



Energy Efficiency Services Sector: Workforce Size, Expectations for Growth, and Training Needs

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Study Motivation



- Many states adopting aggressive EE policies & goals
- Federal goals and support including 2009 stimulus funding & pending legislation
- EE expected to play a major role in meeting power sector needs & greenhouse gas reduction goals

→ Are there adequately trained people to design, manage, and install the efficiency measures needed to meet these goals?



Research Questions



What are the requirements for a growing energy efficiency services workforce through 2020?

- How many jobs and what types of jobs are there in the energy efficiency services sector (EESS)?
- What is the projected need for more workers?
- What training will be required?
- What bottlenecks to expanding the EESS workforce can we anticipate?

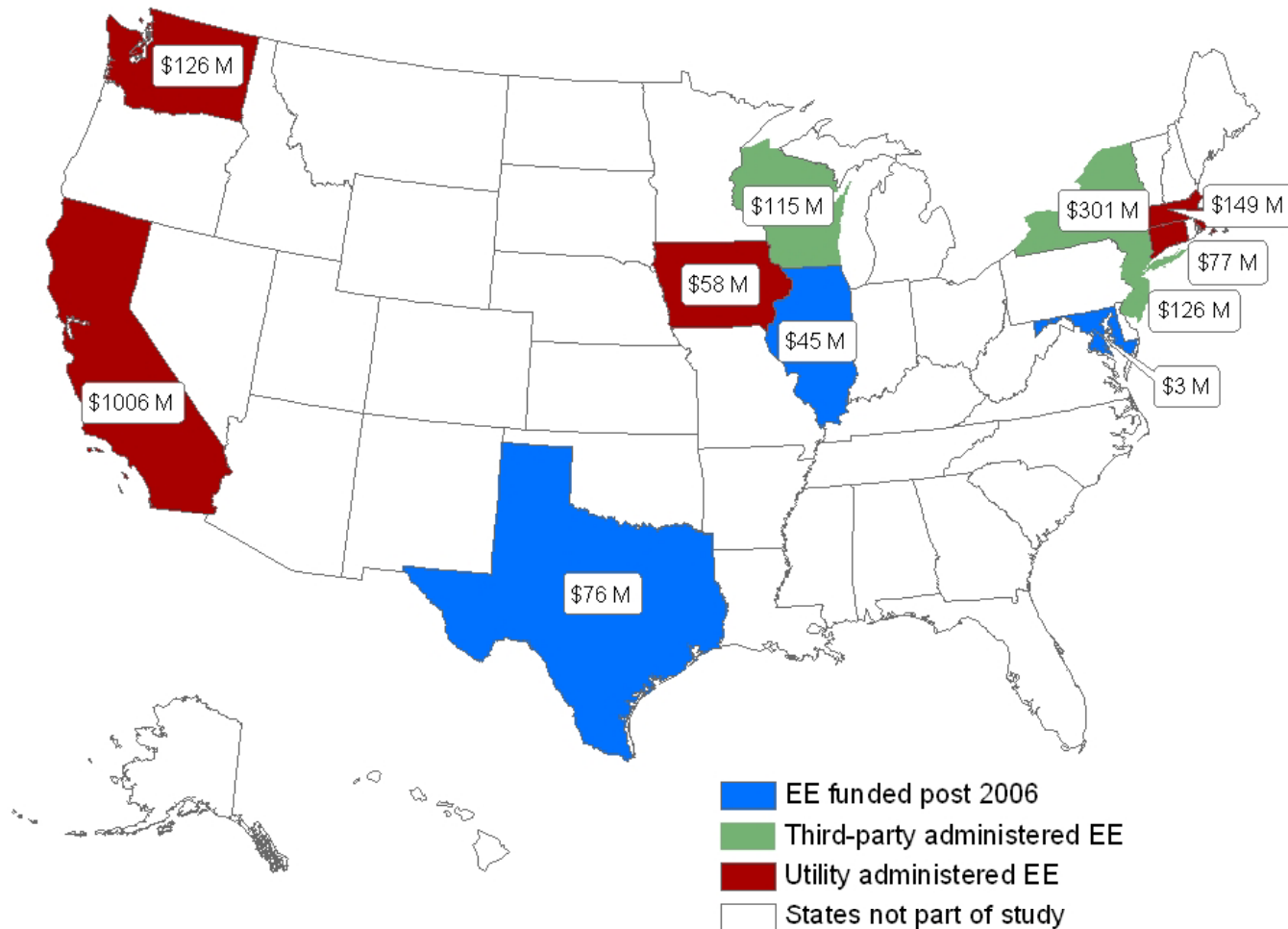


Bottom Up Approach



- **Over 350 interviews in 11 states**
 - Program administrators (n=39)
 - Program implementation contractors (n=34)
 - Energy service companies (ESCOs) (n=9)
 - Building & construction trades/associations/
labor unions (n~190)
 - Educational and training organizations (n=33)
 - Other subject-area experts (n~50)
 - **Literature review; analysis of secondary data**
 - **Coordination with regional employer studies**
 - **Research Team: LBNL and Research Into Action**
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Approach: 11 State Survey: Represents ~75% of 2007 Budget for Ratepayer-funded Energy Efficiency



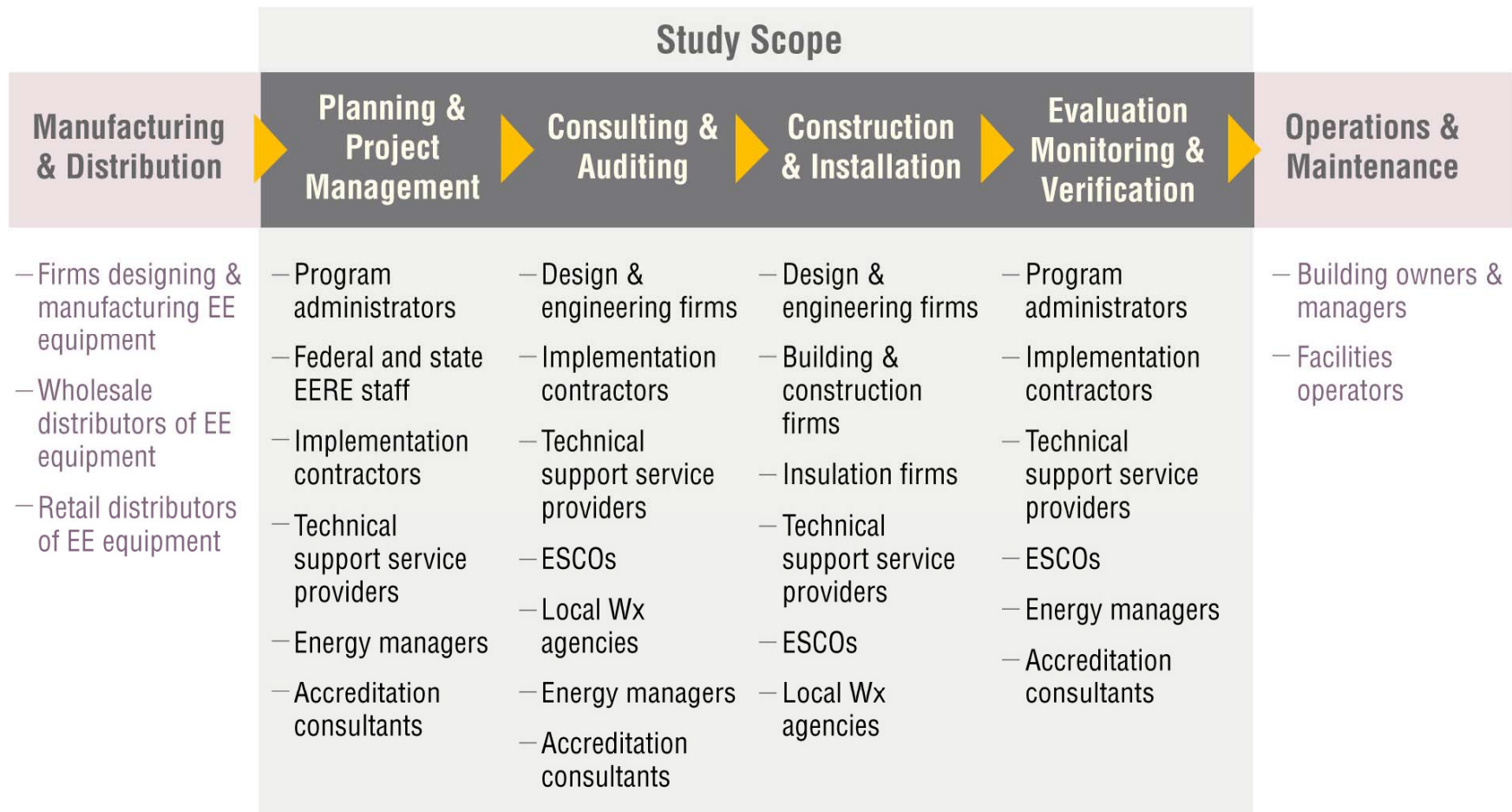


Characterizing the Energy Efficiency Services Sector (EESS)

Defining the EESS



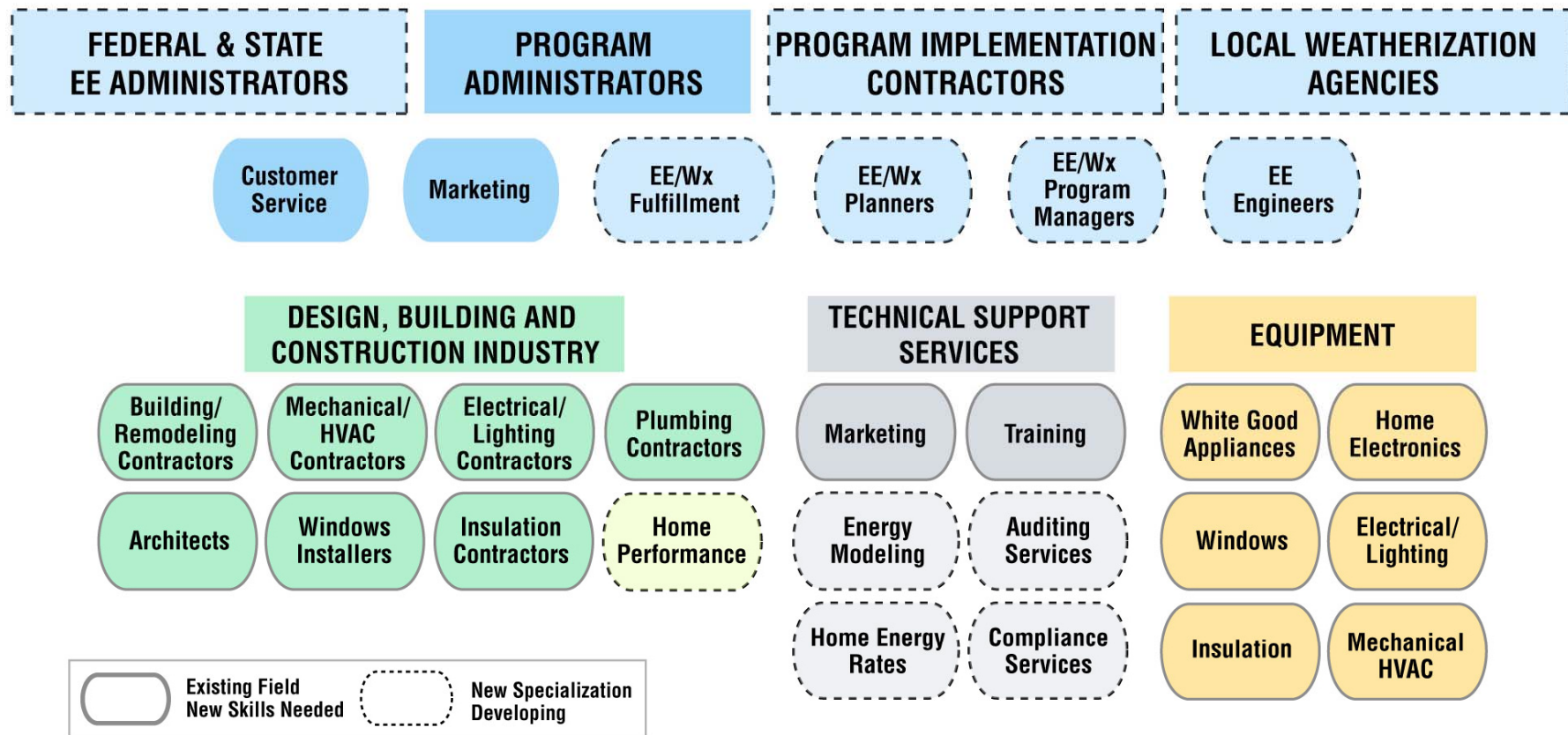
This study includes the portion of the EESS market supply chain that focuses on deployment and installation of energy efficiency products and measures. Within this, we further limit our scope to those EE products and services whose demand is driven *primarily* by the energy savings.



