), Energeia analysis

- Energeia analyzed hourly wages for blue-collar jobs and compared them to the hourly wages of the contractors who install BE appliances
- Plumbers, electricians, and HVAC professionals all make significantly more than most non-BE blue-collar jobs in this example
  - Plumbers make ~$46/hr on average
  - Electricians make ~$45/hr on average
  - HVAC professionals make ~$36/hr on average
- The only non-BE blue-collar job that makes more than contractors related to BE technologies is construction, which makes ~$1 more per hour than HVAC professionals
- The key takeaway here is that plumbers, electricians, and HVAC professionals have competitive salaries when compared to other trade jobs

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Best Practices – Workforce Development

Barriers and Challenges to Workforce Development	Strategies to Increase BE Workforce	Detailed Description of Strategies
Declining Interest in Energy Sector Jobs	Increase Interest Among Younger Students	One obstacle to hiring is lack of interest in or awareness of the opportunity in the next generation of careers in the energy sector. Recruitment needs to start in middle and high school by allowing students to get field experience.
	Promotions and Campaigns	The ten key recommendations include providing technical assistance to workforce ecosystems, conducting recruitment campaigns featuring clean energy workers as “energy heroes,” and driving recruitment and retention by prioritizing job quality
	Job Security (Expected Exponential Growth in BE Jobs)	Found that electrifying all of California’s existing and new buildings by 2045 would create over 100,000 full-time equivalent jobs in various sectors of the economy.
	High Wages	The U.S. Energy and Employment Report found that energy sector employees earn higher hourly wages compared with the national median and other sectors of the economy; this is true across all energy technology sectors.
Narrow Pool of Skilled Workers	Training and Access Programs	Many occupations within the clean energy economy tend to have lower educational requirements, which include occupations like electricians, carpenters and plumbers. However, training programs are required for entry
	Retraining Resources	Extended unemployment or wage replacement, retraining, relocation assistance, and wage insurance
Accessibility to Training	Online Education Programs and Webinars	Building up online presence with more live webinars and pre-recorded resources so information can be accessed more quickly and easily at times that best suit their business,
	Access For Underrepresented Populations	Recent data finds that 61% of the clean energy job holders across the United States are white non-Hispanic workers, with Black and Hispanic or Latino workers underrepresented as compared with the national average.
	Focus On Areas Affected by the Energy Transition	Provide skills-based hiring connections, workforce development and community support for communities affected. In 2019, nearly 1.7 mil people worked in these industries, because these jobs are typically geographically concentrated in certain counties
Job Requirements and an Evolving Labor Market	On The Job Training (Earn-as-you-learn) Programs	On-the-job learning through registered apprenticeships and experiential learning is especially helpful in the clean energy sector given the large role of tacit knowledge and the abundance of positions not requiring an associate or bachelor’s degree.
Existing Barriers From Workplace Development	Constant Creation and Updating of Current Workforce Programs	Current workforce development programs may have unintentional barriers that make the programs inaccessible to segments of the public. This includes requirements for certain educational attainment that may not be possible for some applicants.
Transition to Alternate Trades	Increase Retention Due To Bonuses	Retention and relocation bonuses to keep skilled and trained workers, Pension guarantee, and a "glide path" to retirement for older workers, training completion bonuses
	Incentivize Training Programs	In some programs researched, incentives were paid to qualified participating contractors. Air-source heat pump contractors had the option to keep the entire incentive amount or pass a portion on to the customer/end user.
Significant Amount of Retirements	New Federal Funding Available to Fund Workforce Development	The Infrastructure Investment and Jobs Act will provide at least $60 million to state and local energy efficiency workforce development programs. The funding is for training and education needs, including activities that address workforce gaps.
Cost of Programs	Minimize Costs of Above Programs	Displaced workers are guaranteed re-employment in jobs in the growing low-carbon economy, the electricity industry, or within the public sector.
	Promote Economic Opportunities with Stakeholders	By partnering with employers, labor organizations and other stakeholders, local elected officials can make a real impact in reducing workforce disparities and creating well-paying career opportunities
	Collaboration with Educational Institutions	Provide training and credentialing programs can prepare students for building retrofit jobs and address the workforce needs

