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Comments on the IEPR Workshop
and CEC Draft Staff Report
"Achieving Energy Savings
in California Buildings"

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The following comments are in response to the CEC Draft Staff report *Achieving Energy Savings in California* (July 2011), publication number CEC-400-2011-007-SD; and the July 20, 2011 IEPR Workshop at which that report was presented and discussed.

Overview

The Draft Staff report (the “Report”) lays out some of the important current and historical context of CEC efforts – past, present and proposed; and it serves as a good aspirational document which illustrates the specific areas in which the state has to make significant progress to achieve what are in fact very aggressive energy efficiency and zero net energy goals in the next 10 to 20 years. That said, the Report, in my view, falls short in that:

- It does not fully and realistically identify and prioritize barriers to success in the various areas and programs it covers; and that
- It does not propose specific workable solutions or best approaches from the collective experience of stakeholders to overcome these barriers.

The goal of these comments is to provide CEC Staff and others with this input.

[Note: For anyone reading this who is not familiar with my past experience, the comments are based on thirty years experience assisting the building industry meet and exceed energy standards in thousands of residential and nonresidential projects; participating in the development of many new code cycles, compliance manuals and energy performance software versions; developing and providing standards training to many statewide audiences including energy consultants and building department staff; consulting to local governments and utilities on reach codes and residential energy conservation ordinances (RECOs); and currently helping to establish a new and more rigorous Certified Energy Analyst (CEA) program in advance of the 2013 Standards.]

Comments by Report Section

Executive Summary

Zero-Net-Energy. Whether stated here, or discussed in Chapter 2, I would make a clarification in the Report. Anyone working on Zero Net Energy buildings across a wide spectrum of building types, site and zoning constraints, availability of solar access and variety of climate zones understands that getting to on-site ZNE may not be possible in each and every building. If a clear and workable system of carbon-trading is eventually put in place, then a building that cannot reach on-site ZNE may be required to purchase CO₂e reductions to offset non-renewable on-site energy use. However, unless and until that’s realized, it’s important to make clear that on-site ZNE is the goal *where practically feasible*.

For example, consider the way that nonresidential energy performance budgets are set within the current standards. The standard design energy budget is based on all relevant details which describe the proposed building energy use. If there is a very large process load modeled in the proposed building, then the standard design is assumed to have the same process load in setting the energy budget for that building. Similarly, future standards might consider the specifics of a proposed building, and the energy goal for that building might be:

- Ultra low energy (ULE) use in cases where reaching on-site ZNE is simply not feasible for any one or more of several reasons; or,
- On-site ZNE is practical; or,
- “Sub-Zero Net Energy” (SZNE) may be possible where a quantifiable on-site net annual energy contribution to the grid is possible.

It may be more useful to make clear that ZNE across the full range of buildings (new and/or existing), including the percentage of renewable power in the grid over time, is the ultimate goal.

Staff Recommendations

Data Driven Policy and Market Transformation. In addition to mentioning the collection of appliance energy use data, I would point out that despite having a home rating system (which unfortunately has major implementation and market acceptance problems), good data is still woefully lacking statewide on actual energy use savings as a result of specific retrofit measures or groups of measures in different climate zones. For example, one of the barriers to the City of Hayward moving forward recently with a adopting a RECO was the lack of this sort of home retrofit data which showed the impact of simple energy retrofit measures on an average homeowner’s utility bill.

Improving Compliance and Enforcement. The implication here is that without the authority to cite and fine noncompliant entities, nothing else can or will substantively improve compliance and enforcement. This implication is simply false. In the past, the CEC has had contracts in which the hired Contractor went into a local building department and reviewed a number of projects which had been approved as energy code compliant. These projects were plan checked again by the Contractor, and then the results were discussed as part of a training effort to improve enforcement. There was no punitive aspect, simply highlighting problems and attempting to improve enforcement. This effort made local building departments aware that someone might come in and look over their shoulder, and building department staff became more interested in making an effort to do a better job in plan review and field inspection. We strongly urge that, moving forward, similar contracts are put in place consistently for at least the next ten years.

