August 1, 2013

VIA E-MAIL DOCKET@ENERGY.CA.GOV

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 13-IEP-1F
1516 Ninth Street
Sacramento, CA 95814-5512

Re: 2013 Integrated Energy Policy Report: Lead Commissioner Workshop on the Definition of Zero Net Energy in Newly Constructed Buildings in California—Joint Utility Comments

I. INTRODUCTION

The signatories of this letter represent Pacific Gas and Electric Company (PG&E), Southern California Gas Company (SCGC), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE), collectively referred to as the investor-owned utilities (IOUs). The IOUs appreciate the opportunity to comment on the California Energy Commission's (CEC or Commission) Lead Commissioner Workshop on the Definition of Zero Net Energy in Newly Constructed Buildings in California, held as part of the 2013 Integrated Energy Policy Report (IEPR) proceeding.

At the July 18 Workshop, the Commission discussed its definition for Zero Net Energy (ZNE) Buildings. This discussion takes place in the context of the California Public Utility Commission's (CPUC) Long-Term Energy Efficiency Strategic Plan[1] (Strategic Plan), which references Assembly Bill (AB) 32 greenhouse gas (GHG) emission reduction goals for California, and which sets the following goals for ZNE:

1. All new residential construction in California will be zero net energy by 2020
2. All new commercial construction in California will be zero net energy by 2030

The Strategic Plan has raised expectations for increased deployment of energy efficiency and renewable energy in future residential and commercial buildings. The IOUs have responded to this directive with research and programmatic initiatives around ZNE, and, in so doing, have noticed the profound impact that the rubric of "ZNE buildings" has had upon thought leaders in

[1] CPUC, *California Long Term Energy Efficiency Strategic Plan*, September 2008, updated January, 2011, http://www.cpuc.ca.gov/NR/rdonlyres/D4321448-208C-48F9-9F62-1BBB14A8D717/0/EEStrategicPlan.pdf

the building design industry. ZNE has changed the way leading edge architects, engineers, and builders think about integrated building design, creating a new level of recognition and practice regarding how the building site, the building shell, and the building's systems interact. Thoughtful, holistic building design coupled with well-executed construction practices has produced buildings with very high energy performance levels that delight their occupants.

In Section II of this letter, the IOUs discuss their suggested definition for ZNE buildings, which is based on the belief that a clear and simple definition will best serve the movement toward ZNE buildings, especially with respect to codes and standards development. In Sections III through VIII, the IOUs discuss the key concepts in this definition and highlight the steps that need to be taken to implement ZNE. In summary, the Commission should adopt a definition for ZNE buildings that meets the following criteria:

- Is simple and easy to understand for technical stakeholders, consumers, building operators and the lending industry;
- Is based on an asset rating system embodied in the energy codes;
- Is based on existing elements of the Buildings Energy Efficiency Standards, including Time Dependent Valuation (TDV);
- Includes all energy used within building operations, including miscellaneous electrical loads, typical plug loads, and gas use;
- Recognizes the need to enhance TDV to account for costs associated with exporting significant and increasing quantities of electricity to California's distribution grid;
- Allows for both on-site and off-site renewable energy generation.

In keeping ZNE simple, the ZNE definition should—for now—avoid addressing the more nuanced aspects of implementing ZNE, leaving those exercises for future endeavors. At this time, the definition should <u>not</u> address the following:

- Transportation or embedded energy;
- Future code allowances in lieu of ZNE (or "ZNE Equivalence");
- Future code minimum efficiency levels of efficiency (or "ZNE Ready");
- Other ZNE related metrics that leading to achieving related goals such as "ZNE-electric," "ZNE-source," "ZNE-site," or "Zero Net Carbon."

II. JOINT UTILITIES RECOMMENDED DEFINITION OF "ZNE BUILDING"

The IOUs support including the ZNE definition in Title 24, Part 6, "Building Energy Efficiency Standards." The ZNE definition should apply to all buildings. The Commission's definition should be configured to build upon and be compatible with the existing energy efficiency infrastructure around code development; the existing infrastructure has taken over 35 years to develop and has resulted in tremendous energy savings.

Research sponsored by the IOUs and overseen by the CPUC indicates that a TDV-based ZNE goal is technically feasible for nearly all low-rise residential buildings and most new nonresidential and high-rise residential buildings.[2] Of course, the Commission will need to demonstrate cost-effective exception pathways for buildings where ZNE is not feasible. The IOUs support a TDV-based definition of ZNE for the Title 24 Building Codes.