- A lot of good ideas, but the costs and/or impacts of various strategies to date is not widely reported

Source: Energeia research

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Key Workforce Development Strategies

Workforce Development Strategies, Costs and Impacts

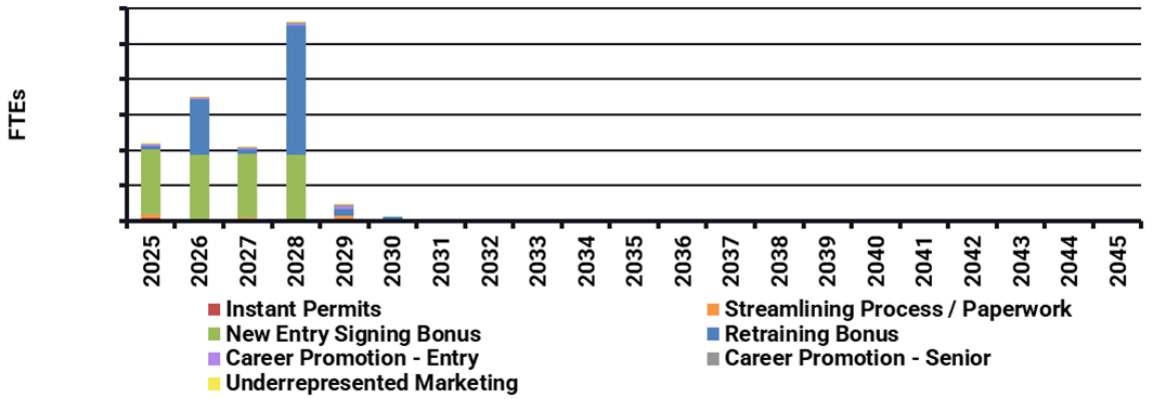
Strategy	Cost to SJCE ($)	Estimated Impact	Freq.
New Entry Signing Bonus	$5,000 per FTE	1 FTE	Annual
Retraining Bonus	$500 per FTE	1 FTE	Annual
Career Promotion	$10,000	2.5% increase in New FTEs	Annual
Underrepresented Marketing	$10,000	2.5% increase in New FTEs	Annual

Source: Energeia estimates

- Energeia developed a set of strategies that address key workforce barriers, and capture estimated costs and workforce impacts of each
- Entry Level bonus reflects the average signing incentives provided to new entrants upon completing training in trades such as HVAC, electrical, and plumbing, based primarily on actual California industry data
- Retraining bonus is based on a Silicon Valley Clean Energy's (SVCE) Future Fit Fundamentals Program that offered a $500 training incentive to those who completed a training course
- Percentage impacts represent estimated values
- Energeia developed an estimate of the cost of process improvements and advertising campaigns based on experience, but these numbers should be validated

