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UC Berkeley Don Vial Center on Employment in the Green Economy Comments on Chapter 3 of Californiaâ€™s Existing Buildings Energy Efficiency Action Plan

Additional submitted attachment is included below.

Don Vial Center on Employment in the Green Economy
April 21, 2015
California Energy Commission
Docket# 15-IEPR-05

Subject: UC Berkeley Don Vial Center on Employment in the Green Economy Comments on Chapter 3 of *California's Existing Buildings Energy Efficiency Action Plan*

Chapter 3 outlines efforts required to bolster the voluntary market for energy efficiency by building a strong and innovative industry. While a variety of approaches are outlined to achieve this goal, including providing support to contractors and other solution providers, providing building professionals tools and incentives to expand their offerings, updating and following best practices in workforce training, and increasing zero net energy retrofits, there remains a gap. Building a high performing industry requires attracting high performing contractors, and the most effective way to attract high performing contractors is to establish and enforce workforce standards. Workforce standards for energy efficiency need a place in the Action Plan. The following comments were adapted from our report Workforce Issues and Energy Efficiency Programs: A Plan for California's Utilities

Workforce Standards Build a High Performing Industry

The energy efficiency industry is a competitive market, and much of energy efficiency work sits in the construction industry, a highly competitive and volatile sector. To achieve California's energy efficiency goals, market actors should be competing based on the quality of their work and its impact on energy savings. By failing to establish a high road market, California has inadvertently established a market where low cost is the primary way in which firms compete.

While there is a variety of ways to shift the competitive environment toward higher performance, including many outlined in the Draft Action Plan (i.e. quality assurance, performance contracts, data transparency, etc.), workforce standards are critical because without them, you lose the most qualified firms. Workforce standards create an environment that encourages participation by high performing contractors and trades workers. This participation of highly qualified contractors is critical to the development of a high performing industry.

Maintaining high standards is particularly challenging in the construction sector, where most of the energy efficiency retrofit jobs are found. Developing and sustaining a qualified workforce is difficult in such a cyclical industry, which is why policies and institutions to maintain workforce standards, such as prevailing wages and state-approved apprenticeship have developed in the higher quality segments of the industry.

As recognized in Chapter 3 of the Draft Action Plan, development of skill standards and certifications specific to energy efficiency is a work in progress. Given the range of technologies currently offered and the ever-changing technological environment, it is very difficult to establish and maintain, not to

mention enforce, appropriate specific worker skill standards for every EE technology, measure and sector. When there is widespread industry agreement for particular skill standards,[1] they are effective ways for establishing a bar for participating technicians and contractors.

In the absence of agreed upon skill standards, there are other options. These include responsible contractor policies, contractor pre-selection, and more general skill requirements like educational degrees or apprenticeship journey cards. Even compensation standards, which govern wages and benefits, are an effective way to improve performance because firms with more skilled and productive workers can offset higher wage and benefit costs, and thus gain a competitive edge over lower performing businesses. In short there is a range of options—all of them good for the purpose of developing a high performing industry.

There is no evidence that costs of standards outweigh benefits

Any strategy to promote proper installation and maintenance has costs and benefits. There is concern that adopting workforce standards will be too costly. This concern has been addressed by encouraging further study to better understanding the costs and benefits of workforce standards. Such understanding remains elusive. There are not enough examples on the use of workforce standards in the energy efficiency sector to evaluate, measure, and verify their impacts. Moreover, we have not found robust research methodologies that can model the impacts or evaluate standards in the abstract, before they are applied in the field and can be assessed under real world market conditions. In short, we can't understand the costs and benefits without first adopting standards and then evaluating their impacts.

There is ample research on the impacts of workforce standards in public works construction and on best value contracting across a wide range of construction project types that serve as a proxy for the impacts in the energy efficiency arena. California state and federal law requires several types of standards (skill and job standards, prevailing wage standards, and contractor prequalification) for work funded by government dollars for public works construction. Given the particularly stringent labor standards required in public works, this research provides an outer bound on the impacts on participation rates and costs.