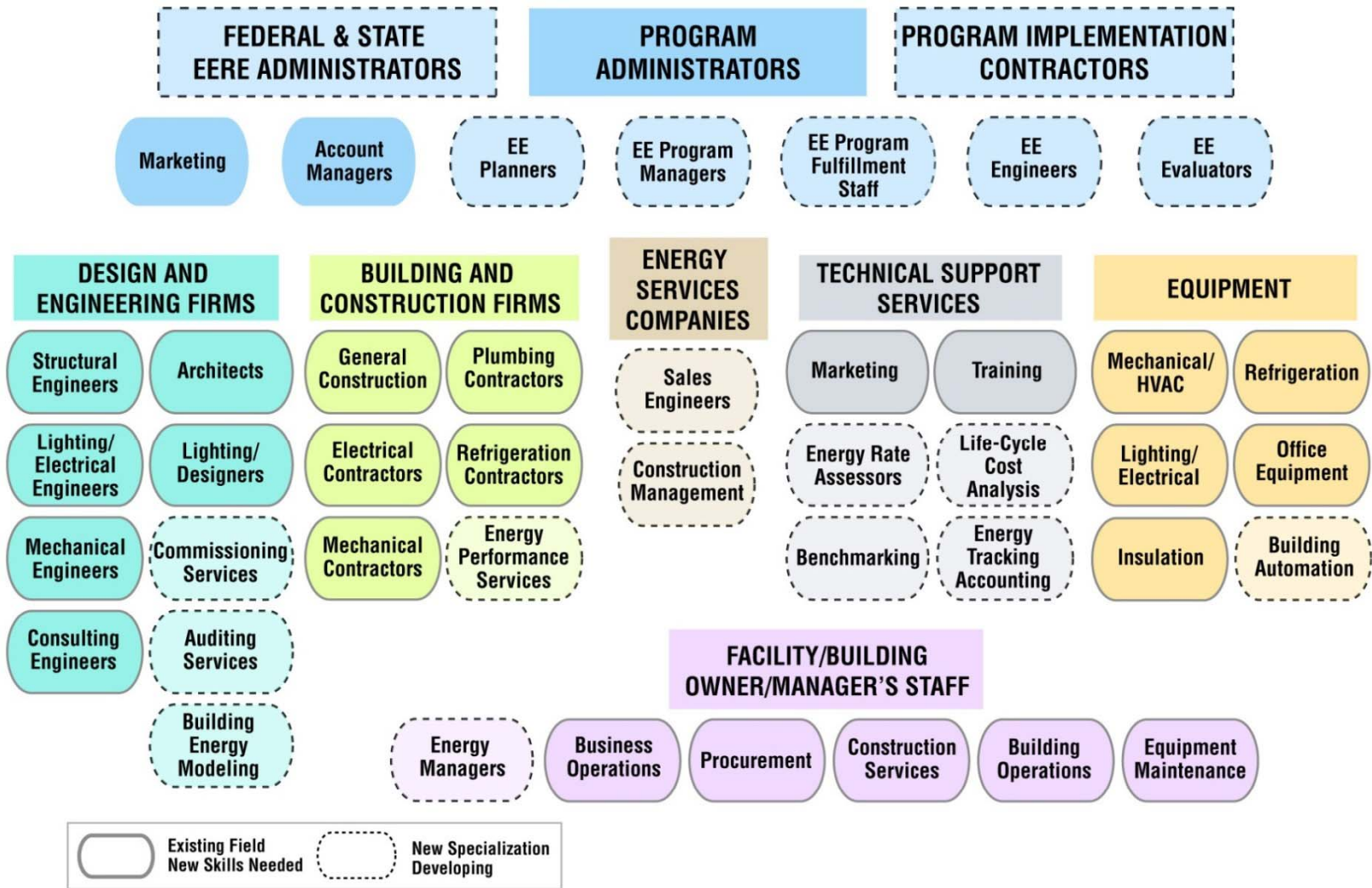
Residential EESS



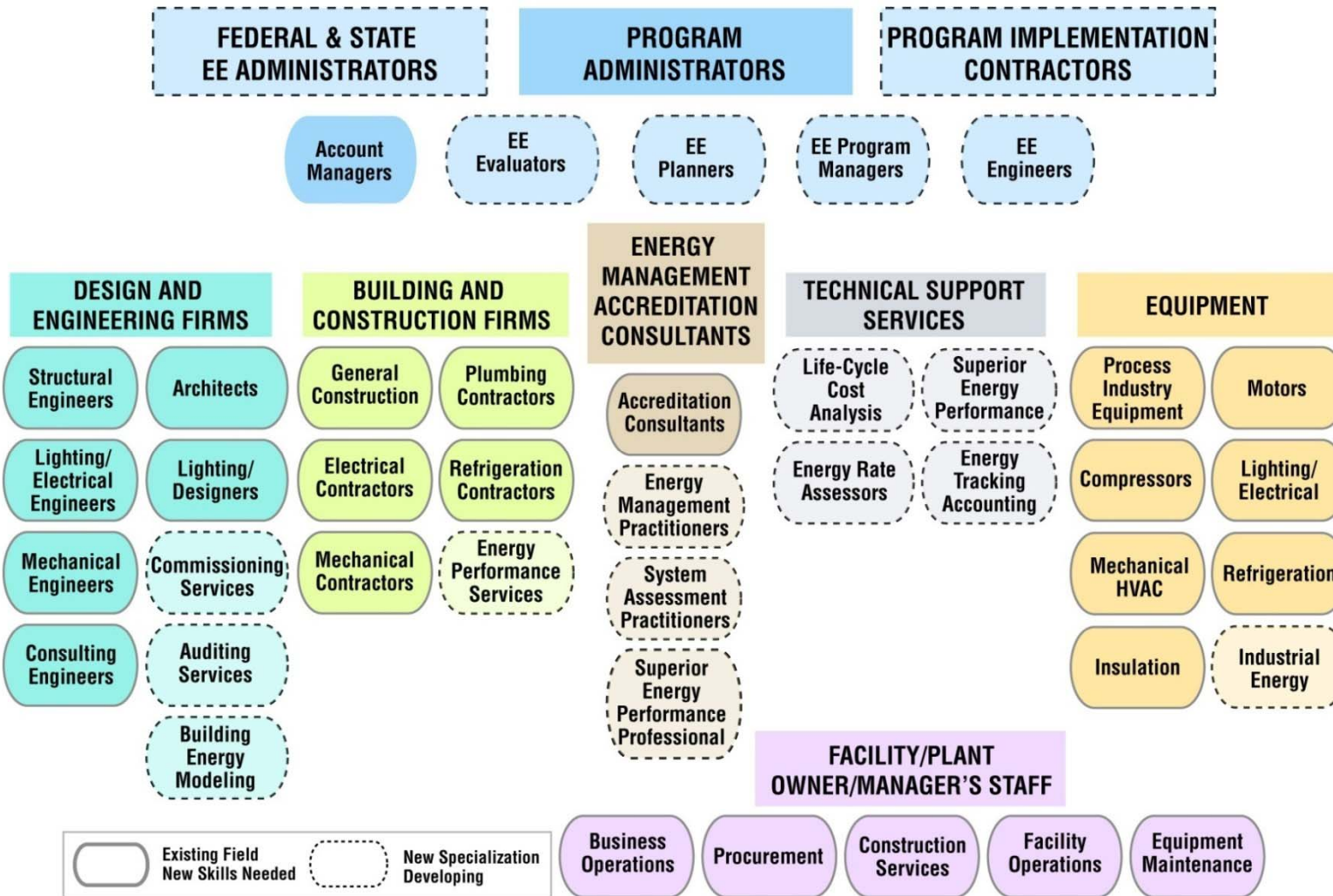
Lighter-colored boxes with dotted outlines show job categories that have emerged primarily as a result of the development of the EESS, and darker-colored solid boxes show firms and job categories that also exist outside of the EESS.



Commercial-Institutional EESS



Industrial EESS



Features of the EESS



Top Tier of the EESS Diagrams:

- Program Administrator (PA) relies on various types of market actors and trade allies to design, deliver, and implement high efficiency products and services.
- Program Implementation Contractors (PIC) are often responsible for the day-to-day management of EE programs and have the ability to scale up or down quickly.

Bottom Tier of the EESS Diagrams:

- The tier row includes firms providing more specialized services in the areas of design and engineering, building and construction, ESCOs (in the institutional/commercial market), energy management accreditation consultants (in the industrial market), technical support contractors, and manufacturers.
- PA typically augment their staff with individuals and small firms with EE specialties. These contractors are the primary providers of the new and emerging activities shown in the dotted-outline boxes (see “Technical Support Services”).

