California Energy Commission
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Questions assigned for comments:

29. Given the diversity of nonresidential businesses and buildings, which energy saving strategies, tools and implementation approaches can be applied across the diversity? What are the conditions that will necessitate unique program elements to improve the efficiency of specific sectors of the nonresidential building market?

Here are some aspects, considerations, comments, and recommendations addressing question number 29:

1.) Non-Residential Building Categorization – The categorization of "nonresidential businesses and buildings" is a complex aggregate of facilities which includes a greatly diverse population of existing and planned facilities, utilization purposes, and geographic distribution throughout California.

2.) Organizing Diversity – Effectively addressing this diversity from an Energy Efficiency (EE) perspective has required the sub-categorization of these buildings into "energy market sectors" (such as 'Large Commercial', 'Commercial Retail', and 'Industrial') and establishing categories of EE 'measures' for the purposes of:

- Maximizing energy savings, cost savings, and EE funding resources
- Targeting energy savings by measure type (HVAC, Refrigeration, Motors, Lighting, Building Envelopes, etc.)
- Incenting EE program participation by ratepayers and building owners

3.) Addressing Variables for Non-Residential Buildings – From an EE program and cost savings design perspective, the diversity of nonresidential buildings represents fundamental variables that must be considered and managed in terms of cost effective EE program design and implementation. Examples of these variables are:

- Categories of building types, purposes, and energy consumption rates
- Energy Consumption Targets (rate and density of energy use by building type & purpose)
- Geographic Dispersion (location and correlation to similar facilities)
- Building Status (age, existing conditions)
- Compliance with existing codes and standards
- Status of existing EE opportunities within each facility (measures and improvements)
- Hours of operation
- Financial capability of building owners to participate in EE programs (often an issue of 'cash flow', simple and long term ROI)
- Financing availability - EE program specific, Utility specific, and commercial sources

4.) Commonalities of EE Programs Spanning Non-Residential Diversity – While Non-Residential building EE programs are often quite different in design, implementation and their approach to ratepayers across the various subcategories of nonresidential buildings, there are clearly some strategies, tactical approaches, tools and methods that can be effectively applied by EE programs across this diversity:

- Data Collection, Utilization, & Targeting – Determining where EE opportunities exist and the current potential for EE savings should be the basis for EE strategy and program design. While aggregate industry specific energy utilization estimates for business and building types are often used, iteratively conducting EE surveys and assessments of the status of individual buildings by subcategories are needed to most effectively determine, prioritize, and target opportunities for EE programs (EE Opportunity Databases). In addition to traditional telephone, paper based, and online information survey techniques, relatively inexpensive hand held technology and application software can be used onsite by personnel trained to conduct initial "surveys" of buildings for EE opportunities, upload the data to remote EE opportunity databases, and then be accessed and 'mined' by a variety of EE programs.

- Coordinated EE Program Availability Awareness – Participation in EE programs by ratepayers and building owners begins with awareness of program availability and associated benefits. Individual EE programs should provide (i) program specific, (ii) 'related', and (iii) general EE program availability and contact information to prospective rate payer program participants. Whenever possible, EE program information should be presented to ratepayers in a coordinated manner, emphasizing programs and options that are available and appropriate for all types of Non-Residential buildings. Without regard to their specific focus, all EE programs engaging rate payers and building owners should provide at least basic information regarding the need for, and expected benefits from, the following EE programs (as may be available and applicable across Non-Residential Buildings):

  - HVAC Tune-ups and Maintenance – Virtually all Non-Residential buildings have HVAC systems of some type. The vast majority of these systems will be in need of some form of maintenance, repair, or replacement that directly (negatively) affects the energy efficiency and operating costs of the building. There is a well established need for HVAC maintenance, tune-ups and commissioning across all categories of Non-Residential buildings.

  - Control Systems (EMS, EIS, BMS, etc.) – Virtually all Non-Residential buildings can benefit from some type of Energy Management System, Energy Information System, or Building Management System. The vast majority of Non-Residential buildings can benefit significantly from some form of controls for EE savings, cost reduction, and building 'occupant comfort' purposes.