COSTS

Significant research has investigated the impacts of public works standards on construction costs. This includes studies on the impact of project labor agreements[2,3] (which include apprenticeship standards, contractor pre-qualification standards and prevailing wages) and studies on the impact of prevailing wages by themselves[4]. These studies compare the costs of construction with and without standards, using large data sets of construction projects and controlling for other factors that affect costs. The vast

[1] For example CALCTP for advanced lighting controls or DOE Task Analysis for different energy efficiency jobs.
[2] Belman, Dale, Russell Ormiston, Richard Kelso, William Schriver, and Kenneth A. Frank (January 2010). *Project Labor Agreements' Effect on School Construction Costs in Massachusetts.* Industrial Relations Vol. 49, No. 1.
[3] Kotler, Fred B. (March 2009). *Project Labor Agreements in New York State: In the Public Interest.* Cornell University School of Industrial and Labor Relations.

majority of the studies find no statistically significant difference in the costs between projects with and without standards.

The Economic Policy Institute (EPI) completed a comprehensive literature review on the costs of prevailing wage in 2008,[5] and found no evidence of increased costs. The EPI study suggested a number of reasons why a compensation standard like prevailing wage does not result in higher costs. These reasons include:

- Labor costs are not the dominant costs in government construction contracts. Even including benefits and payroll taxes, labor costs are roughly 20 to 30 percent of construction contracts, according to the Census of Construction.[6] For example, if labor costs are 25 percent of total costs and prevailing wage rules raise wages by 10 percent, the impact on contract costs would be no more than 2.5 percent. Thus, even if there is an increase in contract costs, it is likely to be small.
- Higher wage costs might be offset through "factor substitution," i.e., the substitution of more expensive labor with, say, less-expensive materials, which shows that worker wages are only one of the avenues contractors can use to win project bids.
- Higher wages might be offset by a rise in productivity. Prevailing wages can attract better-skilled, more productive workers, or firms may rely on higher managerial productivity or invest in labor-saving technologies to offset higher labor costs[7].

Arizona State University's Performance Based Information Research Group has tracked hundreds of projects across 41 industries that employ best value contracting, and finds consistent cost savings and added value over traditional delivery models.[8]

PARTICIPATION RATES

Similarly, studies show no adverse effects of prevailing wage requirements on contractor participation rates. A recent study compared public works projects in five San Francisco Bay Area cities with and without prevailing wage laws.[9] The data show that the presence of prevailing wage regulations does not decrease the number of bidders nor alter the bidding behavior of contractors. Furthermore, the presence of prevailing wage regulations did not discourage the participation of non-union contractors nor reduce their chances of winning work in a heavily unionized area during a busy time period.

EVIDENCE ON THE IMPACT OF STANDARDS USED IN ENERGY EFFICIENCY PROGRAMS

[5] Mahalia, N (2008). *Prevailing Wages and Government Contracting Costs: A review of the research*. EPI Briefing Paper #215. http://www.epi.org/publication/bp215/

[6] Philips, P (1998). Kansas and Prevailing Wage legislation. Report prepared for the Kansas Senate Labor Relations Committee. Note that the total cost of construction contracts in this calculation excludes land acquisition, architectural design, or management fees.

[7] Philips, P. (1996). Square Foot Construction Costs for Newly Constructed State and Local Schools, Offices, and Warehouses in Nine Southwestern and Intermountain States: 1992-1994. Prepared for the Legislative Education Study Committee of the New Mexico State Legislature.