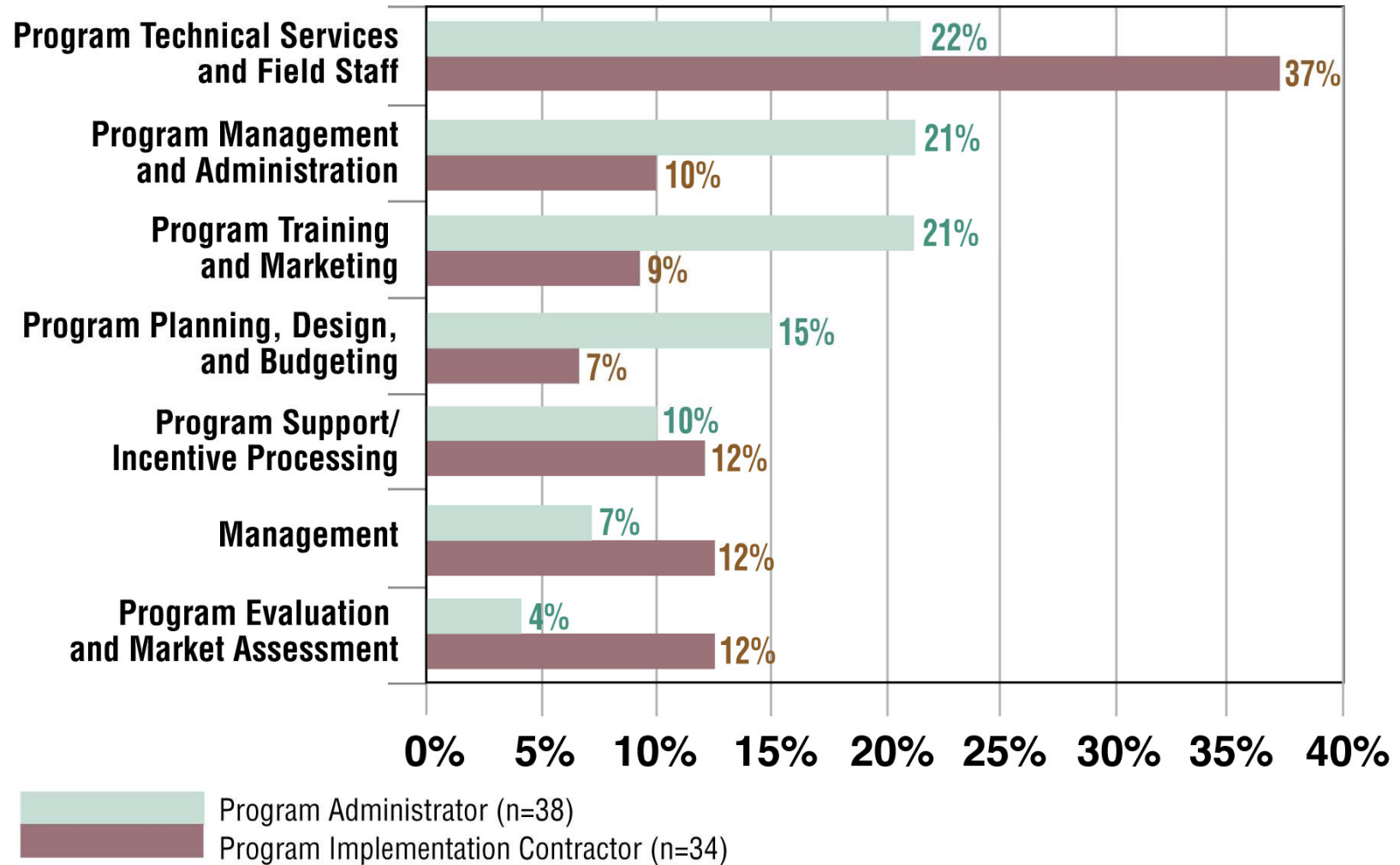


Job Categories: Program Administrators and Program Implementation Contractors



Job category	People in this category ...
Senior management	...provide the senior level of management to the EE organization. In the case of a large utility or private firm this is the EE department; in the case of smaller organizations that solely focus on energy efficiency this could be the senior management of the entire organization
Program planning, design, and budgeting	... conduct activities that get an EE program into the overall program portfolio of an organization
Program management and administration	...provide leadership for a specific program such as a commercial lighting or new construction program
Program technical services and field staff	...provide technical services in the field such as auditors, installers, and verifiers
Program training and marketing	...work with trade allies and others to train them in new programs and market the EE programs
Program support and incentive processing	... provide overall administrative support to EE programs, including incentive processing and data entry
Program evaluation and market assessment	...conduct research aimed at improving the design and implementation of EE programs and assessing their impacts on end use and product markets

Program Administrators and Implementation Contractors Workforce by Job Category

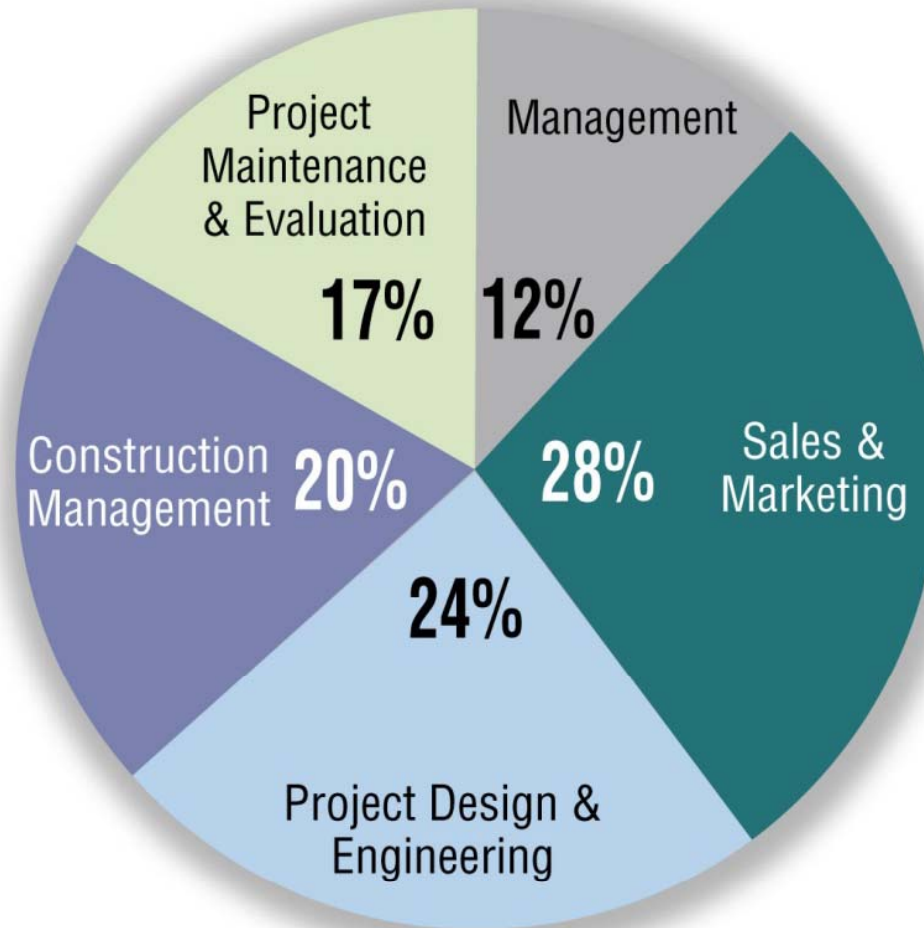


Job Categories: Energy Service Companies (ESCOs)



Job category	People in this category ...
Senior management	...provide the senior level of management to the organization.
Sales and marketing	... staff develop business leads and projects; work with customers to make project happen; participate in investment-grade audits.
Project design and engineering	...conduct investment-grade audits; design and engineer projects, develop project costs and budgets, develop construction drawings and specifications.
Construction management	...provide leadership on site for installations and retrofits, ensure projects are completed on budget and to design requirements.
Project maintenance and savings verification	...oversee project-related operations & maintenance after project is accepted by owner; gather field and billing data to verify savings; prepare reports on project savings and performance.

ESCO Organization Workforce by Job Category



Job Categories: Design, Engineering, and Building & Construction Industries

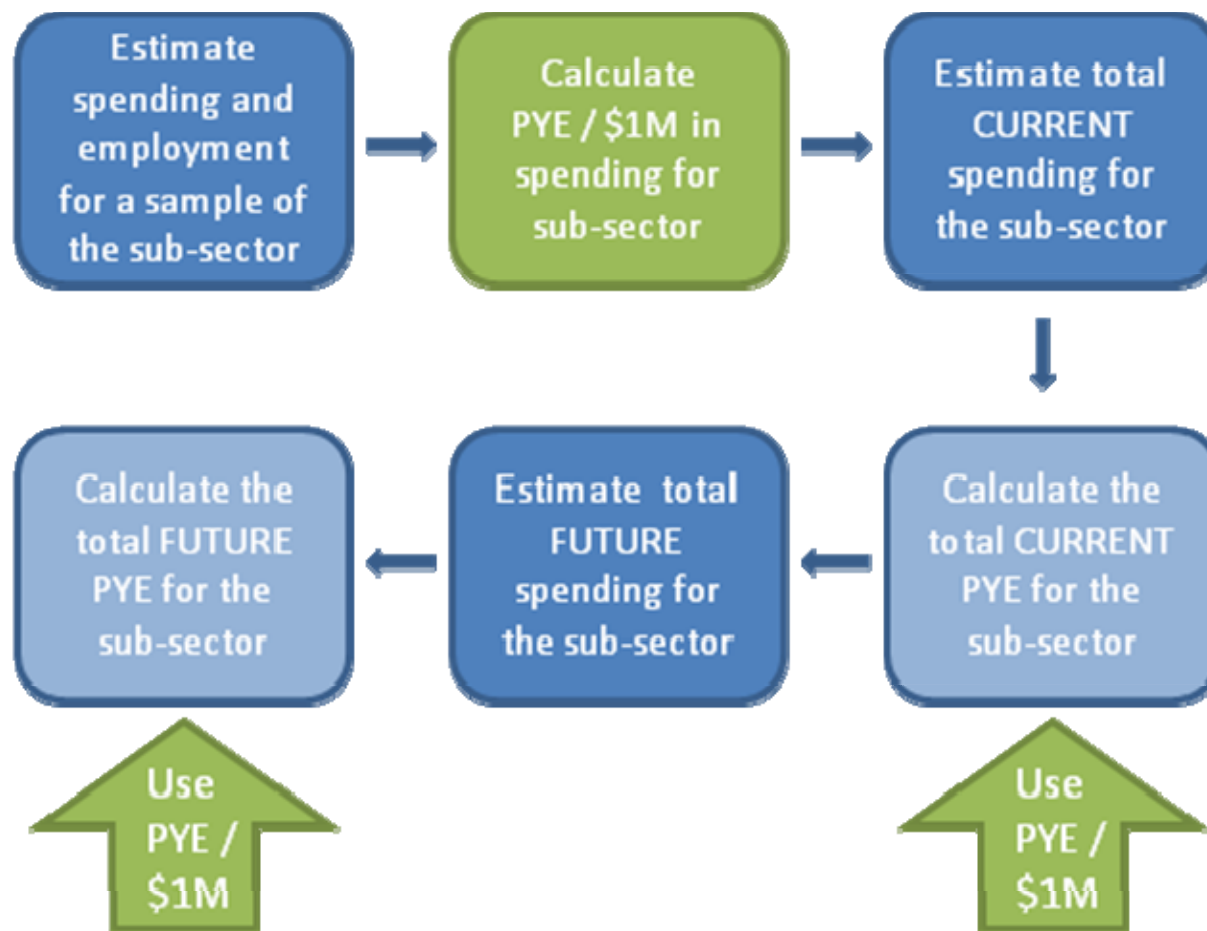


Job category	People in this category ...
Architects	...design buildings, develop drawings and specifications for construction
Engineers	...design energy using systems for new and existing buildings; prepare drawings, specifications for construction; develop software and analysis tools for building modeling and simulation of energy consumption; and commission new buildings and high-efficiency projects
General contractors, builders, remodelers	...create the team that constructs, renovates or retrofits the building; solicits bids from equipment contractors, and structural and construction specialties; coordinate with design team and owners
Equipment contractors (e.g., mechanical, electrical, lighting, and refrigeration)	...install specified products, systems, and equipment consistent with design specifications
Building envelope contractors (e.g. insulation, windows)	...install specified products consistent with design specifications



Current and Projected EESS Workforce Size

Methodology for Job Estimates



Jobs per \$1M Spending



Activity	Person-Years of Employment (PYE) per \$1M
Ratepayer-funded Efficiency Activity	6.2
Low Income Weatherization	8.9
Energy Service Companies (ESCOs)	2.5
Insulation	8.9
Federal and State Govt EERE Offices	6.5