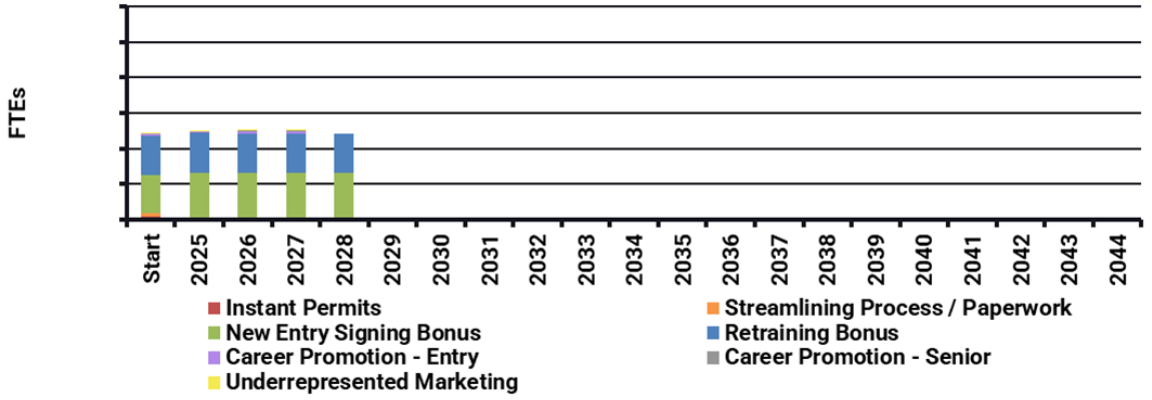
Workforce Development Roadmap

Workforce Development Roadmap by Strategy



Source: Energeia modeling

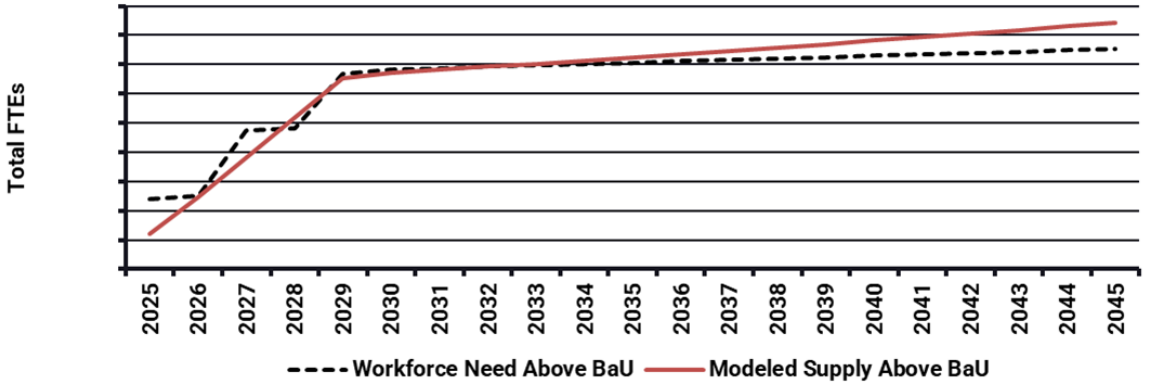
Smoothed Workforce Development Strategy



Source: Energeia modeling

- The annual impacts of the workforce development program were estimated
  - Includes strategies for increasing the efficiency of the existing workforce, e.g., instant permits and streamlining
- The plan was smoothed to reflect the realities of hiring and program implementation (ideally, it should ramp up)
- The resulting workforce transition is shown below against the target needed to hit the building electrification goals
- Energeia recommended revisiting the plan each year due to the lack of readily available data on program impacts

Workforce Need Above BaU vs Modeled Supply



Source: Energeia modeling

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Takeaways and Recommendations

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Takeaways and Recommendations

- **Takeaways**
  - Achieving federal, state and city decarbonization targets will require significant workforce development
  - The impacts across the electric, natural gas, refined product, and utility sectors vary significantly by pathway
  - Best practice government and utility policy planning includes assessment of impacts, and workforce development strategies and plans
  - Workforce planning can effectively manage the transition in a timely and equitable basis
  - Workforce development infrastructure will need to grow and change to meet expected workforce development needs
  - Workforce development funding will need to grow to meet growing transition targets, and is a key gap at the moment
- **Recommendations**
  - Ensure that transition policy planning includes workforce impact and optimization assessments, development strategies, plans and funding
  - Engage with workforce early to identify and address local issues and potential strategies, or risk significant pushback
  - Understand the timing and mix of workforce impacts, and develop strategies to ensure an equitable, timely transition
  - Significant education and support likely to be needed across a wide range of sectors, ensure programs and funding are commensurate

Charging Ahead

Q & A

Next Charging Ahead Topic

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Energeia's Charging Ahead

- Q&A
  - Add your questions in the chat
  - Unanswered questions will be answered via email
- Vote for your favorite Charging Ahead webinar topic
  - Best Practices in Virtual Power Plant Programs
  - Nuclear Technology and Cost Effectiveness
  - Using AI for Expert Domains in the Power Industry
  - Quantifying Climate Impacts on a Zero Carbon Grid

Reserve your place at the next **Charging Ahead** discussion

The State of the Art in Virtual Power Plants (VPPs)

July 22, 2025
9:30 AM – 10:00 (PDT)

Where to find Energeia and Ezra Beeman

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Watch for a follow-up email with recording and presentation links to share

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