  - Lighting – Although lighting has been addressed for many years for a large percentage of Non-Residential buildings, many buildings have either not been updated or would benefit significantly from the adoption of more recent and advanced EE lighting technology. Since lighting is the single largest component of Non-Residential building electrical consumption (approximately 29%), lighting should remain a high priority for EE program information distribution. Virtually all Non-Residential buildings can benefit from a continuum of EE lighting changes.

  - Commissioning – All EE programs can contribute to creating awareness for the rate payer of the need for, and the financial benefits of, a coordinated whole building approach to energy efficiency by making sure that all systems work as designed and in coordination/cooperation with each other. While rate payers and building owners may not be ready to engage in a full Commissioning, Retro-Commissioning, or Re-Commissioning approach to EE, progress can often be made toward creating awareness of integrated EE program approaches.

- Increasing EE Financing Availability Awareness – One of the most common issues facing small nonresidential building owners and rate payers is the lack of operating capital (often expressed as 'cash flow') to invest in energy efficiency. Individual EE programs should provide prospective rate payer program participants with information from Utilities and other potential EE Program financing sources that may be available. Whenever possible, use of EE financing should be encouraged (if available) to rate payers as part of EE program design.
- EE Savings Behavior & Social Media – The subject of encouraging, incenting, and maintaining energy saving behavioral changes has been studied and tested by a variety sources. While the results from such approaches to changing energy savings behavior are varied in terms of their methods and effectiveness, it is clear that such behavior changes are dependent to some degree upon various types of 'feedback' received by the ratepayers (whether financial or 'peer' oriented). Certain types of 'feedback' are well suited to reinforcement, personal interaction with, and 'peer group' comparison by ratepayers through social media (such as "Facebook" and "Twitter" and "LinkedIn"). EE program design can make better use of Social Media as an aspect of encouraging and reinforcing energy saving behavioral changes.

5.) Conditions necessitating unique EE program elements – While there are many commonalities across all sectors of Non-Residential buildings, there are also aspects of specific types of Non-Residential buildings that require unique EE program solutions. These unique EE program attributes are often directly connected to the purposes for which the Non-Residential buildings are focused, but can also be caused by external factors. Examples of these uniquely purposed EE program requirements are as follows:

- Industrial – Relative to all sectors of Non-Residential buildings, the Industrial sector has many unique energy uses that require unique EE program solutions. Often these requirements are more a matter of scale than specific to any truly unique purposes. A simple example of unique EE program requirements are compressed air systems, often described as the "fourth utility", wherein more than 90% of Industrial facilities use and maintain large scale compressed systems that are required to operate their industrial processes. These compressed air systems consume a large percentage of all industrial electrical power and are extraordinarily inefficient and prone to direct energy losses (leaks, misuse, and mismanagement). The primary EE program solutions depend on control systems, similar in some ways to refrigeration and other EMS approaches, but also require extensive understanding and management of expansive and complex compressed air subsystems. Each compressed air system deployed in an Industrial facility is unique, and all EE program solutions must be adapted accordingly. Other large scale topical Industrial examples include refrigeration systems, pumps, and motors, electrical welding and smelting of ores. The primary 'drivers' for adoption of EE measures within the Industrial sector are decreased operating costs, decreased maintenance costs, increased reliability of operations ('up-time'), and reduced process and material waste ('spoilage'), and ROI duration.

- Large Commercial – To a lesser extent, there are also differences within Large Commercial buildings that require unique EE program solutions. These requirements are most often present in Large Commercial Buildings. An example of which is a Data Center, wherein there is an unusually high density of energy consumption per square foot of building space, and a correspondingly unique HVAC and building envelope need to efficiently address and manage heat generated within the building and the external climate conditions in which the building is located. Large Commercial buildings in general are actually unique 'ecosystems' that require individually engineered 'Commissioning' based whole building solutions in order achieve EE goals. The component parts of these EE program solutions may not be unique, but their application requires the conceptual program approach of 'mass customization' in order to address each buildings EE requirements.
- Changes to Codes and Standards – As California continues to strengthen and improve its EE related codes, standards, and other EE related requirements, there is an increasing need to reach deeper savings within Non-Residential buildings. Depending upon the category of Non-Residential building, compliance to the new codes and standards will likely require the engineering, development, and implementation of unique EE technology, integrated processes, and solutions. Industrial and Large Commercial buildings are likely to have the most need for unique EE program solutions in order to comply with new codes and standards.