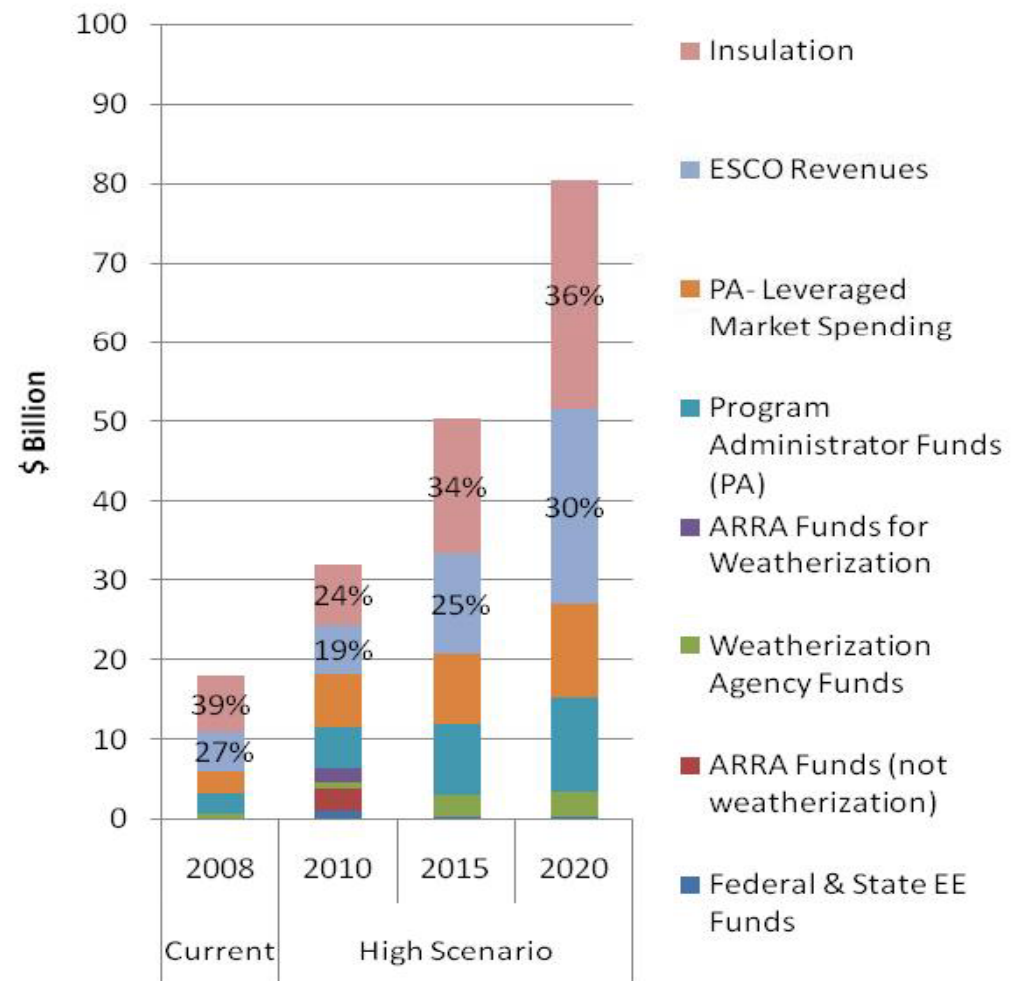
Our results compared to other studies

Study	Job Type	Person-Years of Employment (PYE) per \$M
UMASS-PERI and (2008)	Green Jobs (direct)	9.4
Apollo (2004)	Energy Efficiency	9.2
ACEEE (2008)	Energy Efficiency ("premium" efficiency)	9.8
ASES (2007)	Energy Efficiency (direct)	3.8
Clean Energy Fund (2009)	Energy Efficiency	4.7

Drivers of Growth



- Increase in utility ratepayer funded EE
- Federal stimulus funding
- State, local and (potentially) federal policy
- Market demand for EE products/services due to rising energy prices & influence of policy

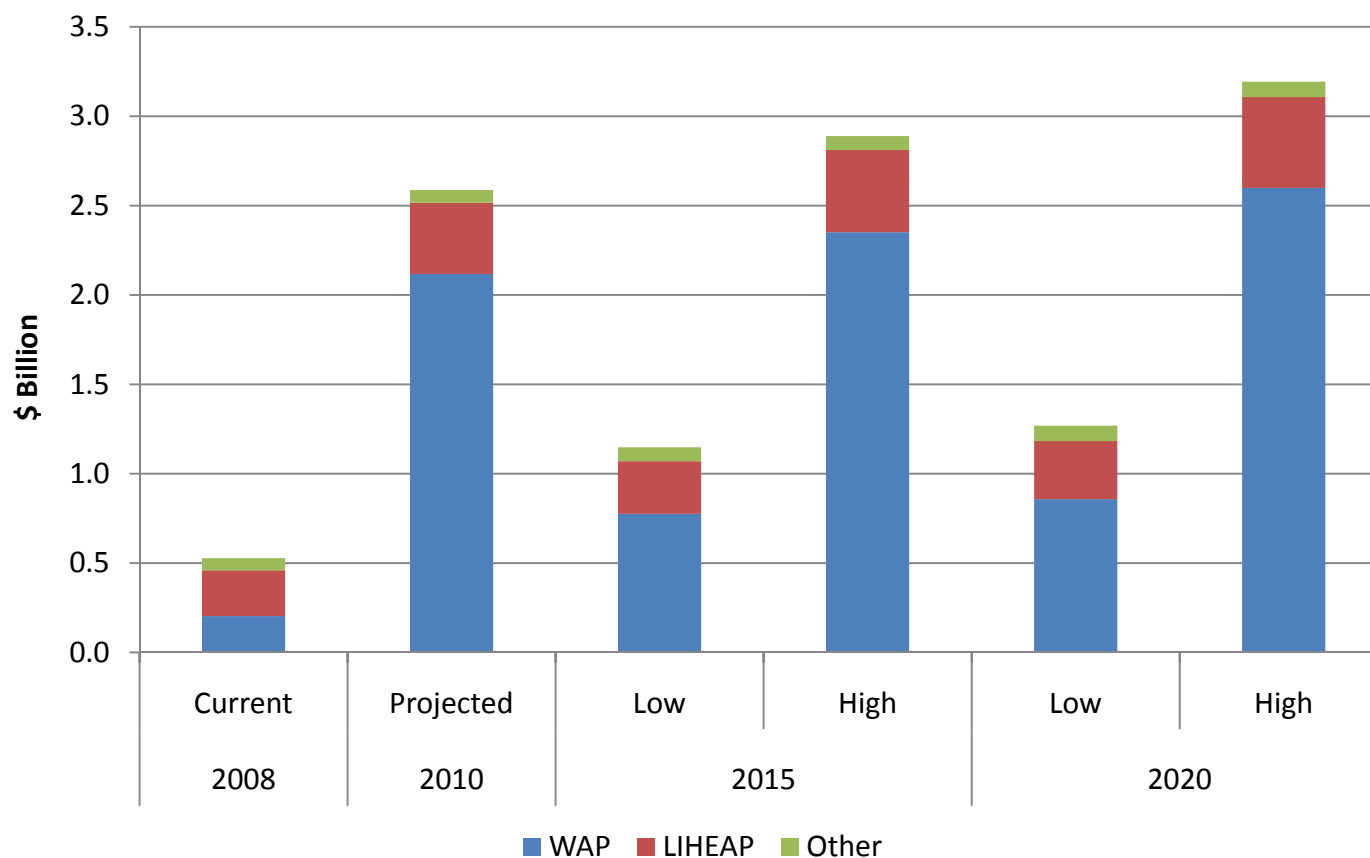


Current and Projected Spending on EESS Activity—High Growth Scenario

Projected 2010, 2015, and 2020 Weatherization Assistance Funding



Low vs. High growth scenarios – much of the future uncertainty depends on continued public support for these programs.



High Growth Scenario



Key Assumptions

- A quick ramp-up in 2010, reflecting the commitment of American Recovery and Reinvestment Act (ARRA) funds to weatherization assistance and other efficiency program activities.
- Significant increases in spending on energy efficiency over the next dozen years resulting from governmental policy and market investment in efficiency.

High EE growth scenario is more likely than low growth scenario due to the current political will to implement policies that address energy security, climate change, and job creation in activities that cannot be moved overseas.

EESS Workforce Size



Current Size:

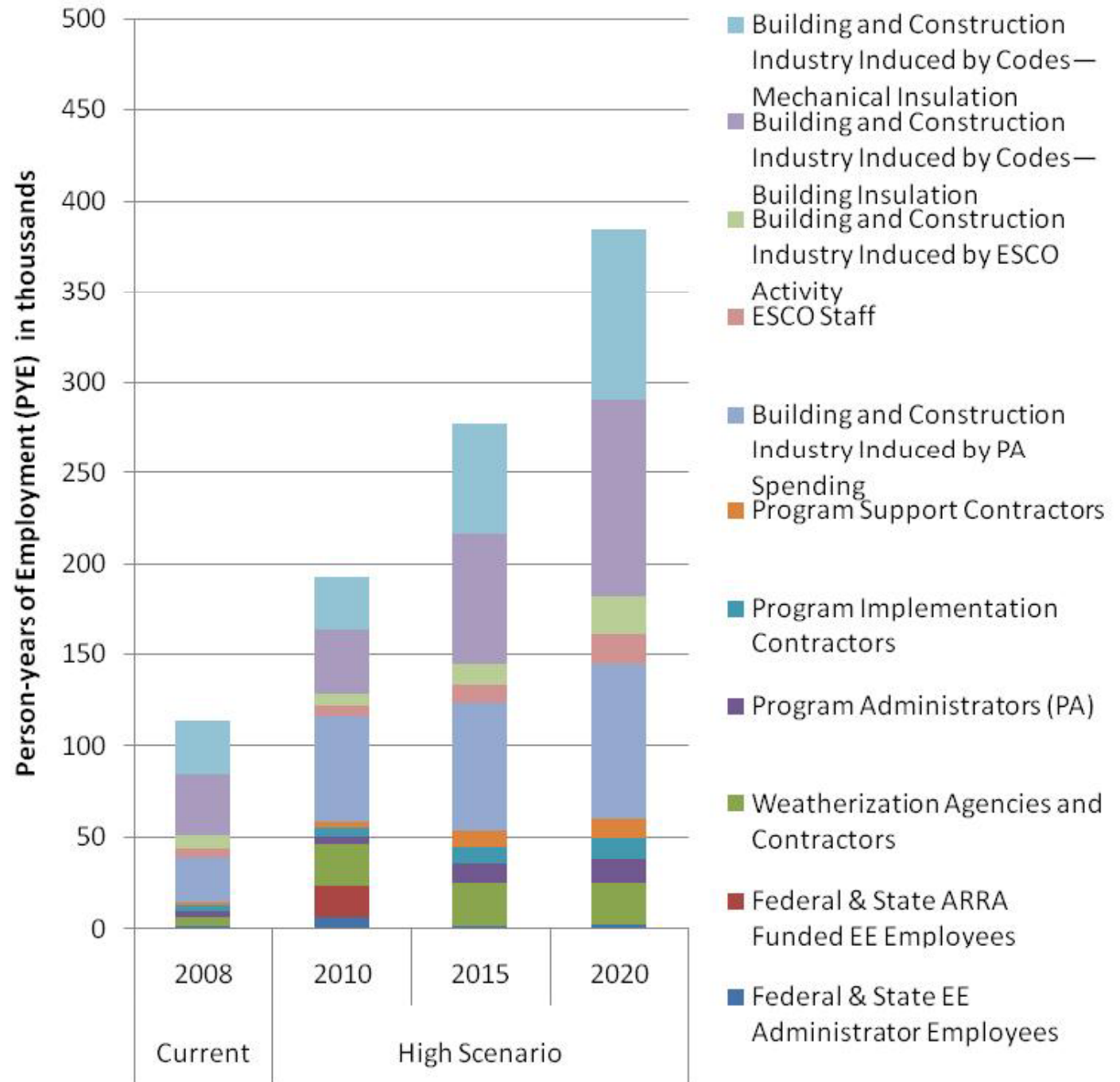
- 114,000 person-years of employment (PYE)
- Approximately 380,000 individuals employed

Projected Size in 2020:

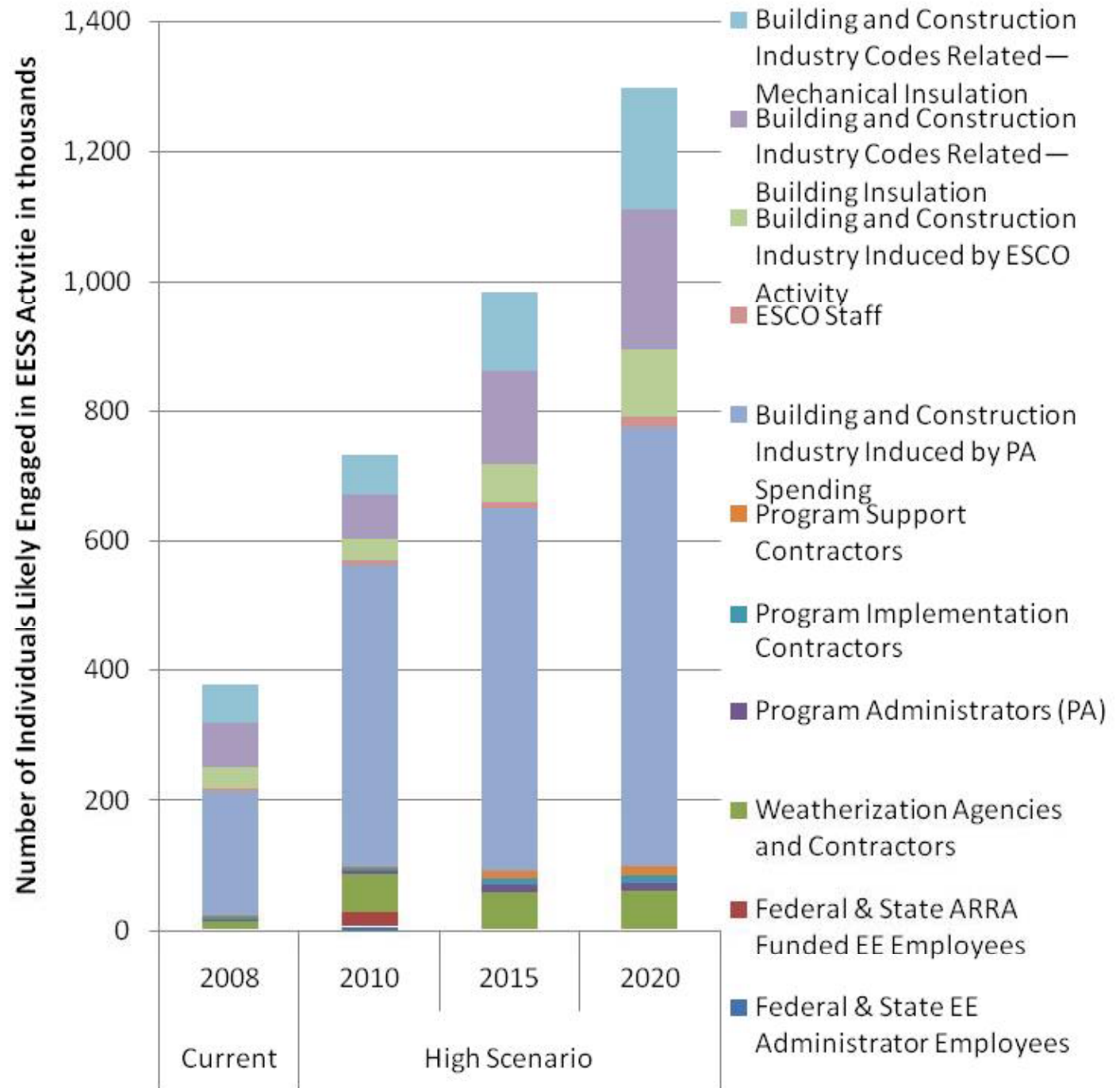
- Approximately 400,000 PYE (high-growth scenario)
- Up to 1.3 million individuals employed

→ A projected 2-fold (low-growth scenario) to 4-fold (high-growth scenario) increase in employment by 2020

**Energy
Efficiency
Services Sector
Workforce Size:
Current and
projected levels
of employment
in PYE**



**Energy
Efficiency
Services Sector
Workforce Size:
Current and
projected levels
of individuals
employed**



Breakdown of Current Jobs



~55% of current PYE – **Trades people and professionals** responsible for building envelope insulation and mechanical insulation

~30% of current PYE - **Rate payer-funded energy efficiency** efforts, including the staffs of program administrators, implementation contractors; as well as the building and construction professionals and trades people that design and install the equipment leveraged by ratepayer-funded programs

~10% of current PYE - **ESCO** efforts, including ESCO staff and the contractors they hire among the building and construction industry

~5% of current PYE – **Weatherization assistance** efforts of the federal and state governments





Lessons from Regional Case Studies

Regional Case Studies



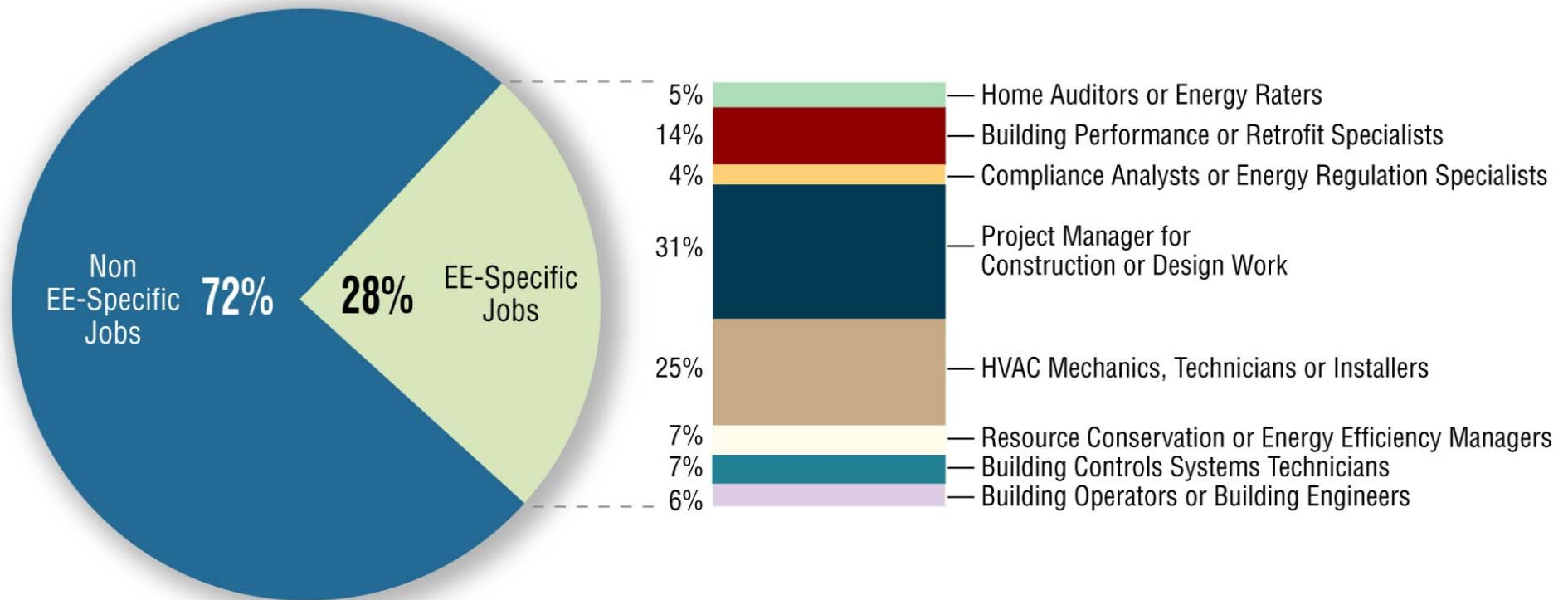
We were able to draw lessons from four regional studies of EESS employers. The chart below shows the segments of the energy efficiency value chain covered by these employer surveys.

	Manufacturing & Distribution	Planning & Project Management	Consulting & Auditing	Construction & Installation	Evaluation Monitoring & Verification	Operations & Maintenance
EESS Workforce Study		✓	✓	✓	✓	
California Survey	✓	✓	✓	✓	✓	✓
Massachusetts Survey		✓	✓	✓	✓	
Pacific Northwest Survey	✓	✓	✓	✓	✓	
Connecticut Survey	✓	✓	✓	✓	✓	✓

Many Non EE-Specific Jobs in EESS Firms



Jobs that require specific training/education in energy efficiency services account for only a fraction of the total employees in EESS firms.



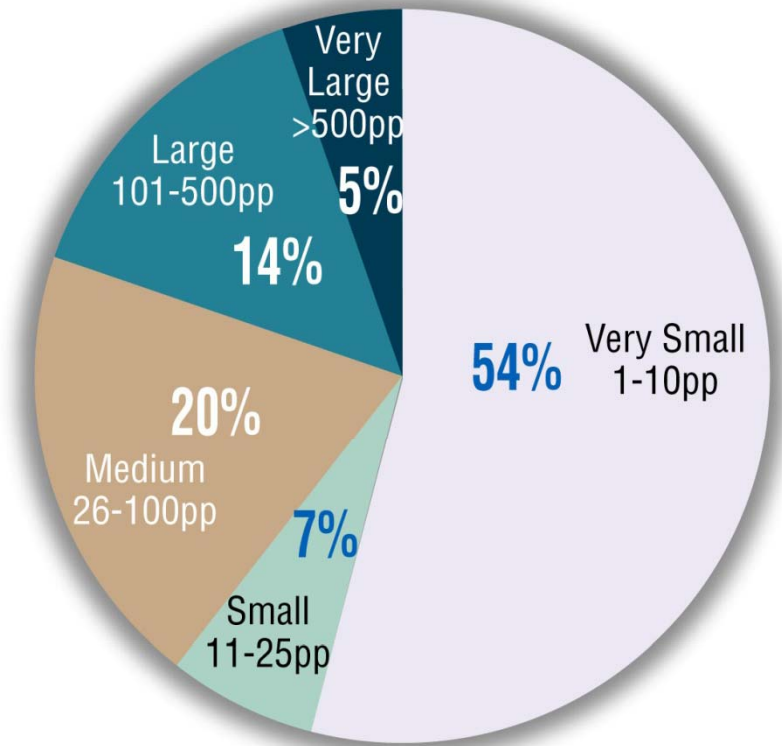
Employer data for eight specific energy efficiency occupations in California.

Data Source: California Community Colleges Centers of Excellence 2009

EESS has Aspects of a “Cottage Industry”



- Most firms providing energy efficiency services are extremely small (often under 10 people), with a few very large firms.
- >75% of firms in California, the Pacific Northwest and Massachusetts have 100 or fewer employees per firm, and at least 34% of EESS firms in each state have 10 or fewer employees.
- These employers tend to include a large number of small consulting firms and startups, and a few very large engineering firms and ESCOs.



Distribution of firm size among energy efficiency service providers in Massachusetts

Multi-State Operations



- **Operations of EE services firms appear to frequently span more than one state. For example, in Massachusetts, firms indicated that only about 21% of their employees were based in Massachusetts.**
 - This could be a regional phenomenon, given number of small states in New England and population density.
- **Most of these multi-state firms are the large engineering and energy service companies.**



High Expectations for Growth



Expectations for growth are high, particularly in the EE jobs portion of a firm's business.

•Massachusetts

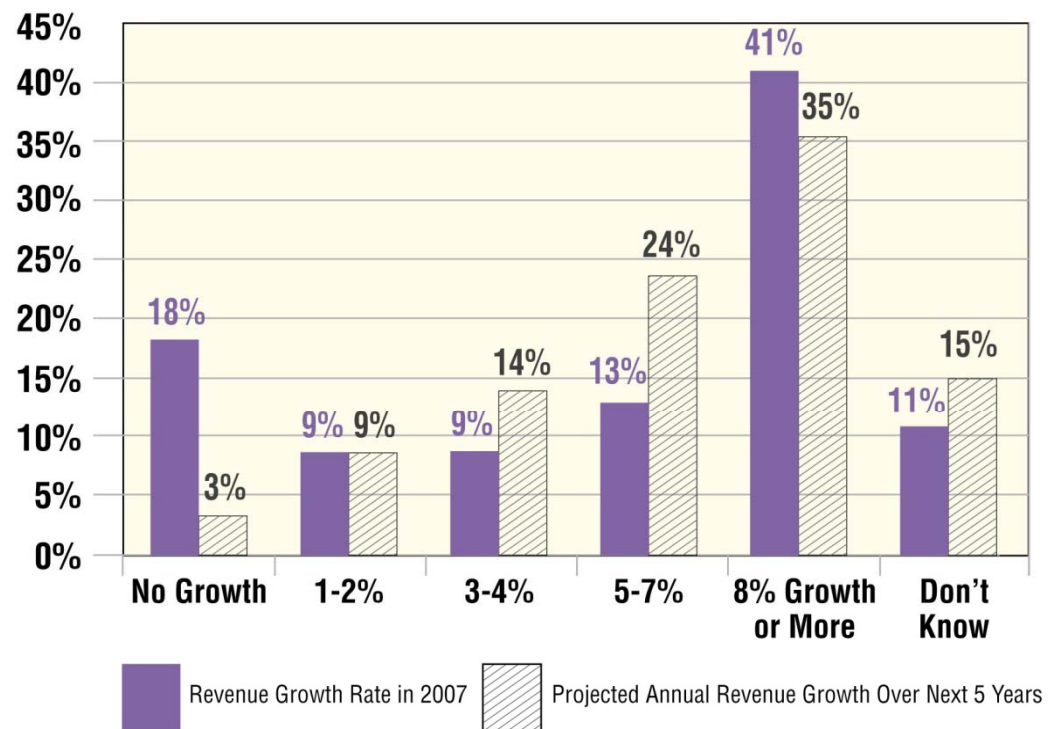
- Most employers expect >10% growth in revenue and average 9% increase in employees in the next 12 months