[8] Kashiwagi, D (2011) *Case Study: Best Value Procurement/Performance Information Procurement System Development*. Journal for the Advancement of Performance Information and Value VOL. 3 NO. 1. http://pbsrg.com/app/wp-content/uploads/2011/07/Journal-for-the-Advancement-of-Performance-Information-and-Value-V3I1.pdf

[9] Jaewhan Kim, Chang Kuo-Liang, and Peter Philips (2012). *The Effect of Prevailing Wage Regulations on Contractor Bid Participation and Behavior: A Comparison of Palo Alto, California with Four Nearby Prevailing Wage Municipalities.* Industrial Relations, Vol. 51, No. 4 (Oct 2012). © 2012 Regents of the University of California

In the absence of more studies on the costs and benefits of labor market standards focused specifically on energy efficiency work, the studies cited in the last section provide good indicators on the likely impacts. The empirical research on the costs and benefits of labor market standards in energy efficiency covers only a few of the many possible standards. Examples of research are outlined below.

In the HVAC sector, recognizing existing work quality problems, a CEC working group recommended increasing the fraction of technicians trained and certified from 10 percent (in 2008) to 100 percent by 2020.[10] A preliminary NATE study shows that systems installed by certified technicians achieve 10 percent better field-adjusted energy efficiency compared to uncertified technicians.[11]

Since standards are intended to lead to work done right the first time, standards can also reduce the cost of maintenance to the service provider. According to one study, projects performed by a NATE-certified HVAC contractor generate 12.9 percent fewer callbacks than projects performed by an uncertified contractor.[12] Direct costs of a callback include dispatching a service vehicle, paying a technician, and purchasing materials. Indirect costs include the opportunity cost of missing out on a new job that would generate revenue and the damage done to a contractor's reputation for poor quality work.

When maintenance is necessary, worker certification helps to ensure high quality work. A covert field study of 13 technicians performing maintenance duties observed that certified technicians performed more maintenance and service tasks than uncertified technicians, and executed them correctly more often.[13] In some cases, standards such as skill certification requirements can generate cost savings for employers and consumers. For example, the NATE study referenced above found that NATE-certified HVAC contractors cost 6.8 percent less than projects performed by an uncertified contractor due to higher billing efficiency by certified contractors.[14]

Another example of a positive benefit-cost ratio for standards is presented in the case of the CALCTP training and certification program for advanced lighting controls in commercial buildings. Evidence from six pilot studies indicates customer cost savings in the range of 10 to 30 percent for the installation of advanced lighting controls by a CALCTP-certified contractor versus a non-certified contractor .[15] Lower costs are attributed to CALCTP training, which enables more accurate bids, faster installation, and higher initial system performance as a result of greater familiarity and expertise with advanced lighting

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[10] Messenger, M. (2008). *Strategic Plan to Reduce the Energy Impact of Air Conditioners*. California Energy Commission Staff Report. CEC-400-2008-010. p. 8

[11] Messenger, M. (2008). *Strategic Plan to Reduce the Energy Impact of Air Conditioners*. California Energy Commission Staff Report. CEC-400-2008-010. p. 19

[12] Michel, M. (2006). *NATE Impact Study*. Service Roundtable. Prepared for NATE. p. 8.

[13] *Contractor & Technician Behavior Study*, EMI, 9/14/12, p. 62, re: contractor and technician knowledge and use of ASHRAE/ACCA 180, ACCA 4 and 5 standards

[14] Michel, M. (2006). *NATE Impact Study*. Service Roundtable. Prepared for NATE. p. 9.

[15] Office of the Future Landmark Square Pilot Results (Design and Engineering Services, SCE, October 2010; Office of the Future 25% Solution Assessment (Emerging Technology Solutions, December 2010) ; Advanced Office Lighting Systems (Energy Research and Development, SMUD); High Efficiency Office, Low Ambient/Task Lighting Pilot Project (Large Office) Heschong Mahone Group; Low Ambient/Task Lighting Pilot Project (Small Office) Emerging Technologies Associates; Advanced Lighting Controls System Assessment (Emerging Technology Associates)

controls[16,17] The IOUs in Program Implementation Plans filed in July 2012, wrote "because CALCTP training translates into high performance operation and maintenance, operational data on CALCTP installed systems, to date, indicates an extremely low rate of installation difficulties, callbacks, re-works, changes, etc."[18]

