Comments of the Natural Resources Defense Council (NRDC) on the
Staff Workshop on Achieving Energy Savings in California Buildings

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I. Introduction and Summary

The Natural Resources Defense Council (NRDC) appreciates the opportunity to offer the following comments on the Integrated Energy Policy Report (IEPR) workshop for "Achieving Energy Savings in California Buildings" and the associated draft staff report (Report).[1] NRDC is a nonprofit membership organization with a long-standing interest in minimizing the societal costs of the reliable energy services that Californians demand. We focus on representing our more than 105,000 California members' interest in receiving affordable energy services and reducing the environmental impact of California's energy consumption.

NRDC strongly supports the California Energy Commission (CEC) in its effort to achieve significantly higher energy efficiency savings as a critical component of achieving the state's Zero-Net-Energy (ZNE) goals for residential buildings in 2020 and commercial buildings in 2030.[2] We commend the staff for their draft report and for their outreach to stakeholders in an effort to ensure California is on track to meeting its ZNE targets and to comply with AB 758 requirements. To support this effort, we have prepared the following recommendations:

- NRDC recommends that the final report identify specific energy efficiency and renewable energy goals that would achieve the lowest-cost combination of measures for ZNE buildings.
- NRDC supports the adoption of a statewide definition of ZNE, and recommends that in addition to the time-dependent valuation (TDV) of operating energy, the CEC should also include energy associated with transportation, water consumption, and building materials in the ZNE calculation.
- NRDC recommends that the final report include a much broader scope of electronic plug loads as part of the ZNE energy efficiency strategies.
- NRDC recommends that servers be included as a high priority target for commercial plug load efficiency as part of the state's overall ZNE strategy.

[1] "Achieving Energy Savings in California Buildings: Saving Energy in Existing Buildings and Achieving a Zero-Net-Energy Future", Draft Staff Report. Pub # CEC-400-2011-007-SD. Posted July 11, 2011. http://www.energy.ca.gov/2011publications/CEC-400-2011-007/CEC-400-2011-007-SD.pdf (draft staff report)
[2] Draft staff report, Page 1.

II. General Recommendations

A. NRDC recommends that the final report identify specific energy efficiency and renewable energy goals that would achieve the lowest-cost combination of measures for ZNE buildings.

The draft staff report states that "Achieving ZNE buildings will require the energy use in buildings to be reduced as much as possible through energy efficiency, to the point where the remaining energy demand of the building can be met through photovoltaic or other renewable systems."[3] NRDC fully agrees with this objective. To achieve ZNE with the lowest-cost combination of efficiency and renewable systems, NRDC suggests that the CEC break down the projected cost curves of HVAC, Lighting, Water Heating, Electronic plug loads, and Appliance plug loads, and set quantified targets for each area. The ZNE industry currently has no way of calibrating its efforts – which measures do we need to achieve to get to ZNE? In which order should we be addressing them? Without quantified goals and the guidance they offer, the state's efforts towards ZNE could end up with best-effort incremental efficiency improvements. This would leave high and costly requirements for on-site renewable energy generation that could have been reduced more cost-effectively with energy efficiency[4]. This would at best create undue cost burden for California's billpayers, and at worst jeopardize the achievement of ZNE objectives. Quantified goals are essential to drive targeted policies what will ensure the state first captures the most cost-effective efficiency and renewables, in alignment with California's loading order.

In order to determine the optimal mix of energy reductions and energy generation, it is necessary to determine the projected cost curves of efficiency in each area as well as that of renewable energy by 2020, and to pick the combination that yields the lowest overall cost per kWh. If this analysis has not already been completed, it will undoubtedly require additional effort and public participation, and therefore NRDC recommends that the final 2011 IEPR call for the timely development of such goals in order to set the right level of ambition for efforts in each area.

Until this analysis is complete and the goals are set, NRDC strongly recommends that the Commission adopt aggressive Title 20 appliance and Title 24 building efficiency standards. Title

[3] Draft staff report, Page 1.

[4] This hypothetical assumes that projected costs for renewables are more expensive than the efficiency measures that could have been implemented had an analysis been completed and goals set. This may not end up being the case, but it highlights the need for the analysis that will provide the "loading order" of ZNE measures to be completed.