•Pacific Northwest

- Most employers expect revenues to grow at an annual rate of 5-7% over next 5 years

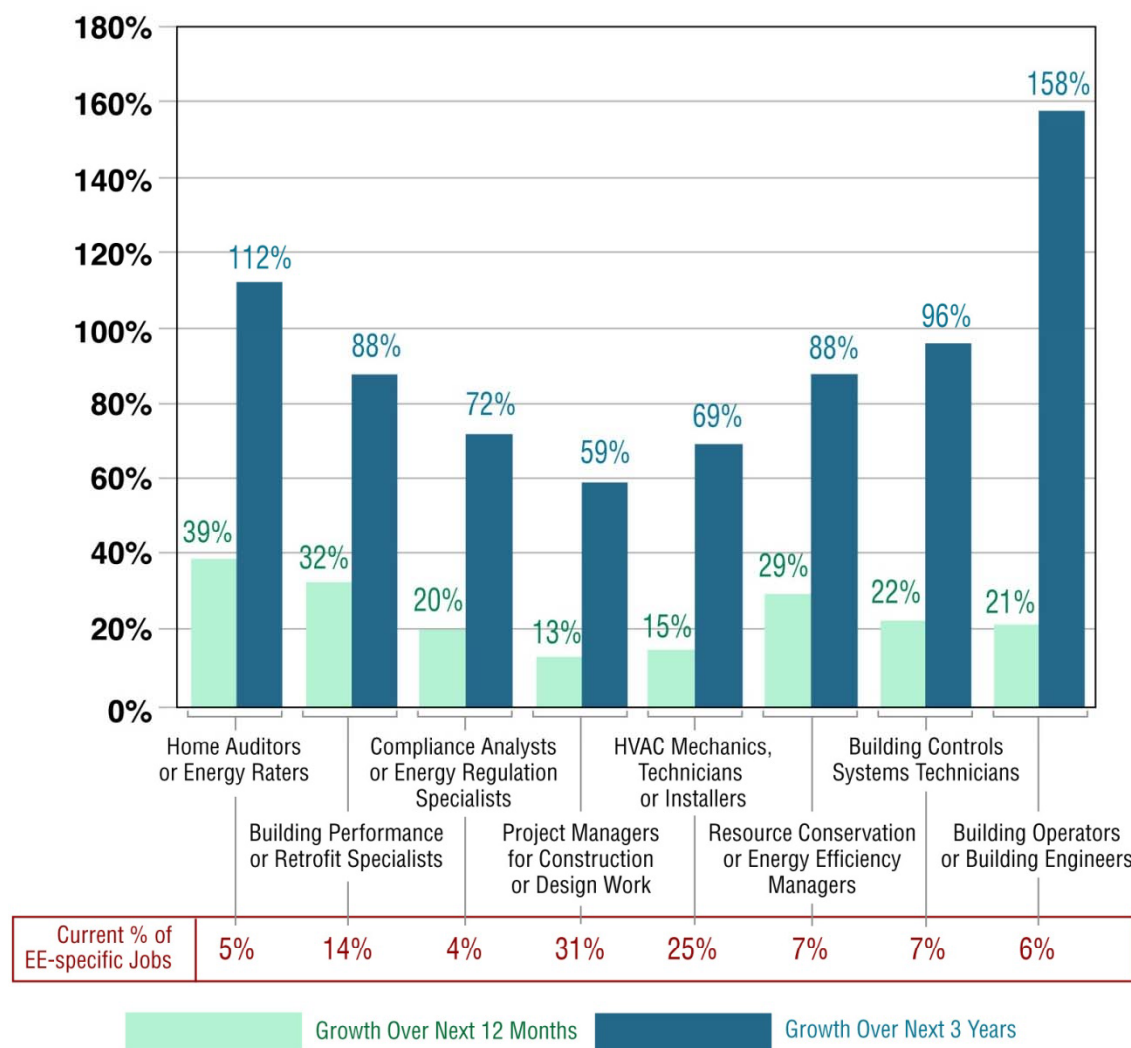
•California

- Employers expect a 20% growth in energy efficiency-specific jobs in the next 12 months vs. 2% growth for all job categories



Actual revenue growth in 2007 and projected average annual revenue growth over next five years for Pacific Northwest energy efficiency service providers.

High Expectations for Growth



Job growth expectations in 12 months and 3 years for California employers.

EE Training Needed



- **California**
 - 56% to 73% of employers report “Great” or “Some” difficulty in hiring (depending on the job category)
 - **Pacific Northwest**
 - 70% of employers “could not or sometimes could not find qualified applicants”
 - **Massachusetts**
 - 24% of employers were not able to fill positions with qualified candidates
-



Key Insights & Challenges

Transforming Existing Jobs



Many jobs in the EESS are not new jobs, but rather jobs that need to evolve to provide more energy efficient versions of current (and future) products and services.

Two primary paths for entering the EESS workforce:

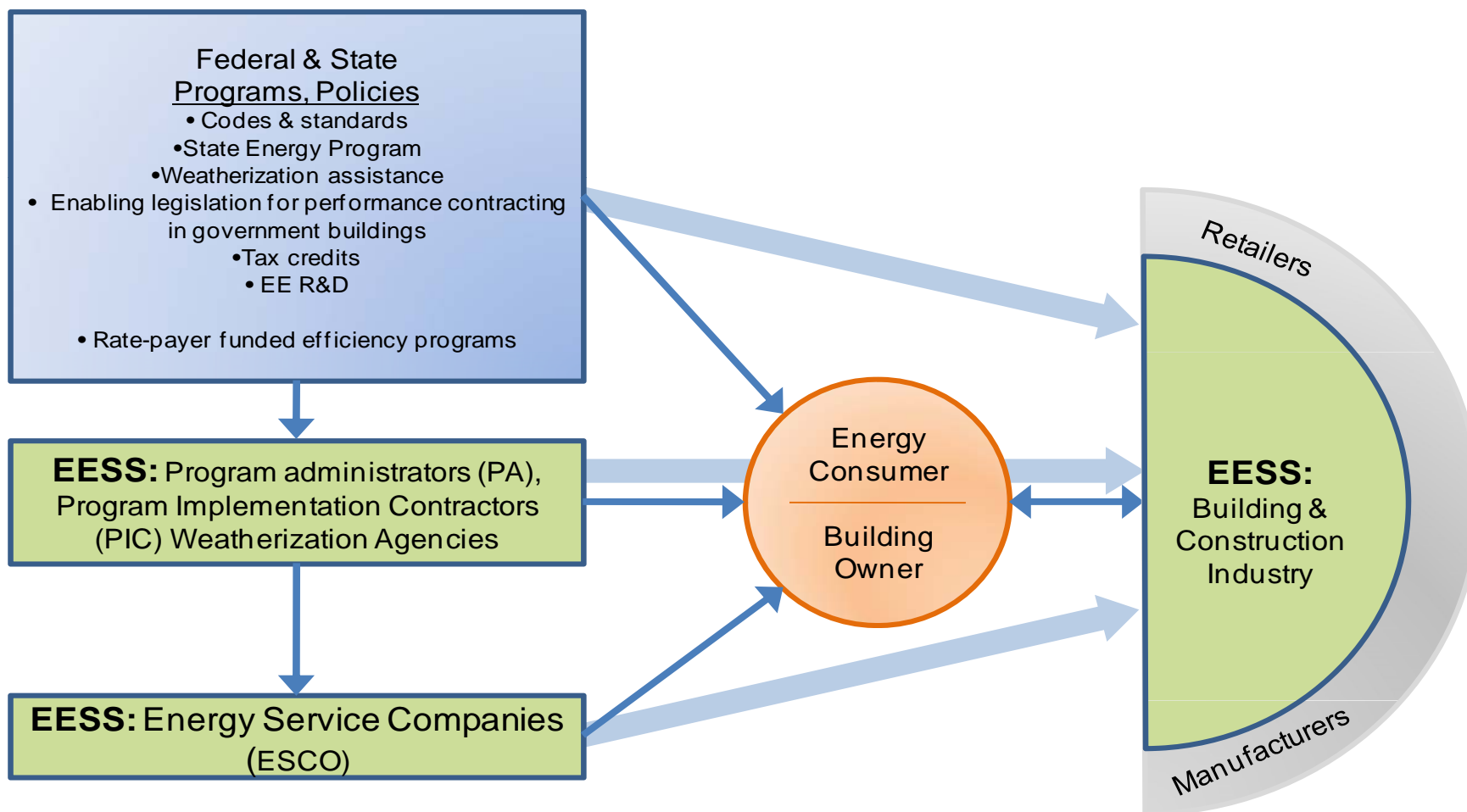
- **Existing occupations** (e.g., HVAC technicians, lighting contractors, construction trades, project managers) which are transformed into more energy efficiency-focused positions via retraining
- **Emerging occupations** that are somewhat unique to the EESS (e.g., home energy raters, commissioning services, energy/home performance services, energy auditors)



The EESS is Driven by Policy



Historically, a majority of the activity in the EESS is spurred directly and indirectly by government policies and ratepayer-funded programs.

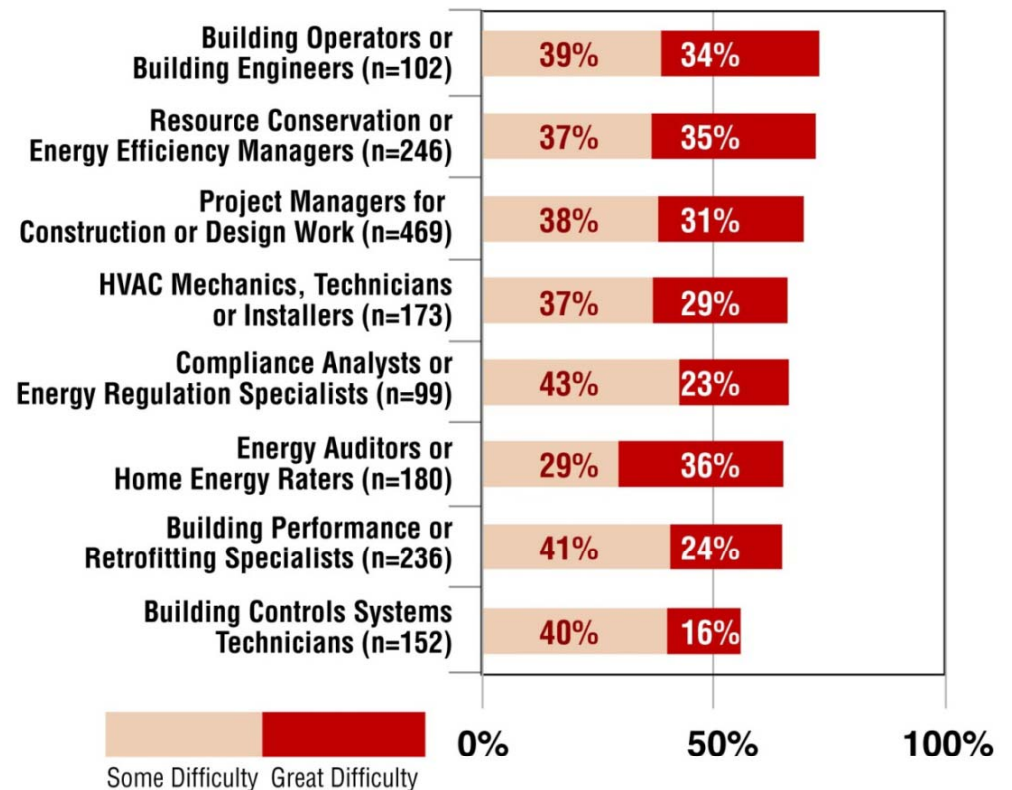


Difficulty Hiring?



Respondents believe there are challenges hiring into the EESS for ANY position other than entry level.

- Managers and engineers with experience in energy efficiency especially difficult to find
- Filling experienced positions often occurs by hiring from other firms
- Labor union respondents also report some difficulty recruiting qualified applicants into apprenticeship programs



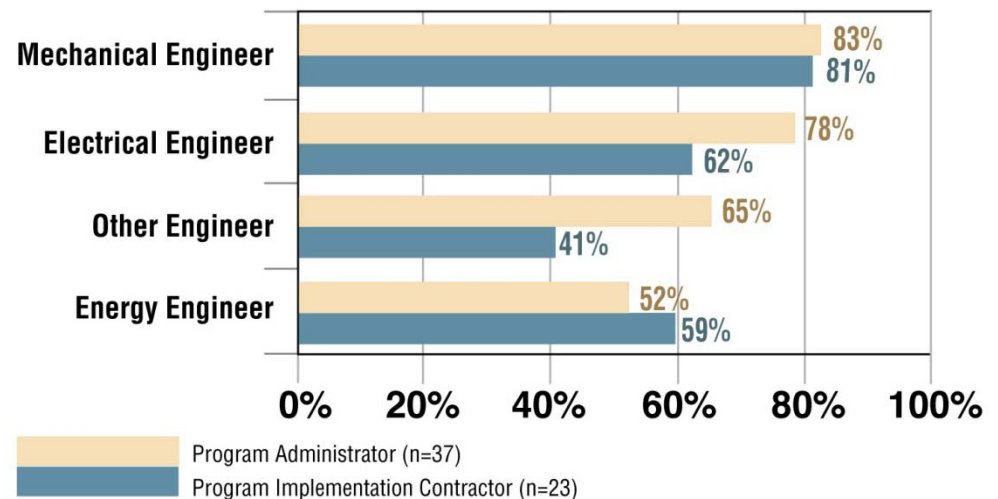
Difficulty in hiring for the 8 efficiency-specific occupations in California.

Enough Engineers?



The most likely source for new EESS engineers is to transition engineers from other fields into energy efficiency. But until energy engineering is recognized as an engineering discipline this may be difficult.

- Few engineers enter the field with EE experience
- The demand for engineers with knowledge of efficiency is currently met by hiring other types of engineers and training them on the job
- Many industries compete for engineering talent, and engineers often do not know the EESS field exists



Preferred Engineers for Program Administrators and Implementation Contractors

Enough Managers?



30% of survey respondents indicated that it is as difficult to find experienced EE managers as engineering talent.

- The primary limitation on implementation contractor firm growth (or expanded program offerings for some administrators) is the lack of management-level applicants with EE experience
- Experienced managers are vital mentors for the next generation of managers and staff



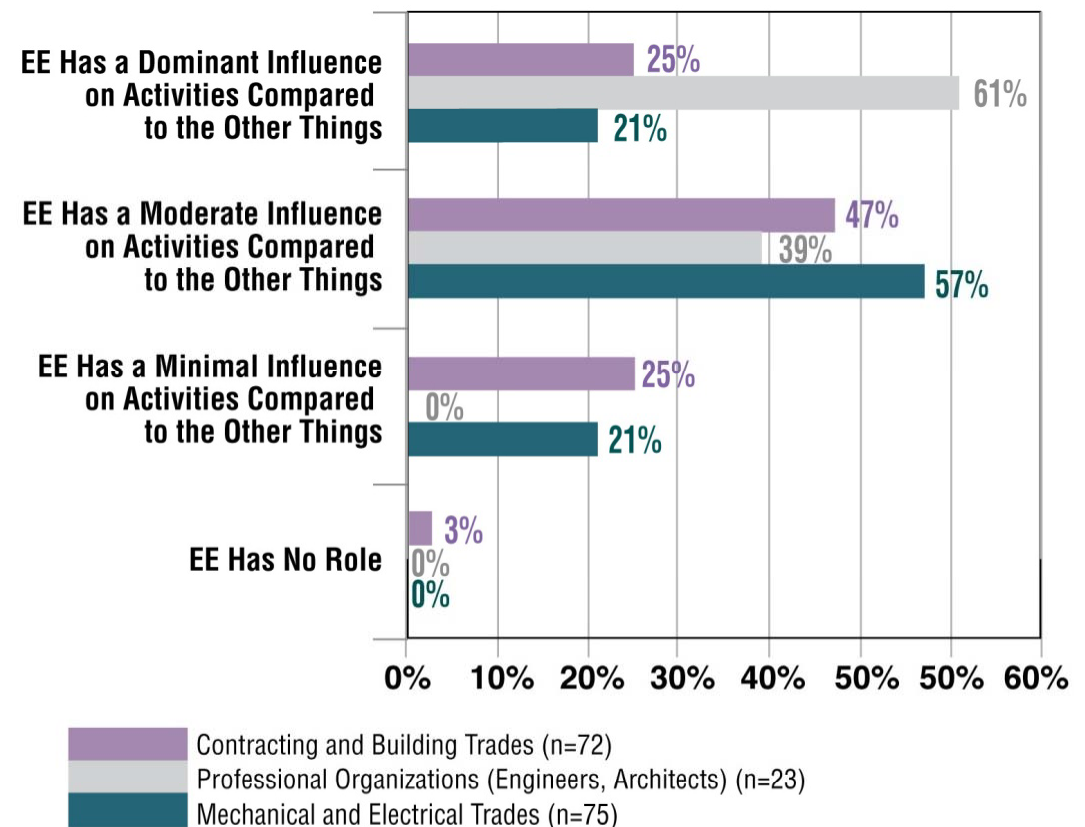
Ready for Growth?



Relatively low level of awareness in the building and construction industry about the potential for growth in the EESS

- Pgm. Administrators estimated that their staff will grow ~19% by 2010
- Implementation Contractors estimated that their staff will grow ~64% by 2010

→ In contrast, less than 50% of 160 respondents that represented building and construction industry associations and trades could even estimate the percent of the current workforce that was involved in EE



The influence of energy efficiency on the building industry.

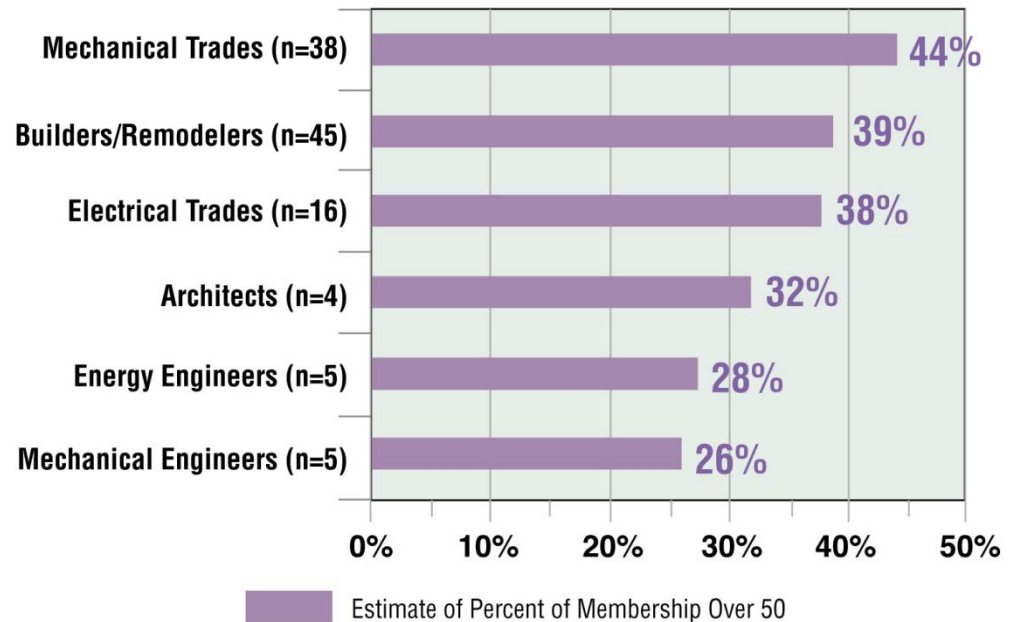
Aging Workforce?



Retirement is not currently a concern for program administrators or implementation contractors; however, the building and construction industry is facing substantial changes in the workforce due to retirements between 2015 and 2025

Percent of staff likely to retire in next 5 years:

- Program Administrators – Minor issue for some (~15%)
- Implementation Contractors & Program Support Contractors – Not an issue (~5%)
- ESCOs – Not an issue (~5%)
- Building and Construction Industry – **Growing concern (>35%)**



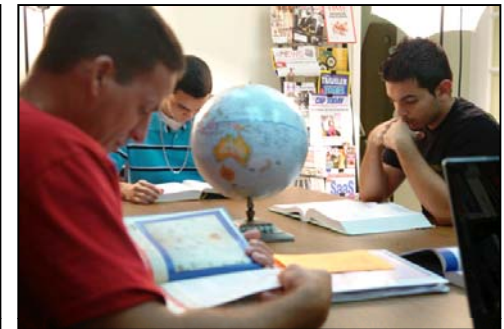
Building Industry Workforce Older than 50

Summary of Key Challenges



- Shortage of management-level applicants with experience in energy efficiency
- Shortage of experienced energy efficiency engineers
- **Building and construction industry:**
 - Limited awareness that the EESS is poised to expand significantly and their skills will be required
 - Retirement is a growing concern
 - Limited number of skilled trainers for EE





Current Workforce Training & Educational Requirements

Approach to Education & Training Research



- **Identified 492 education and training organizations**
 - Sources: USDOE, IEPEC, ASEE, academic institutions, Pgm. Administrators, EESS providers, government officials, library datasets
 - **Screened for programs focusing on EE**
 - Engineering, architecture, policy, building trades, technical training, interdisciplinary programs
 - **Interviewed 33 of final 43 programs identified**
 - Colleges/universities, professional associations, and community/technical colleges
 - **Interviewed ~190 representatives of trade and industry associations and labor unions in 11 states**
 - Building trades and contractors (n=163)
 - Design and engineering professionals (n=23)
-

Program Screening



- **Threshold for inclusion in study**
 - Educational organizations: certificate or degree program directly related to EE, or at least two EE-specific courses
 - Training programs: explicit EE courses or programs
- **Study Limitations**
 - EE may be included in courses which do not indicate EE as primary focus (e.g., resource management, sustainability)
 - Does not include programs under development (10 were identified)
- **Final group classified by occupational specialization**

Occupational Specialization	Number of Programs Identified Nationally	Programs Interviewed
Building Trades	11	10
Building Design and Analysis	22	16
Energy Efficiency Programs, Policies, and Evaluation	10	7
TOTAL	43	33

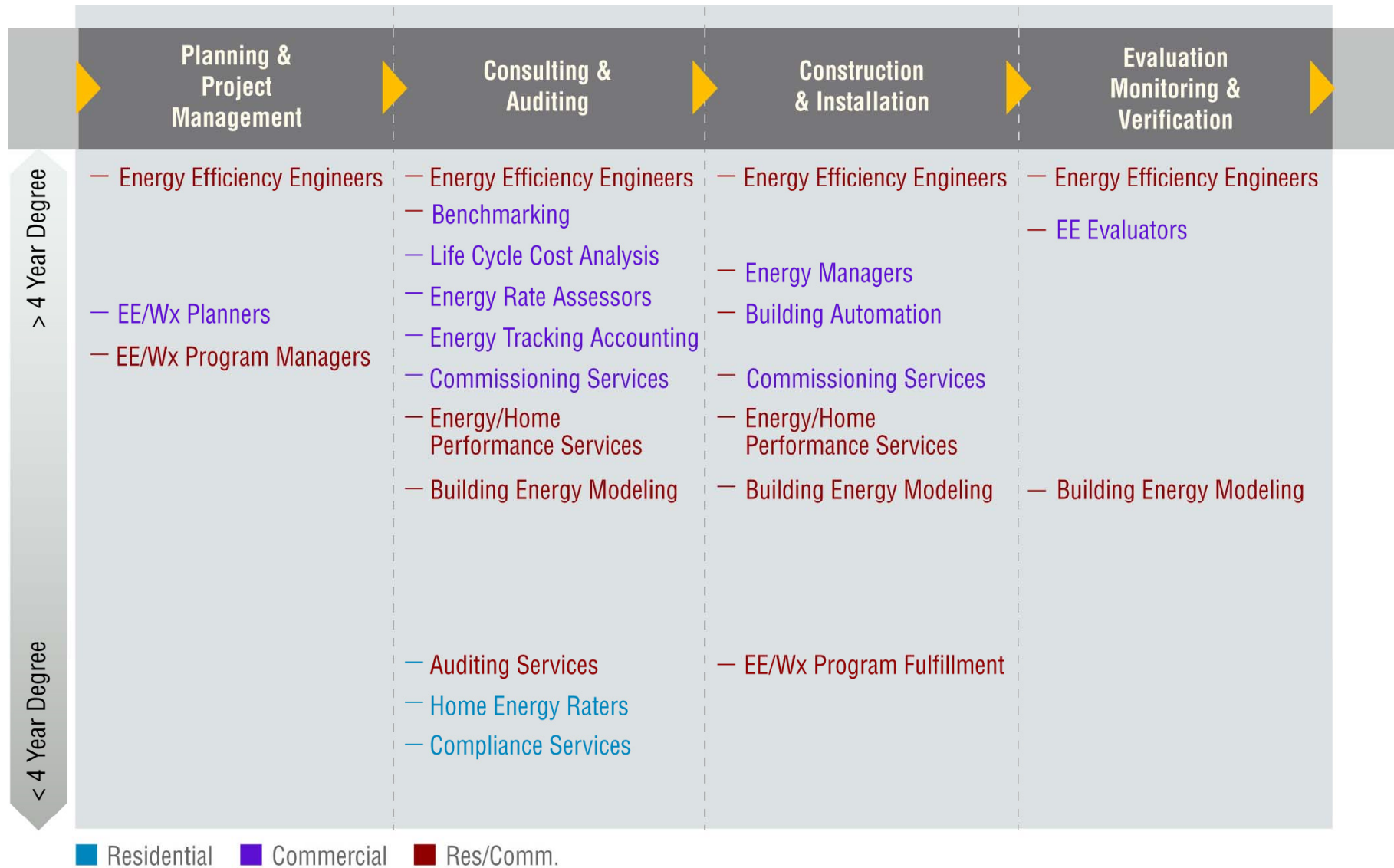
Education Requirements



- **Management and professional positions generally require a four-year college degree**
- **Many building and construction trades may require technical training but not necessarily a college degree**
 - They typically receive initial training in their field (e.g., electrician, HVAC contractor) through union apprenticeship training programs, technical schools, or community colleges
 - Most who work on energy efficiency projects are unlikely to have received specific energy efficiency training, although respondents from unions noted that advanced journeyman training sometimes includes EE



Education for Emerging Occupations



Retraining Opportunities

	Planning & Project Management	Consulting & Auditing	Construction & Installation	Evaluation Monitoring & Verification
Trade Associations, Unions, & Certification Programs	<ul style="list-style-type: none"> — Mechanical/Electrical/Consulting Engineers — Account Managers — Customer Service — Sales Engineers 	<ul style="list-style-type: none"> — Mechanical/Electrical/Consulting Engineers — Architects — Training — Marketing 	<ul style="list-style-type: none"> — Mechanical/Electrical/Consulting Engineers — Architects — Construction Management — General Contractors — Mechanical HVAC Contractors, Trades, & Distribution — Lighting Designers — Plumbing Contractors, Trades, & Distribution — Refrigeration Contractors, Trades, & Distribution — Building/Remodeling Contractors — Electrical/Lighting Contractors, Trades, & Distribution — Insulation Contractors & Trades — Window Contractors & Trades 	<ul style="list-style-type: none"> — Mechanical/Electrical/Consulting Engineers — Architects

■ Residential
 ■ Commercial
 ■ Res/Comm.

A Variety of EE Trainings are Emerging and Growing



- Residential Energy Services Network (RESNET)
- Weatherization Assistance Program (WAP)
- Association of Energy Engineers (AEE)
- Building Performance Institute (BPI)
- Association of Energy Services Professionals (AESP)
- Some community colleges
- Some four-year programs
- Union apprentice programs (though EE-specific curriculum appears limited)



Many EE Education & Training Programs Oversubscribed



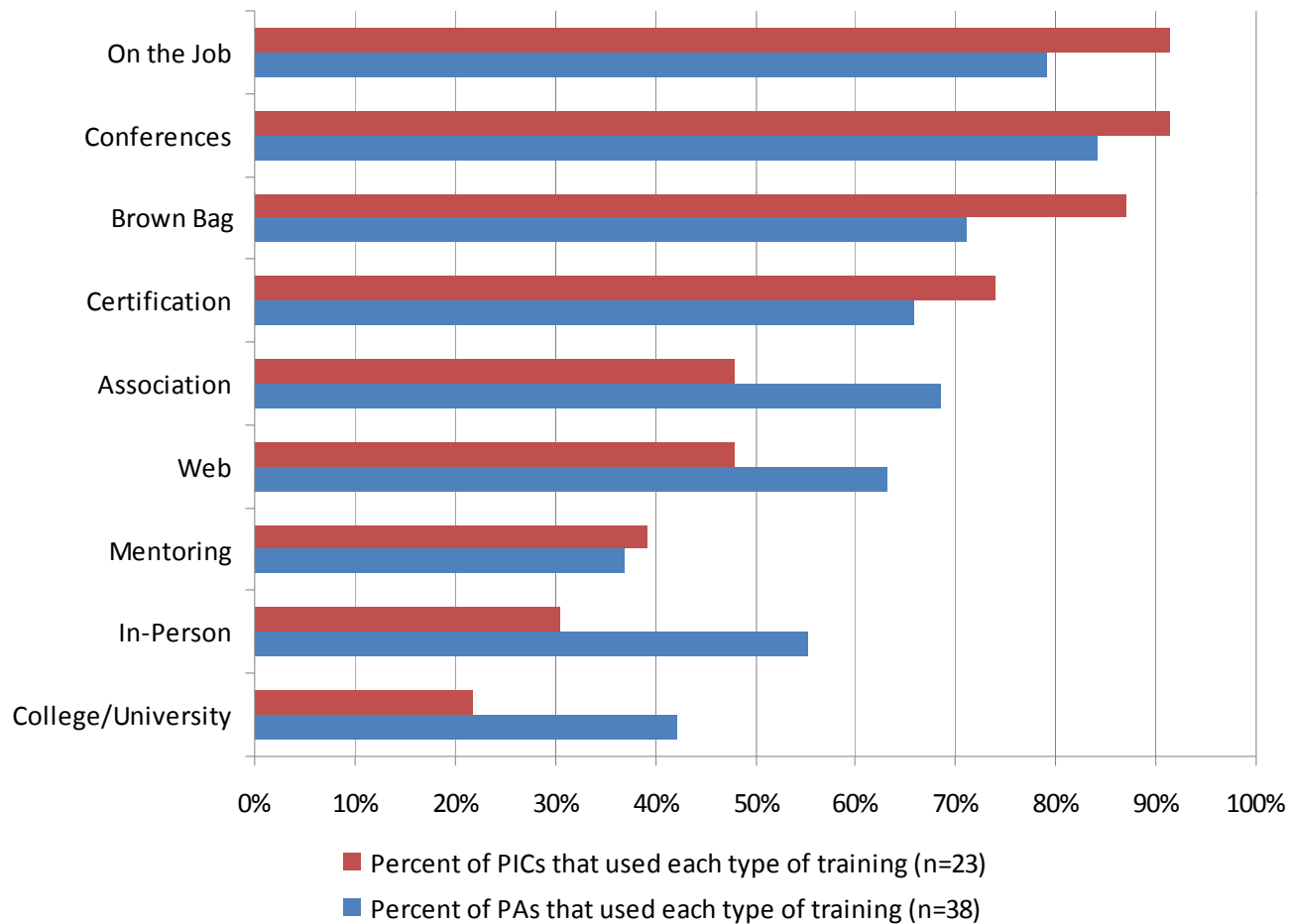
- **Universities:**
 - Respondents indicated that existing energy-efficiency-related programs are currently approaching capacity and universities typically take many years to develop new programs
 - **Community colleges**
 - Can more easily ramp up than universities, but many still have waiting lists for their programs
 - **Association of Energy Services Professionals (AESP)**
 - Enrollment in training programs projected to increase from ~350 in 2008 to between 1,000 and 2,000 in 2010
 - **BPI**
 - Certified ~300 people in 2005; certifications are expected to approach 12,000 by 2011-2012.
- Respondents expressed concern that rapid program expansion could lead to reduced quality of training



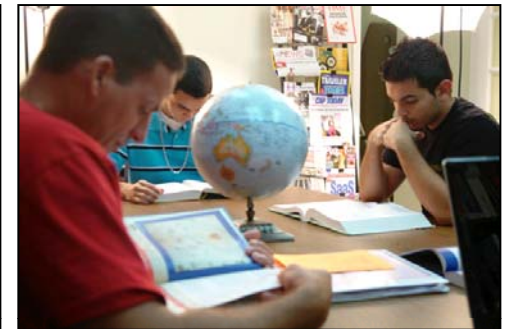
On the Job Training



EESS organizations and building contractors view on-the-job training as the most valuable training available to their staff.



Pgm. Administrators, Implementation Contractors, and ESCOs use a variety of ad hoc after-hire training resources because few candidates with specific training in energy efficiency are available



EESS Workforce Training & Education Recommendations

Target EE Training for the Trades



- **Building and construction trades constitute about 65-70% of the overall workforce in the EESS, and there is a notable lack of awareness that the EESS is poised for significant growth**
 - **Problem appears more severe in states that do not have long-running ratepayer-funded programs**
- It will be important, especially in states that are ramping up energy efficiency, to integrate building and industrial process system efficiency into existing curricula



Increase Short-Duration, Applied Trainings to Augment On-the-Job Training



- Much of the growth in the EESS will come from new entrants who already have some applicable skills (e.g. contractors who become efficiency retrofit specialists)
 - Strong demand for up-to-date training for those who are currently employed in the EESS but who need to update or augment their skills
 - Mid- and senior-level engineers and managers also need more access to conferences and training, such as those offered by the AESP and the Certified Energy Manager certificate program offered by the AEE
- Short-duration courses on specific, applied EE-related topics will be more relevant than a 2 or 4-year degree program for BOTH professionals and tradespeople
-

Prepare the Next Generation of EESS Professionals



- Few colleges offer EE-specific curriculum, and those that do say funding to grow these programs is extremely limited
 - Funding is needed to support new and expanded EE-related programs
 - Industrial Assessment Centers have been a successful model to provide EE services to industry and a training ground for engineering students
- **RECOMMENDATION:** Develop centers in conjunction with college-based engineering, architecture, planning, and policy-focused programs
- Building science centers for architecture and engineering students
 - Policy centers that emphasize education needed for EE program design and project implementation



Increase Funding to “Train the Trainers”



- **There is likely to be a lack of qualified trainers to train the workforce needed to support the projected EESS growth**
 - WAP network estimates they will need 700 additional trainers by summer 2010 to meet their goals
 - Many community colleges rely on a small group of key instructors to teach courses, and many are nearing retirement age
 - BPI experienced 5-fold increase in number of certifications between 2005 and 2008, and believe the number will almost triple between 2008 and 2009
 - **These growth rates strain the capacity of existing trainers**
- Additional resources must be directed towards training the next generation of EESS trainers
-

Coordinate Training Efforts



→ Coordinate and track training efforts within states; share best practices across states

- With ARRA funding, many states are initiating and/or ramping up a range of training activities that target the EESS
- Still challenging to identify those programs that will provide specific EESS education; This information needs to be tracked in a systematic way
- Establishing broad statewide education/training efforts (e.g., NYSERDA's collaboration with Hudson Valley Community College) may be helpful to avoid duplication of efforts



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