A new challenge with the ZNE definition, in contrast to past efficiency efforts focused entirely on building efficiency, involves reasonably reflecting the costs of distributed generation (DG), including those costs associated with integrating and maintaining significant amounts of DG on California's electric distribution grid. The IOUs support of a TDV-based definition is contingent on the enhancement of the TDV metric: it is essential that it more accurately reflect both the value of energy exports from buildings and any costs associated with exporting significant, increasing quantities of electricity to California's distribution grid. Further, the IOUs recommend that the renewable energy component of the adopted ZNE definition promote cost-effectiveness by allowing for the flexibility of ZNE buildings to source renewable generation from on-site and off-site sources.

A clear definition of California ZNE will assist IOUs in aligning demand side management (DSM) programs across the state in support of state policy goals, and will support existing IOU efforts to work closely with other market actors to ensure consistent policy implementation in alignment with the definition.

A clear ZNE definition provides consumer protection to homebuyers who otherwise have no method (outside of a Home Energy Rating System or "HERS" rating) of comparing two similar-looking homes with photovoltaics (PV) on the roof. A clear ZNE definition helps builders avoid misunderstandings with their customers over misconceptions that ZNE will result in "zero bills." Finally, a clear ZNE definition as suggested above does not limit deployment of PV to rooftops, which would reduce the potential for stranding assets or for destabilizing the grid when more cost-effective methods and more operationally efficient methods of offsetting on-site consumption can be procured. Therefore, the IOUs propose the following definition for ZNE:

> *A new California zero net energy (CA- ZNE) code building is one that has a CBECC (California Building Energy Code Compliance)[3] design rating of 0 TDV kBtu or less with its renewable energy sourced from on-site or monitored off-site generation.*

---

[2] All low rise residential and 92% of all residential and nonresidential new construction area representing 70% of total energy consumption was estimated to be technically capable of having TDV energy footprints low enough to achieve zero net energy; some small percentage of new construction, not quantified in the study, would not have adequate solar access on site for renewable generation with PVs. *The Technical Feasibility of Zero Net Energy Buildings in California*, Arup et. al., December 2012, pp. 41
http://www.energydataweb.com/cpucFiles/pdaDocs/904/California%20ZNE%20Technical%20Feasibility%20Final%20Report.pdf

[3] Note that for low rise residential the relevant CBECC would be CBECC-Res, and for high rise and nonresidential it would be CBECC-Commercial.

III. CALIFORNIA BUILDING ENERGY CODE COMPLIANCE

The IOU definition explicitly references the California Building Energy Code Compliance (CBECC) design ratings: CBECC ratings are very similar to the HERS ratings and provide an accurate metric of energy use. Both CBECC design ratings and HERS ratings are asset-based rating systems, with each based upon the simulations of currently regulated energy consumption. Since actual plug load information is often not known and is not entered into the CBECC software, default values are used. When using the performance approach to comply with the building energy code, the performance software provides a code compliance calculation and generates a CBECC design rating at the same time; the same inputs are needed for both calculations.

For residential applications, the CBECC design ratings are similar to the HERS rating in that neither the energy consumption of swimming pools nor the energy consumption of electric vehicles or other transportation is included in the rating. However what is included in the design rating could change over time though the CBECC development process. In particular, the metric should evolve to incorporate off-site renewable generation and enhancements to TDV to properly value energy exports into CBECC design ratings.

IV. ZNE DEFINITION SHOULD BE LIMITED TO THE ENERGY USED TO OPERATE THE BUILDING

Consistent with existing energy use accounting, the Commission should limit the definition of ZNE to the energy used in building operations (e.g., the HVAC, lighting and plug load and natural gas consumption). *Embedded* energy, which describes the energy used in making the building (including the energy used in producing building materials), is an important policy subject; however, the IOUs believe it is inappropriate for the ZNE definition because there are simply too many variables and would likely render a very complex and not very meaningful result. *Transportation* energy, including energy required by residents to travel to and from the building to conduct their daily lives, while likewise important, would be better addressed in local land-use planning than in Title 24 efficiency standards.

V. TDV METRIC

TDV is the metric of merit for evaluating trade-offs between gas consumption, electricity consumption, and renewable energy production in the CBECC software. The TDV value of energy has been used in the building standards since the 2005 Title 24 cycle and has proven to be a robust method of balancing trade-offs between energy, peak demand, and different fuel types. However, as found by the *Technical Feasibility of Zero Net Energy Buildings in California*:

> "TDV was specifically designed to assess only the statewide distribution costs of *energy imports* to a building. There are potentially additional costs for *energy exports* from a building if those exports push the grid to perform in a manner for which the grid is not presently designed. Those costs, once understood, could be incorporated into specific

> TDV values for solar electricity exports. Those grid impacts could also grow along with the rapidly increasing saturation of distributed photovoltaic generation."[4]

This research finding suggests that the TDV metric needs to be enhanced to more accurately value energy exports and account for the costs associated with exporting significant and increasing quantities of electricity to the distribution grid. The IOUs recommend that the discussion around the ZNE definition in the 2013 IEPR recognize the need for research to produce this enhancement and require that the CBECC software include the enhancement before implementation of any ZNE definition.