Reaching Zero-Net-Energy. It makes sense for the CPUC and the CEC to share the same ZNE definition using the societal value of energy (e.g., “ZNE-SV”). However, it may also make sense for the Air Resources Board and CalEPA to use a definition based solely on CO₂e (e.g., ZNE-CO₂e) given their charge and agency function. Although there is no inherent conflict between these ZNE metrics, they don’t always track each other as 2008 reach code cost-effectiveness studies of TDV energy savings and CO₂e reductions by Gabel Associates illustrated.

A related issue which the CEC and CPUC should consider is the definition of “cost-effectiveness” as stated in the Warren-Alquist Act, and whether it can accommodate the societal value definition of ZNE. If there is a conflict between Warren-Alquist and the ZNE definition, then that needs to be resolved. Is it cost-effective, by any current definition, to achieve ZNE in buildings? It seems that this issue must be addressed and not avoided.

With respect to the development of 2013 reach codes: I would add the sentence “To encourage local governments to adopt reach energy performance standards, the Energy Commission should calibrate Tier 1 energy efficiency levels to provide meaningful energy savings and demonstrable cost-effectiveness.” If CALGreen Tier 1 level is made too stringent, there may be very few local governments willing to adopt a reach code under the 2013 standards as compared to the roughly three dozen already approved by the CEC under the 2008 standards.

Chapter 2: Stepping Down to Zero-Net-Energy

Getting to ZNE Buildings: Market-Driven Strategies

Empowering Consumers. Based on the consensus of experience of home performance contractors, homeowners, local governments and the IOUs trying to implement Energy Upgrade California (EUC), the HERS Phase II rating system is not working well for a variety of reasons. For some future version of HERS, the Energy Commission and CPUC must face the fact that HERS needs to be completely reworked in accordance with the main needs of key stakeholders in mind. Unless HERS is re-configured to work successfully as a market-driven system, it will never be positioned to empower consumers or be accepted by the real estate industry. A revised HERS audit and label system should:

- For the General Public, be easily understood, and serve as a meaningful way to compare typical energy use from one home to another (i.e., an asset rating which includes the effects of house size, relative energy efficiency and local climate);
- For Individual Homeowners, also be useful in understanding which energy upgrades are likely to have what kind of impact on annual energy use, energy costs and CO₂e;
- For Home Performance Contractors, provide a clear and easy path to provide a reasonably priced (\$200 to \$300) audit, label and series of retrofit

recommendations that are “actionable items” which a homeowner can approve;

- For Local Governments, provide an overall framework in which homeowners and contractors connect to produce home energy improvements, and the results of those improvements (energy and CO₂e emissions) can be tracked; and establish a system that can support a local Residential Energy Conservation Ordinance;
- For Utility Companies, provide an effective foundation upon which a consistent and long term structure of home energy incentives can be built;
- For the Real Estate Industry, fulfill the promise of a standardized home energy label which can lead to market acceptance when – and this is crucial -- appraised home value routinely includes the investment in energy efficiency.

The homeowners, home performance contractors, local government staff and utility company staff with whom I’ve discussed this issue at length have come to the general conclusion that the current HERS II Rating for Existing Homes program is not working for the key stakeholders in providing an effective home energy rating. I greatly appreciate the efforts of many dedicated people who put HERS II for Existing Homes in place, but the unfortunate fact is that HERS II is seriously deficient regarding several important criteria. For example:

- It is not working effectively as a tool to assist home performance contractors provide homeowners with an accurate assessment of typical energy savings from recommended energy upgrades;
- The cost of the HERS II rating – typically between \$750 and \$1,000 – is a major deterrent for most homeowners, even when a portion of that cost is covered by a utility or local government incentive;
- The HERS index is not a metric that is simple and clear for homeowners or others to understand;
- There is no integrated IT platform to allow different stakeholders with different levels of access to obtain or track data, or which might serve as the basis for future integration with the real estate multiple listings;
- The only certified HERS II software tool (Energy Pro v5.1) was designed primarily for the Title 24 Standards and is very complex to use for home performance contractors interested only in a HERS II rating.