Another example, in the IOU realm, is the Sierra Nevada Energy Watch (SNEW) program run by the Sierra Business Council and serving 14 counties of the Sierra Nevada region. SNEW is the only IOU program that we found that has a requirement that participating contractors pay a specific wage standard. In nine counties, SNEW hires staff and local contractors to implement a direct install program for small businesses, local governments, special districts, and non-profits.[19] The program requires contractors to pay all employees a living wage of at least $35.00 per hour for licensed electricians and at least $17.00 per hour for apprentices for time spent on SNEW work.[20] "The wage standard helped increase program effectiveness because it attracted solid, reliable contractors that delivered timely installations, fewer glitches, happier customers, and better partnerships in the community. Ensuring that customers first experiences with energy efficient services were positive was important to the long-term success of the program and the larger goal of market transformation", said former Director of Program Development Betony Jones.[21,22]

While it is not possible to isolate the impact of this wage standard apart from overall program design, on energy savings or cost effectiveness, the SNEW program has been successful and one of the most cost-effective and comprehensive of the local government partnerships operating in the PG&E service area. According to Steve Frisch, Executive Director of the Sierra Business Council, the program's biggest metric of success was expansion from five to nine counties.[23]

The Seattle 2030 District-Community Power Works program incorporates standards through a partnership with Emerald Cities, an organization that establishes workforce standards and reporting requirements through Community Workforce Agreements developed with each grant recipient. Contractors and subcontractors must compensate workers at the Davis Bacon commercial prevailing wage rate for projects funded through the American Recovery and Reinvestment Act (ARRA). City and state business license requirements apply, along with insurance requirements. Contractors must also provide meaningful subcontracting opportunities for minority- and women-owned firms.[24]

In Seattle, standards did not increase the cost of the first project completed with a Community Workforce Agreement (CWA). The project exceeded the 15 percent goal for apprenticeship utilization,

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[16] Brookfield Properties, SCE Engineering Services for Case Study

[17] Southern California Edison, 2013-2014 Energy Efficiency Plans, July 2012, p.343 and PG&E Reply Comments 9/21/12, Attachment B.

[18] Southern California Edison, 2013-2014 Energy Efficiency Plans, July 2012, p.344.

[19] See case study: *Local Government Energy Efficiency Best Practices* http://www.lgc.org/freepub/docs/energy/case_studies/SNEW_GreenJobs3.pdf

[20] Sierra Nevada Energy Watch Contractor Letter (February 26, 2010). This rate is based on prevailing wage tables for the five original SNEW counties (Alpine, Calaveras, Mariposa, Sierra, and Tuolumne) and "Inside Wireman, Technician" classification.

[21] Personal communication (February 1, 2013)

[22] Betony Jones later joined DVC and was an author of the IOU WE&T Guidance Plan

[23] Interview with Steve Frisch, Executive Director, Sierra Business Council (February 1, 2013)

with over one-third of construction hours performed by apprentices at an average wage of $21.52 per hour.[25] The balance was performed by journey level workers at an average wage of $37.42 per hour.[26] The total construction labor represented only 10.6 percent of the total project cost, well below the average labor cost of 20 to 30 percent.[27] According to Steve Gelb, Local Director of Emerald Cities Seattle, "the concern that CWAs increases the cost of projects is probably not true at all due to the use of apprentices".[28] New projects under the CWA will be completed soon, providing valuable data for comparison.

Through extensive interviews and review of the literature, **we found no credible evidence that standards raise costs that are not offset by benefits.**

Lack of workforce standards in linked to low energy savings

Realizing energy savings through a voluntary market requires that equipment be properly installed and maintained and that buildings be retrofitted consistent with best practices and technical specifications. There is substantial evidence of improper equipment installation and building retrofits in California.

The assumption that the market (i.e. customers) can determine the appropriate level of skill for workers is flawed because customers often lack the equipment and expertise to evaluate work quality in energy efficiency. Correct installation, operation, and maintenance of mostly hidden systems are not readily observable to customers in the way a remodel is, and when equipment doesn't work properly, customers may reject the technology. Furthermore, without a clear mechanism to ensure that they will receive what they are paying for, customers will be reluctant to invest in energy efficiency.[29]

As demonstrated by the solar water heating experience in the 1980s, the impact of poor work quality on energy savings can undermine adoption of measures for a generation. Solar water heating technology was largely abandoned in California by the end of the 1980s as a result of poor installations and abuse of market subsidies. A lingering perception of poor reliability caused the collapse of the industry for the next two decades, with sales dropping from US$1billion/year in 1982 to US$30million/year in the late 2000s[30].

We may currently be seeing the same trend with advanced lighting controls, which have slow uptake due to lingering negative perceptions about the technology. Research and expert interviews provide evidence that improper installation of advanced lighting control systems has undermined their widespread adoption in the market. According to one lighting subject matter expert, "the anecdotal

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[29] Giraudet, Louis-Gaëtan and Sébastien Houde. (2013) *Double Moral Hazard and the Energy Efficiency Gap*. International Association for Energy Economics, First Quarter 2013.

[30] Nemet, Greg, Grubler A., Aguayo, F., Gallagher, K.S., Hekkert, M., Jiang, K., Mytelka, L., Neij, L., Nemet, G. & C. Wilson.. Solar Water Heater Innovation in the US. Historical Case Studies of Energy Technology Innovation in: Chapter 24, The Global Energy Assessment. Cambridge University Press: Cambridge, UK., 2012.

data overwhelmingly shows that poor quality installation is a widespread problem in the lighting sector".[31] An evaluation of Title 24 acceptance testing effectiveness found that automatic daylighting controls failed in 7 out of 7 tests, and occupancy sensors failed in 2 out of 3 tests. All of the failures were due to design, installation, or calibration issues.[32] A study of the commercial lighting sector demonstrates that when properly installed, lighting controls reduce commercial buildings' energy use for lighting by 24–38%, but that only 30% of the market uses these advanced controls.

The California IOUs noted that "over the years, IOU incentive programs for lighting controls have had relatively low participation rates, in large part due to the poor performance of the control systems which has been linked to substandard installation, inadequate commissioning, and lack of proper maintenance. As a result of the poor performance, many customers were not willing to invest in the systems - even with an incentive."[33]

Quality control challenges led to lower-than-expected savings results in the 2006-2009 HVAC installation and maintenance programs in California.[34,35] The California Public Utilities Commission's Energy Division has recognized that poor installation quality is a primary barrier to the realization of energy efficiency savings in the HVAC sector. Installation quality affects the energy use of HVAC systems. In the commercial HVAC industry, up to 40 percent of energy costs can be saved by sizing equipment properly and selecting equipment with high efficiency ratings, compared to conventional installations.[36] A properly commissioned HVAC system can use up to 20 percent less energy by correcting installation and operation problems, and optimizing system controls.[37]

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[31] Interview with Doug Avery (February 20, 2013)

[32] Tyler, Matthew, John Farley and Eliot Crowe. Evaluation of Title 24 Acceptance Testing Enforcement and Effectiveness. PECI, September 2011.

[33] A. 12-07-001-04. SCE WE&T Program Implementation Plan, 23 May 2013, pgs 384-386

[34] Hunt, Marshall, Heinemeier, Kristin, Hoeschele, Marc, Weitzel, Elizabeth. "HVAC Energy Efficiency Maintenance Study" Davis Energy Group and Western Cooling Efficiency Center. CALMAC Study ID SCE0293.01, 2012

[35] KEMA, Cadmus, Summit Blue. "EM&V of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs," 2006-08 Program Year, Volume 1 and 2, 2010.

[36] *Guidelines for Energy-Efficient Commercial Unitary HVAC Systems*, prepared for Consortium for Energy Efficiency, revised Jan 2001, p. 2; see citation 15b

[37] Mowris, R., Eshom, R., Jones, E. 2011. Laboratory Measurements of HVAC Installation and Maintenance Faults. ASHRAE. June 2011.