Particular consideration must also be given to the system-wide implications of adopting building energy generation systems into the code based on the TDV metric as it currently stands. By valuing energy production on an equal basis as energy consumed by the building site, there is significant embedded potential for inappropriate cost-shifts among customers once TDV is implemented for ZNE. The implicit "equal basis" assumption assigns *benefits* to solar customers, including ZNE customers; however, any *costs* associated with that solar system are not recognized in the TDV calculation. As a result, these very real costs would be levied onto non-DG customers *de facto* in rates. To fulfill requirements under the Warren-Alquist Act, these impacts, affecting the state's economy as a whole, must be considered.

The IOUs are also concerned that TDV under one code cycle may overvalue the benefits of renewable generation when compared to future cycles. This scenario would result in decreasing returns on long term self-generation investments by customers, a potentially less reliable grid, and compounded rate equity issues. The Commission should ensure that the valuation of all components of ZNE accurately reflect impacts to the grid and all customers over a reasonable period of time, not singularly at the present time.

VI. SIMPLICITY

The IOUs recommend that the definition of ZNE be kept simple and that other definitions, such as "ZNE Electric," <u>not</u> be included. These other definitions would dilute the message of a single straightforward definition. The simplicity of a ZNE definition where the TDV of energy equals zero for all building and plug loads discourages efficient fuel choices. However, the IOUs acknowledge that branding around the term ZNE and a code-based definition is a significant hurdle in widespread market adoption: the code-based definition based on TDV is inherently complex and it will be chronically difficult to communicate to the lay public. The housing market will comply with whatever requirements are codified in Title 24, but the market may not embrace promoting the definition as ZNE, opting instead to develop its own branding or definition of ZNE.

[4] Ibid, pp. 17

VII. CODES AND STANDARDS

The IOUs agree that the ZNE goal should reflect the loading order of energy efficiency and demand response first, followed with renewables as the final step. Thus it is imperative that the CEC take steps to incorporate all feasible and cost-effective energy efficiency electric and gas measures into the 2016 and 2019 Title 24 building energy efficiency standards before layering on renewable generation to achieve ZNE status. A similar approach towards adopting all feasible and cost-effective Title 20 appliance standards covering both electricity and gas well in advance of 2020 will help assure this loading order is achieved. It is also important for the CEC to leverage synergies amongst technologies that span across the loading order: for example, smart DR-capable efficiency technologies, or, DR-capable renewables. The 2013 IEPR should affirm the Commission's commitment to the loading order by including a discussion of this important policy.

Additionally, the IOUs recommend against specifying some minimum level of energy efficiency in the ZNE definition at this point. Optimal levels of energy efficiency will vary by project and will be affected by potential changes to the HERS and design ratings. The targets for the minimum levels of efficiency are impacted by the following considerations that are under development:

- The detailed Codes and Standards Enhancement (CASE) reports on the feasibility and the cost-effectiveness of energy efficiency measures for the 2016 and 2019 Title 24 standards have not started yet. Therefore an accurate accounting of the optimum level of efficiency is not well known for all the potential combinations and variations of measures.
- Approximately 50 percent of residential electricity use is for miscellaneous electrical loads: the target levels of efficiency thus depend upon progress made during the upcoming Title 20 proceedings and on how this progress is reflected in the equipment consumption defaults in the CBECC design rating.
- New data is being collected on miscellaneous electrical loads (MELs) and improvements to the MELs model are expected.
- Some important alignment work among the CA-HERS system, the national HERS rating and the CBECC design rating is yet to be accomplished; the outcome of these efforts will impact the nominal ratings values associated with achievable levels of efficiency.

As such, it would be premature to quantify specific levels of efficiency.

Finally, IOUs recognize that test methods to demonstrate renewable energy system efficacy will need to be publicly and rigorously vetted before rating systems for those technologies can be adopted into code. In the case of solar PV, while the CEC's current test method established in Senate Bill 1[5] for qualifying systems to participate in the California Solar

[5] Guidelines for California's Solar Electric Incentive Programs (Senate Bill 1), Fourth Edition, Appendix 1: http://www.energy.ca.gov/2011publications/CEC-300-2011-005/CEC-300-2011-005-CMF.pdf

Initiative (CSI) program provides a good foundation, the IOUs recommend that it be enhanced to develop a comprehensive performance rating system by climate zone that characterizes the climate, system orientation, and solar resource-specific performance of the system. Such a rating system should also provide some assurance about the persistence of a PV system's performance over the stated equipment life, which affects both the life-cycle cost-effectiveness calculations and the direct homeowner economics. Further, the performance rating should facilitate modeling of the PV system to accurately estimate its system-specific TDV performance. Such a comprehensive test method and performance rating system is a critical component to ensuring accurate TDV values by climate zone.