CEC Staff and Contractors looking at AB758 (discussed later) should carefully study the findings of the online publication *Energy Performance Score 2008 Pilot Findings & Recommendations Report (August 2009)* found at: www.earthadvantage.org/assets/uploads/EPS_Pilot_Report_2008.pdf and review how those findings might be implemented to create an effective HERS rating system.

With respect to implementation of AB1103, and the AB758 development of a Commercial Building Energy Asset Rating System (BEARS), the same fundamental issues and stakeholders need to be addressed.

To empower customers, state agencies and market actors must work together to put in place effective and broadly accepted building audit, rating and labeling systems. A building owner who invests in energy efficiency needs to know that, at the time a property is sold or is leased, his or her investment will be properly valued and disclosed to prospective buyers or tenants. Having accepted and routinely used building rating or benchmarking systems in place will encourage investment in energy efficiency as studies in the EU have shown.

Market Partners. Similar to the creation of the California Lighting and Technology Center and the proposed “plug load center” to expand research expertise to understand plug loads, the PIER program should create a center to better understand and research building energy modeling, and calibrate energy asset ratings with operational ratings and metered energy use data. Not nearly enough work has been done in this area which is very important in both the technical validity of asset ratings (whether for the standards, or for an existing building energy label) and correlations with actual building energy use. Such a proposed center could, as needed, also study different computer model simulation tools, as well as data on occupancy-driven and other important operating conditions for modeling; and it could serve as the entity which continues and perhaps takes over some or most of the software compliance modules that CEC staff is directing a variety of contractors to develop.

From Parts to Whole: Rethinking Efficiency Standards in the ZNE Context and Stairway to Zero: ZNE Through Building Efficiency Standards

For the whole-building approach to work understanding integrated energy design, evaluating cost-effectiveness and moving toward ZNE, the Energy Commission and CPUC should recognize and mitigate the current barriers to achieving success in the next 10 to 20 years. The whole building approach is comprised not only modeling many of different energy design features; but also includes many moving parts or links in chain, as it were, each of which must function well for the entire process to succeed.

Software Tools

- **Energy Simulation Engines, Algorithms, Fixed and Restricted Inputs (for Standards and Related Analysis).** The energy simulation tools, in combination with the ACM default or standard occupancy or operating assumptions, give the all-important feedback on the energy performance of a particular building design; and how the energy performance is affected by changing one or more design features. A lot more research and calibration of the models to real-world site energy use needs to be done for both residential and nonresidential buildings, especially for existing

buildings. Again, more work needs to be done to connect asset ratings that derive from computer models with typical site energy use of actual buildings of the same occupancy, vintage, construction type and climate zone. The 2004 and 2009 RASS studies, for example, show typical home energy use which is significantly different for space heating and cooling in older homes than the Title 24 or HERS models predict.

- **Capacity to Model Innovative Technologies and Design Strategies.** There are a number of innovative HVAC systems (e.g., the Daikin Altherma heat pump) that the ACMs are not set up to model properly. Research into all new and viable technologies should be translated into CEC-defined modeling capabilities contained in the ACM Manuals and/or simulation engines that ACM vendors can incorporate into their programs. This is becoming increasingly important with the push to reach ZNE through innovation. Another example is the CEC PV calculator which, in the latest thinking on the 2013 standards as expressed recently by Staff, will not be included in either the Residential or Nonresidential ACM Manual. This does not help the industry move toward ZNE when on-site solar PV is feasible. (CEC PV calculator results must be generated separately, and the results documented and input into the ACM programs.)
- **Generating Clear Output Reports for Various Uses.** We strongly urge an advisory process similar to the one used as the 2008 standards were developed for the 2013 standards to (a) evaluate current compliance, installation and acceptance forms (b) decide on an overall strategy and work plan to improve the forms for compliance, installation and enforcement purposes and (c) use the advisory group to make specific suggestions and/or edit draft changes to improve the final 2013 forms. A variety of stakeholders and individuals should be involved in this process.
- **Clear and Easy-to-Use Interfaces.** While the CEC does not have any direct control over how ACM program interfaces are written, the ACM manuals are an opportunity to specify particular features that are essential for the ACM vendors to include. For example, the 2013 standards update to the ACM manuals should include requirements such as:
 - When entering data for a Title 24 energy performance calculation, other software inputs that do not affect the Title 24 calculations must either disappear from the screen or be grayed-out to let the software user know which inputs are applicable to the standards.
 - The ACM should be required to print out a listing (on-screen as well as in a printed form) as to all the energy measures that are used to set the Standard design energy budget for the Proposed building.
 - Any ACM input which affects either the Standard design budget or the Proposed building energy use must appear as an item in one of the compliance forms for plan check.