20 and 24 codes will undoubtedly be a very important part of achieving ZNE by 2020, along with utility programs that continually accelerate the adoption of new technologies in the market. California must plan ahead to ensure that each update is sufficiently aggressive to move the state towards reaching ZNE by 2020. As such, the 2013 Title 24 standards should consider the cost of *not* making the 2020 goals (e.g. having to purchase additional renewable energy) rather than the current Title 24 paradigm, which is simply whether a new code is cost-effective. The draft staff report suggests a 20-30% linear decrease for each Title 24 update, using only "cost-effective" measures.[5] NRDC recommends a Title 24 target of 40% for 2014, 35% in 2017, and the 25% in 2020, as efficiency will likely be cheaper than buying photovoltaics to cover the energy consumption that was not "cost-effective" to reduce. Title 20 goals should be similarly aggressive, emphasizing the urgency of implementing efficiency before having to resort to less-cost effective renewables in order to achieve ZNE.

B. NRDC supports the adoption of a statewide definition of ZNE, and recommends that in addition to the time-dependent valuation (TDV) of operating energy, the CEC should also include energy associated with transportation, water consumption, and building materials in the ZNE calculation.

The staff's draft report outlines its recommendation for the TDV definition of ZNE, and proposes that all state agencies adopt this definition.[6] We agree that a uniform definition of ZNE should be adopted by all state agencies to ensure coordinated decision-making and analysis. Over the past year, CPUC-led workshops and the CPUC ZNE Champions "definitions" group have attempted to hammer out a ZNE definition and calculation methodology for the state to consider. The committee was unable to unanimously agree on which elements should be included and which metrics should be used to evaluate their energy-related impacts. NRDC generally supports the CEC's TDV metric, which incorporates a number of societal costs and therefore is a more complete metric than simple building site energy use, which has been proposed at the CPUC workshops. However, the TDV metric still ignores many other facets of energy use related to residential construction and design.

We recommend modifying the proposed TDV definition of ZNE to include energy consumption implications of geographical location, water consumption, and the embedded energy of materials themselves. The amount of transportation energy used by a resident or tenant

[5] Draft staff report, Pages 5, 6.
[6] Draft staff report, Page 35.

during the life of the building is directly correlated to the building's location. By including this measure as part of how we define ZNE, urban sprawl will be discouraged and smart infill practices will be rewarded. In addition, water consumption has energy penalties beyond in-building heating and cooling; the energy cost of processing and transporting water before and after it reaches the building should be a market signal to planners and developers in the ZNE equation. The state should also encourage the smart use of materials, recycling and reusing as much building material as possible, as there are enormous energy penalties associated with new material.

Location and Transportation

A recent EPA-funded study[7] concluded that *where* you build can have a much greater environmental impact than *how* and *what* you build. The study found that typical transportation energy usage trumped the home energy usage by more than 20% annually for conventionally designed subdivisions that relied mostly on single-occupant trips.[8] When the same conventional home was located in a transit-oriented development which relied less on single occupancy vehicles for trips, transportation energy use could be reduced by 70%. When conventional cars were replaced with fuel efficient vehicles another 10% of transportation's energy could be eliminated. NRDC urges the CEC to incorporate the broader value of reductions in energy use into the ZNE calculation to ensure that the current business-as-usual housing construction practices are replaced by more efficient practices such as infill and locating near public transit.

Water

In additional to direct energy use associated with household water, there is an external energy penalty for consumption due to the fact that California's water supply is usually filtered, treated, and pumped from snowy areas hundreds of miles from the most populated areas. In the quest to reduce home energy usage, the state risks encouraging water usage for cooling purposes – such as evaporative cooling – without accounting for its associated energy costs.

[7] "Location Efficiency and Housing Type – Boiling It Down to BTUs". Prepared by Jonathan Rose Companies. Revised March 2011. http://www.epa.gov/smartgrowth/pdf/location_efficiency_BTU.pdf

[8] This comparison is measured in millions of BTUs.

In 2005 the CEC developed an embedded energy value associated with the delivery of the state's water supplies.[9] While rough and perhaps small when compared to home electricity usage, it accounts for residential water usage's upstream energy inputs and waste water energy demands. We recommend including the embedded energy value in the ZNE calculation to properly account for the energy associated with water consumption.

Embedded Energy in Building Materials

Building materials used in construction and renovation require energy to harvest, process, manufacture, store and deliver. These embedded energy inputs are calculated according to the International Organization for Standards (ISO) 14040-14044 requirements that are necessary to certify a process-based Life Cycle Assessment (LCA). While a full LCA includes many other environmental impacts beyond embedded energy, the energy inputs from this assessment can readily be included in the calculation of zero net energy.[10] The ZNE definition should include embedded energy for two reasons:

1) It properly rewards renovation over new construction; the structural components of a house (which renovations do not usually require) comprise the biggest source of embedded energy in a home.
2) It encourages contractors to consider the embedded energy of their materials, requiring them to balance a certain material's embedded energy with the energy savings that it might provide. Without consideration of embedded energy in the ZNE calculation, a

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[9] White and Klein, 2006. "The Water-Energy Connection in California," ACEEE Summer Study 2006; and Klein, G. et al., 2005. "California's Water – Energy Relationship," California Energy Commission Report CEC-700-2005-011-SF. http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF

[10] Partial LCA is already part of CALGreen. The procedure is listed below. **SECTION A5.409 LIFE CYCLE ASSESSMENT A5.409.1 Materials and system assemblies.** Select materials assemblies based on life cycle assessment of their embodied energy and/or green house gas emission potentials.

Notes:

1. Software for calculating life cycle costs for materials
and assemblies may be found at:
    a. The Athena Institute website.
    b. The NIST BEES website.
    c. Life Cycle assessment may also be done in accordance with ISO Standard 14044.
2. More information on life cycle assessment may be found at the Sustainable Products Purchasers Coalition; at the American Center for Life Cycle Assessment; at U.S. EPA Life Cycle Assessment Research; and at U.S. EPA Environmentally Preferable Products.

contractor may choose a certain material that saves some energy once installed, but consumed a great amount of energy when sourced and transported.

Incorporating the embedded energy of materials in the calculation will properly credit approaches that lead to renovation over new construction and will accurately account for the full amount of energy used in the construction process.

C. NRDC recommends that the final report include a much broader scope of electronic plug loads as part of the ZNE energy efficiency strategies.

The draft staff report highlights completed standards for televisions, external power supplies, DVD players and compact audio devices as key successes that advance energy efficiency. The draft report also mentions the current CEC rulemaking on battery chargers and the energy savings opportunities from improved set-top box and computer efficiency.[11] While these products represent some of the highest electricity end-uses amongst electronic plug loads, there are dozens of other product types that should be addressed when pursuing all cost-effective energy and the ZNE goal.

As noted in the draft staff report, consumer electronic and miscellaneous plug loads consumed 30 percent of household electricity as of 2010, and are projected to increase their share rapidly by 2020.[12] Meeting the ZNE objectives will require a comprehensive approach for electronic plug loads. Therefore, NRDC recommends that the final staff report include a thorough assessment of all electronic plug loads and their energy efficiency opportunities, to better align plug load reduction goals with the ZNE implementation roadmap. Once electronic plug load opportunities have been identified and goals for energy reductions set, strategies (with commensurate resources) can be developed and implemented.

We offer the table below, which proposes a list of plug loads for consideration. This list is not comprehensive, but offers a starting point from which the CEC can develop a research plan.

[11] Draft staff report, Pages 17, 18.
[12] Id., Page 13.

Residential

ELECTRONIC PLUG LOADS				
TV / Video / Photo	**Computer & peripherals**	**Audio**	**Telephony**	**Portable Electronics**
TVs	Desktops/Integrated desktops	HiFi Systems	Cell and Smart Phones / PDA	MP3 Players
STBs / DVRs	Monitors	Radios	Bluetooth Headsets	eReaders
DVD / Blu-Ray players	Notebooks & Netbooks	CD Players	Cordless Base Stations	Portable Video Games
Game Consoles	Handhelds/Tablets	Wireless Speakers	Cordless Handsets	Portable DVD Players
Digital Picture Frames	Home Networking	MP3 Speaker Docks	Answering Machines	Camcorders
	Printers and scanners			Digital Cameras
	Surge protectors and UPS			