VIII. RENEWABLE ENERGY GENERATION

The IOUs further recommend the following guidance for allocating renewable generation to a particular building. The CPUC defined on-site renewable generation as being at the level of a single "project" seeking development entitlements and building code permits. As a practical matter, by far the majority of project-based renewable generation deployed from today through 2020, the target date for ZNE code adoption, will continue to be small-scale PV. There appear to be two key embedded assumptions to this approach: (1) an assumption that small-scale renewable energy installations, most often rooftop-by-rooftop, are the most cost-effective method for all stakeholders in pursuing California's GHG reduction goals under AB 32 and (2) the proliferation of small individual PV through the building code will not compromise the reliability, cost, and stability of the California electric grid. These embedded assumptions require further investigation.

As indicated in the draft report the *Cost-Effectiveness of Rooftop Photovoltaic Systems for Consideration in California's Building Energy Efficiency Standards* prepared by Energy and Environmental Economics (E3), residential PV, the most common renewable DG technology in CA, currently relies upon a host of subsides, primarily the net energy metering (NEM) tariff. These subsidies have significant effects on whether the technology is cost-effective.[6]

Continuing with the PV example, greater efficiencies in cost and reliability can likely be attained through larger-scale efforts such as district or community PV systems. The research to date has examined the cost-effectiveness of rooftop PV only; the economic advantages of district or community PV systems under the TDV metric need further, more serious consideration. Additionally, the E3 study did not reflect the cost-shifting that would occur as some customers are able to adopt rooftop PV and others are not. Any study of district or community scale renewables needs to include this consideration to ensure that flexibility, cost-effectiveness, and equity are prioritized so that any results can be actionable and supportive of California's GHG reduction and ZNE goals.

[6] *Cost-Effectiveness of Rooftop Photovoltaic Systems for Consideration in California's Building Energy Efficiency Standards* (Draft Report), Energy and Environmental Economics, Inc., May 2013, pp. 40-43: http://www.energy.ca.gov/2013publications/CEC-400-2013-005/CEC-400-2013-005-D.pdf

Grid operations should also be addressed: according to recent ZNE research, the amount of rooftop PV estimated to come online year-on-year after the ZNE code implementation in residential construction alone could be up to 530 MW annually.[7] The IOUs and the California Independent System Operator (CAISO) currently cannot monitor or "see" the real-time production of rooftop PV as they can with utility-scale generation, exacerbating the challenge of integrating rooftop PV (at this scale) for grid planners. Additionally, this rapid integration of rooftop PV will compound the ramping issues that CAISO has identified.[8]

In light of these challenges, the IOUs recommend that the 2013 IEPR include requirements for examining further research into these cost-effectiveness and grid issues before committing to implement the ZNE definition proposed here that includes on-site and off-site renewable energy generation. Moreover, we recommend that the CEC confer with building officials and the homebuilding industry to explore how incorporation of on-site and off-site renewable energy generation into the permitting process can be achieved in practice and can be integrated with the rule sets embedded in the CBECC software. This will be of particular interest for multifamily projects, college campuses, or other large, planned developments where one might plausibly have or build a large renewable generation source nearby but not directly on the rooftop or property of each building.

IX. CONCLUSION

In conclusion, the IOUs reiterate their support for establishing a simple and clear definition of ZNE. The IOUs support of the positive impact that the ZNE concept has had on the building design and construction industry. The IOUs thank the Commission for the opportunity to be involved in this process and encourage it to consider the recommendations outlined in this letter.

[7] *Road to ZNE: Mapping Pathways to ZNE Buildings in California, Heschong Mahone Group, Inc. et al, December 2012, pp. 105:*
http://www.energydataweb.com/cpucFiles/pdaDocs/897/Road%20to%20ZNE%20FINAL%20Report.pdf
[8] From CAISO presentation "R.11-10-023: RA Flexibility Workshop: Flexible Capacity Procurement Proposal", 2012)

Sincerely,

/s/

Valerie J. Winn
Pacific Gas and Electric Company

/s/

Mitch Mitchell
Southern California Gas Company
San Diego Gas and Electric Company

/s/

Manuel Alvarez
Southern California Edison