Software Users

The ACM software users (i.e., energy analysts) are a crucial component in meeting and exceeding standards to reach ZNE. CABEC is now involved in a major project (supported by the IOUs statewide Codes & Standards program and encouraged by CEC Staff) to establish a much more relevant and robust Certified Energy Analyst (CEA) credential before the 2013 standards take effect. This important effort will continue, and the new CEA program will be in place by 2014. Although the CEA credential will remain voluntary, the CEC should support the new CEA (i.e., the substitute for the current CEPE) as the 2014 requirement for the New Solar Homes Partnership (NSHP) program; and the IOUs should require the new CEA as a requirement for documenting performance-based incentives.

If the new CEA program is deemed successful in 2014 and 2015 by key stakeholders, the CEC might consider requiring that energy performance calculations and documentation be prepared by a CEA starting with the 2016 or 2019 standards.

Setting the Standard and Calculating ZNE

There is one extraordinarily important point that CPUC and CEC Staff and other policy makers always need to remember:

Whether it's demonstrating that a particular building meets the standards or achieves ZNE, **it is the energy software program in the hands of the person using it that sets the standard for the building.** To the extent that the software is flawed, or the software user does not know how the standards work or know how to operate the software correctly, the standards are not likely to be properly set or met.

Whether for code compliance, or to move further toward ZNE (and as the code itself moves toward ZNE), much more research and development into better ACMs, in combination with education, testing, certification and scrutiny of the energy analysts must occur to ensure that the whole building approach yields credible and consistent results. All statewide efforts to improve both of these should be fully supported and funded, without which the whole building approach may on some occasions become merely a paper chase used for building permit approval.

The CPUC should require, and CEC should support, much greater funding for the IOUs Statewide Codes & Standards program toward these efforts. As standards move toward ZNE, and the IOU incentive programs shift gears to adapt to that new paradigm, the state will need all the parts and the players in place to implement a serious ZNE strategy: better software tools, higher education and professional training, certification, real enforcement review at the local building department level, registration of key forms and ACM input files in a central CEC data repository to track energy performance in future research, and so on.

Other Stakeholders

To reach ZNE, other work needs to be done to help building industry players understand what each new set of standards means for them, and what they will need to do to adapt to the effort to reach ZNE. Ideas:

- New “*Filterable*” *Compliance Manuals* should be developed to be online. Based on how the person downloading the document identifies himself or herself (e.g., architect, mechanical engineer, lighting designer, building department plan checker, field inspector, energy consultant, homeowner, general contractor, specialized installer), the download version of the Compliance Manual is filtered to include only that information which is relevant to the role that individual plays with respect to the standards.
- *Ongoing education at the community colleges and state universities* should be designed specifically for building contractors and installers, building designers (architects, mechanical engineers, lighting designers), enforcement staff. These trainings should be coordinated in their content with trainings being developed and conducted by the CEC, IOUs and others. This is especially important with the implementation of new standards, such as in 2014.
- *Title 24, Part 6 “GPS” Software* should be developed as a public domain, online program. Based on a successive number of simple queries of what kind of project, project scope, building location is involved, the software would guide a building owner or designer or energy consultant or building department on helping them understand what the standards require as mandatory; and what other compliance requirements are applicable and available, including a summary of prescriptive options.

Further Comments

I have run out of time in writing up these comments prior to leaving on a planned trip tomorrow. I will make an effort to turn in additional remarks on the Report in the next several weeks, especially in regard to *Chapter 3, Efficiency Improvements in Existing Buildings*.