30. What workforce development is needed to meet the efficiency goals in nonresidential buildings? How can workforce development be better integrated with the delivery of energy efficiency upgrades?

Here are some aspects, considerations, comments, and recommendations addressing question number 30:

1.) Workforce Development Factors For Meeting EE Goals – The need to continue the development of a workforce capable and sufficient in size to meet current and future EE goals, Codes and Standards for California is apparent across all facets of the energy industry:

- Changing Composition of the Workforce – In all sectors of the energy industry (such as Utilities, Contractors, ESCOs, Government Agencies, and other EE companies), there are many knowledgeable and experienced people that will be retiring or otherwise leaving the industry within the next several years. The need to 'back fill' these experienced professionals with people who are new to the industry is exacerbated by California's increasing population, the associated increased demand for energy by this growing population, and the time it takes to transition the knowledge that these industry professionals posses to their colleagues. These changes in the workforce will require coordinated and ongoing recruitment and training of the people who will fulfill the California's EE goals.

- Increasing Energy Demand – In addition to the expected population growth in California, there is also an increasing demand for energy consumption on an individual (per capita) basis. While there are various causes for this expected increase in per capita energy consumption (ranging from increased personal energy use and dependency upon technology, to the HVAC and building occupancy energy demands related to the effects of climate changes), these changes will result in the need to continually train, prepare, and expand the EE industry workforce in order to meet the demands of changing methods, technology, and the scale of EE programs.

- Changing Codes & Standards – As California continues to strengthen and improve its EE related codes, standards, and other EE requirements, there will be an increasing need to train, accredit, certify, develop, expand and develop the EE industry workforce deployed throughout the state. Much of this workforce development will be centered upon the large number of contractors who collectively perform much of the EE retrofits and other work required by EE programs.

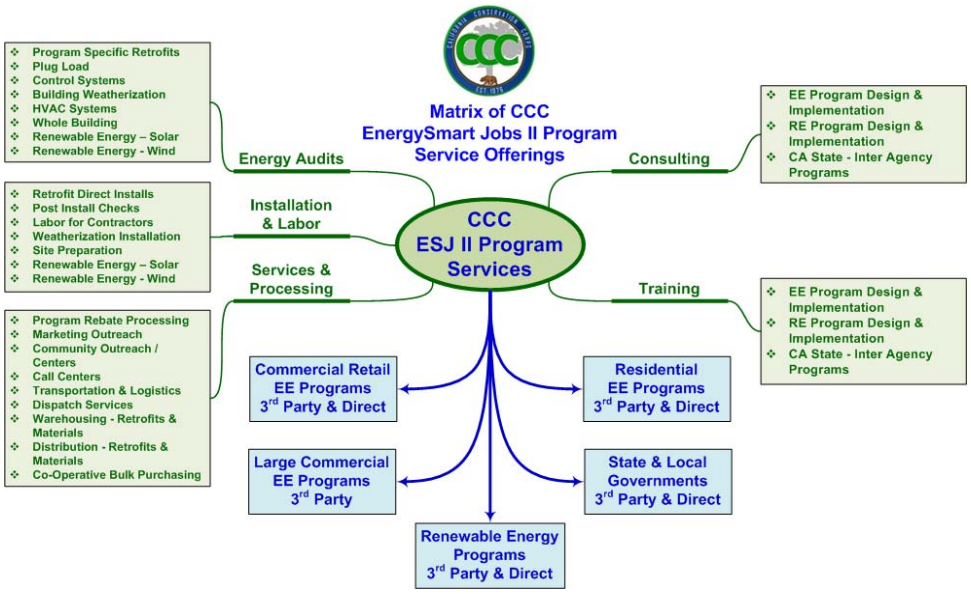
- Technology & Iterative Change – Changes to EE due to the evolution and advancement of technology will also require workforce development. Advances in technology can (and do) create compelling economic and energy efficiency related reasons to revisit (upgrade and replace) previously installed EE technology and measures in order to achieve deeper energy and cost savings goals. As technology continues to 'advance', it can be expected that this iterative upgrade process, including its dependency upon ongoing workforce development, will continue.