APPLIANCE PLUG LOADS			
Kitchen	**Household**	**Outdoor**	**Transportation**
Fridges and Freezers	Clothes Washer	Mowers / Trimmers	Electric Vehicles
Dishwasher	Clothes Dryer	Pool	Mobility Devices
Coffee-Makers	Wine Cellar	Hot Tub	Marine/Automotive/RV chargers
Microwave	Childcare / Baby Monitors		
Cooking Appliances	Floor care - Vacuum Cleaners		
Toaster	Home Security Systems		

Commercial

ELECTRONIC PLUG LOADS				
Computer & peripherals	**Data processing and comms**	**TV / Video / Photo**	**Audio**	**Telephony**
Desktops & Integrated desktops	Servers	Professional displays	HiFi Systems	IP phones
Monitors	Storage	TVs	Radios	Headsets
Notebooks & Netbooks	Networking	STBs / DVRs	CD Players	
Handhelds/Tablets	Wireless base stations	DVD / Blu-Ray players	Wireless Speakers	
Printers and copiers	UPS	Video- conferencing		
Surge protectors and UPS				

APPLIANCE PLUG LOADS			
Kitchen	**Facility**	**Transportation**	**Power Tools**
Fridges and Freezers	Floor care - Vacuum Cleaners	Electric Vehicles	Professional power tools
Dishwasher	Security Systems	Mobility Devices	
Coffee-Makers		Marine/Automotive/RV chargers	
Microwave			
Cooking Appliances			
Toaster			

D. NRDC recommends that servers be included as a high priority target for commercial plug load efficiency as part of the state's overall ZNE strategy.

Server rooms and closets are an overlooked plug load efficiency opportunity. Server technologies and technology processes are becoming much more energy efficient, but market barriers such as education, behavior change, and other non-technological issues are blocking their widespread adoption. Most server rooms use servers at just 1 to 2 percent capacity, continuing to use twenty servers when they could consolidate and use only one. This is particularly true in smaller server rooms, which have been slow to adopt these new efficient technologies and processes. Small server rooms comprise almost half the server room electricity consumption in the United States[13] and can represent over half of a small office's entire energy consumption.

Best-practices are currently available to dramatically reduce the energy consumption of server rooms, including: consolidation and virtualization of under-used servers; server power management; hardware refresh; and cloud computing. There is a strong and growing deployment of these solutions in the large datacenter market, but small server rooms have significantly more barriers to adoption than their large datacenter counterparts. Small server rooms do not always have an IT professional dedicated to their operation; rather they may be serviced by one technician responsible for all company IT or by an outside contractor. Individual small server rooms are not as attractive sales targets as large data centers for the large solution vendors like VMWare, Microsoft, and Citrix. Small server rooms often exist in smaller companies who do not have the capital available to invest in cost-effective, energy-saving server technologies. Small server rooms are also more likely to have a real-estate agreement in which they have split incentives (i.e. the utility billing arrangement does not incentivize the equipment purchaser to reduce energy consumption).

Some of the energy-saving solutions for servers are technology solutions but many are business processes and behavior change opportunities. Appliance standards improve hardware efficiency – for example, ensuring that all servers on the market use high efficiency power supplies. However, standards alone are not sufficient in this area as the larger opportunity in improving business processes and user behaviors. Targeted incentives and education efforts are necessary to adequately capture this opportunity. We recommend the final report include servers in the strategy to achieve ZNE and reduce energy consumption in commercial buildings, as there is a large impact that server efficiency programs and technological solutions can make on commercial ZNE targets.

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[13] "Server closet", "Server room", and "Localized data center" electricity consumption estimated at 46% of total. "Mid-tier data center" and "Enterprise-class data center" comprise the rest. EPA Report to Congress on Data Centers, Aug 2007, p.27, http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency_study

III. Conclusion

NRDC appreciates the hard work of the CEC staff and the opportunity to provide comments on California's efforts to reduce energy consumption associated with residential and commercial buildings. We look forward to working with the staff and stakeholders to ensure that California succeeds in achieving its goals.

Respectfully Submitted,

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