2.) Workforce Development Integration and Delivery of EE Upgrades – There are a number proven approaches and opportunities for improving the integration of Workforce Development in regards to the delivery of EE upgrades that should be considered:

- EE Program Complexity Effects Roles and Responsibilities – The pursuit of ever more efficient buildings often results in increased complexity and costs of EE measures, assessments, evaluations, audits, solutions, commissioning and maintenance requirements. While this complexity of approach to buildings in regards to EE programs can be offset in part by advances in technology (such as control systems and EMS automation) used in the implementation of the EE measures, it can also greatly increase the aggregate range and depth of training, qualifications, certifications, and other requirements of the individual professionals engaged in the EE Programs. This often manifests itself in a 'broadening' or 'deepening' of the range of tasks and responsibilities performed by any single EE program employee (often without regard to the actual requirements of the individual task within an EE program. This can result in increased EE program direct and overhead costs, which negatively affect the overall inefficiency of EE programs (measured as the cost of each kWh saved).

- Workforce Stratification for Economic Efficiency – Using 'overqualified' employees for a significant percentage of tasks that do not actually require their level of qualifications (and associated costs) is both inefficient and a 'lost opportunity' from a Workforce Development perspective. The composition of the work tasks proposed and performed within an EE program, and the associated cost of the professionals who actually perform this work, are often not sufficiently 'stratified' to allow for more efficient costs, billing rates, and position structures. An example of this would be having a highly paid EE engineer spending a significant percentage of their billable time on an EE program performing tasks suitable for performance by much less professionally skilled, experienced, or costly employees. It is also an example of the need to develop and deploy an intentionally 'stratified' EE industry workforce that will allow EE programs to be more cost effective, EE funding dollars to accomplish more, and provide entry level positions as part of an integrated EE Workforce Development program.

- EE Programs Can Integrate Workforce Development and Energy Savings – The CEC recently concluded a large scale statewide ARRA funded integrated EE Workforce Development Pilot Program called "EnergySmart Jobs" (ESJ Program). The very successful ESJ Program consisted of extensive partnerships established between EE Companies, Utilities, Contractors, Manufacturers, Community Colleges, and the California Conservation Corps (CCC) located throughout California. Designed, implemented and administered by PECI as part of "Energy Upgrade California", during a period of 20 months the CEC's ESJ Program created more than 260 jobs, employed more than 110 CCC and Local Corpsmembers, and saved 62 Million kWh and $5.2 million per year (on a sustainable basis). The ESJ Program also performed 6,200 energy surveys in hard to reach commercial retail stores distributed throughout the state, retrofitted 5,200 stores, and created direct and indirect economic stimulus for "Commercial Retail" electrical rate payers, building owners, and Contractors in California.

- Stratification of Jobs & Costs in an EE Workforce Development Program – The ESJ Program is an excellent example of the positive effect of properly stratifying tasks, positions, responsibilities, and costs in order to create a effective integration of Workforce Development and EE program goals. The ESJ Program was designed to employ, train and deploy more than 100 CCC and LACC Corpsmembers (women and men between 18 and 25, and veterans) throughout California as the central workforce of the ESJ Program. Assisted by a hand held energy survey software application, the CCC Corpsmembers were trained and deployed to conduct "energy opportunity surveys", and perform direct installs and post install checks on a highly cost effective basis. The ESJ Program multi lingual Corpsmembers also provided personal delivery of a variety of EE program information to participating ESJ Program store owners and rate payers. The energy surveys were reviewed, confirmed and processed by experienced and highly qualified EE Program staff and management. The result of this stratification of ESJ Program tasks and associated costs was an efficient and highly cost effective integrated EE and Workforce Development Program.

- Current Integrated EE Workforce Development Program – The CCC has now established a new Energy Efficiency and Workforce Development program that is initially entitled "EnergySmart Jobs II" (ESJ II Program). ESJ II offers a much more extensive range of Energy Efficiency, Renewable Energy, and Consultation Services to companies, utilities, and California state and local government agencies on a sub-contractible basis. The CCC provides Corpsmembers as trained and highly cost effective direct labor resources, CCC staff members as project and program management, and has an established statewide infrastructure and logistical support network of CCC resources for energy efficiency and renewable energy projects and programs. The CCC also provides energy efficiency and renewable energy project and program design and implementation consultative services. In partnership with an existing network of thirteen (13) local California Corps, the CCC can provide extensive, capable, trained, well managed, cost effective, and 'high availability' energy efficiency and renewable energy project and program resources throughout California. ESJ II Program services offered are illustrated below: