nbi new buildings institute

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California Energy Commission
Dockets Office, MS-4
1516 Ninth Street
Sacramento, CA 95814-5512

Re: Docket No. 11-AAER-1

To Whom It May Concern:

On behalf of New Buildings Institute, I would like to submit the following comments regarding the 2011 California Energy Commission's Rulemaking Proceeding on Appliance Efficiency Regulations.

New Buildings Institute (NBI) is a nonprofit organization working to improve the energy performance of commercial buildings. We work collaboratively with commercial building market actors – governments, utilities, energy efficiency advocates and building professionals—to remove barriers to energy efficiency. We promote advanced design practices, improved technologies, public policies and programs that enhance energy efficiency. NBI also develops and offers guidance to individuals and organizations on designing and constructing energy-efficient buildings through our research, tools and resources.

NBI is deeply involved in energy efficiency and zero-net energy (ZNE) work, both in the state of California and nationwide. As part of our ZNE efforts, we collaborate with the California Public Utilities Commission to help implement the ZNE Commercial Action Plan and work closely with California leaders to advance the goals of this Plan, including advancing appliance standards to reduce plug loads to support ZNE targets of zero-energy residential by 2020 and zero-energy commercial buildings by 2030.

To support these ZNE targets and make a significant reduction in plug loads specifically on commercial buildings, NBI would like to comment on the following key aspects of the CEC Scope, specifically to encourage the CEC to:

1. Prioritize the following appliances in this Title 20 scope

***Computers and Servers*:** The State of California should make every effort to regulate computers and servers in commercial buildings to further efforts toward low and net-zero energy buildings. As computer facilities become more distributed and office equipment becomes more portable, the effect of server energy use has increased to a more significant level in a wider range of commercial buildings. As opposed to server 'farms' or official data centers, small servers contribute to plug loads in commercial buildings and are becoming a growing portion of total energy use in buildings. Yet servers are not directly regulated by building codes. In the near term, additional research and appliance regulations on server energy use seem critical to decreasing energy use in commercial buildings.

Supporting Data on Computers & Servers Energy Use:

- Servers - Recent results from a PIER-funded research study (conducted by NBI and Ecos Consulting) on whole building energy use and office equipment savings opportunities estimated servers and associated cooling at ~68% of overall plug loads in one office building. This data is referenced in Attachment A, and demonstrates that, even separating out the cooling for the server (18% of total plug loads), the server was 50% of the energy of overall plug loads. This is a significant portion of an office's energy use and provides a sense of the opportunity that focused regulation of this type of equipment can bring to overall energy efficiency.
- Computers - The office equipment deep-dive assessment from the Ecos/NBI PIER study evaluated savings from a variety of measures installed on individual pieces of office equipment. A few examples are provided in Attachment A. In addition, the Northwest Energy Efficiency Alliance (NEEA) 2009 Electronics Energy Use Forecast (developed by Gregg Hardy and Chris Calwell at Ecos Consulting) provides 2009-2014 estimates on Northwest and U.S. computers stock, estimated loads, annual use, user variables and potential savings.
- Information Processing Loads - Cascadia Center for Design and Construction is a six-story commercial building currently under construction; it is aiming for zero-net energy by 2012 and an ambitious energy use index (EUI) of 16 kBtu/ft^2 (based on gross ft^2). As part of design and modeling, plug loads for information processing are projected to be more that 25% of the building's overall energy use, even after significant reductions. For reference and a useful visual of overall loads, a breakdown of this project's energy use by category is included as Attachment B. This project indicates the importance of increased attention to plug loads as we move toward zero-energy buildings.

Lighting Controls: Lighting designed with controls can make a significant contribution to energy savings, particularly in commercial environments. While lighting systems are regulated under Title 24, one recent trend is the transfer of lighting loads from connected power demand to plug load devices (i.e. task lights). To address this increasing share of plug load demand, controls such as those listed below should be incorporated in this Title 20 update. Lighting that is not regulated under Title 24 should include control requirements as appropriate, such as:

- Wiring for demand response
- Occupancy sensors to turn off or dim components when workstations are vacant
- Dimmable downlights with mounted controls in work stations
- Automatic by time-clock controls for shut-off after operating hours
- Photo sensors to slowly reduce or cut off electric lighting as natural light enters a space
- Manual override switches to allow users to turn on each zone of light separately
- Vacancy sensors to switch each zone of lights off when spaces are vacant

Supporting Data for Lighting Control Energy Use - As part of our Office of the Future pilot studies, NBI has data on seven sites that have implemented best practices in lighting controls within commercial workspaces. This data will be available in the near future.

***Standby power management of miscellaneous unregulated plug loads*:** The CEC should formulate a strategy with the objective of minimizing the amount of standby losses from unregulated power devices. Below are three strategic approaches for consideration:

- Increase Title 24 requirements for availability of switched receptacles that minimize standby loss and augment user awareness of switched receptacles.
- Regulate standby losses in as large a subset of appliances as possible that do not currently have standby power loss regulations either federally or in Title 20.
- Where the device is unregulated, and likely plugged into an un-switched receptacle, implement consumer education and user awareness (e.g. labeling) of the costs and environmental impacts of standby losses.

With all recommendations, exceptions should be made for health and safety equipment and for devices requiring continuous operation. The Ecos/NBI PIER report also includes several examples of plug strip and related measures as applied to office equipment (e.g. figures 15 and 19 in Attachment A).

2. Consider adding the following to the Title 20 scoping list

***Imaging equipment** (printers, scanners, copiers):* While not a high ranking priority on the overall scale of high energy consumption per individual piece of equipment, the aggregation of this type of equipment in offices is an important consideration for regulation and should be added to the scoping list for discussion. Also see Attachments A and B for additional energy efficiency targets for imaging equipment.

***Monitors and displays**:* Airports and other commercial advertising users are increasingly using digital displays, and many offices now have multiple monitors per employee. The increasing proliferation of monitors and displays is a growing load in commercial buildings and should be added to the scoping list for discussion. Also see NEEA/Ecos data referenced above for supporting research on monitors including stock estimates, energy use and savings, and Ecos/NBI data in Attachment A.

Thank you for the opportunity to comment on the CEC scoping effort of the Rulemaking Proceeding on Appliance Efficiency Regulations.

Sincerely,

David C. Hewitt
Executive Director

Attachments:

Attachment A – Excerpts from Ecos/NBI Office Equipment Assessment
Attachment B – Cascadia Center for Design & Construction – Energy Performance

Attachment A

Examples of Ecos study savings for non-server office equipment

These examples are extracted from the final Ecos Plug Load Savings report as part of NBI's PIER project: Evidence-based Design and Operations. They represent specific deep dive assessment from individual office equipment metering before and after the installation of the identified measure.

Mercier, C. and L. Moorefield. 2011. *Commercial Office Plug Load Savings and Assessment.* California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-*500-08-049*.)

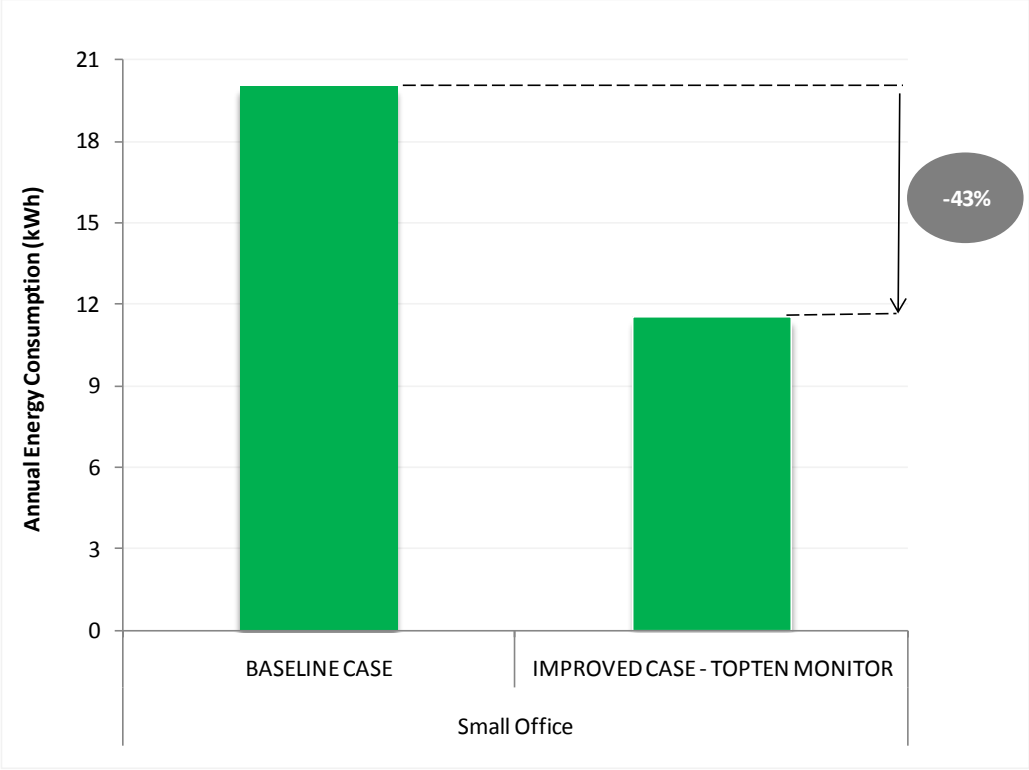


Figure 13: Savings from Replacing One Existing Computer Monitor with One Comparable, High-Efficiency Model

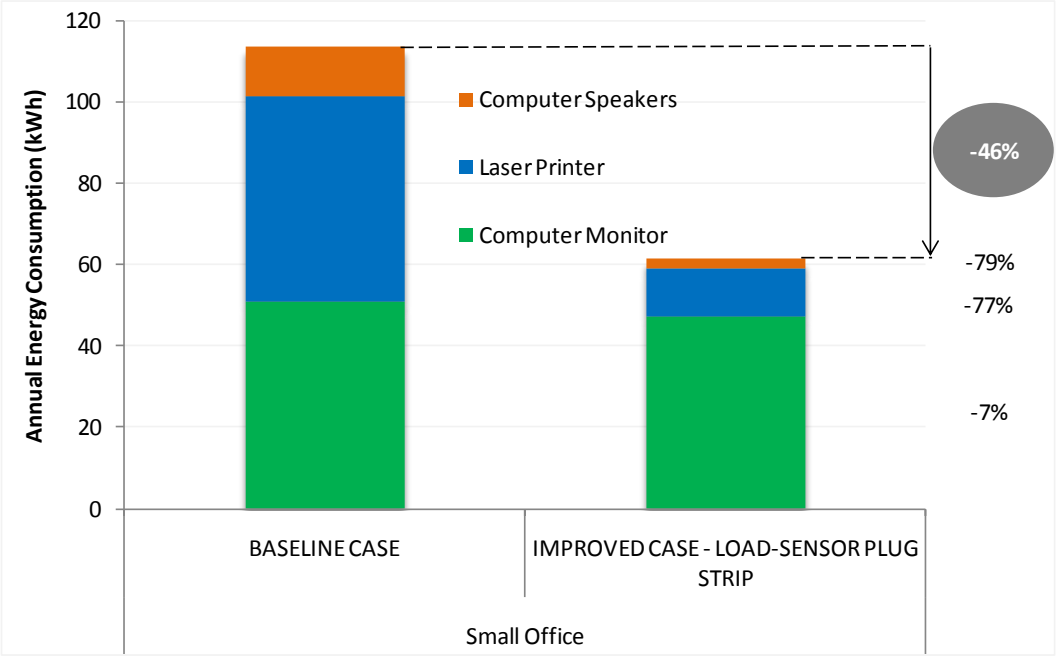


Figure 15: Savings from Load-Sensor Plug Strips

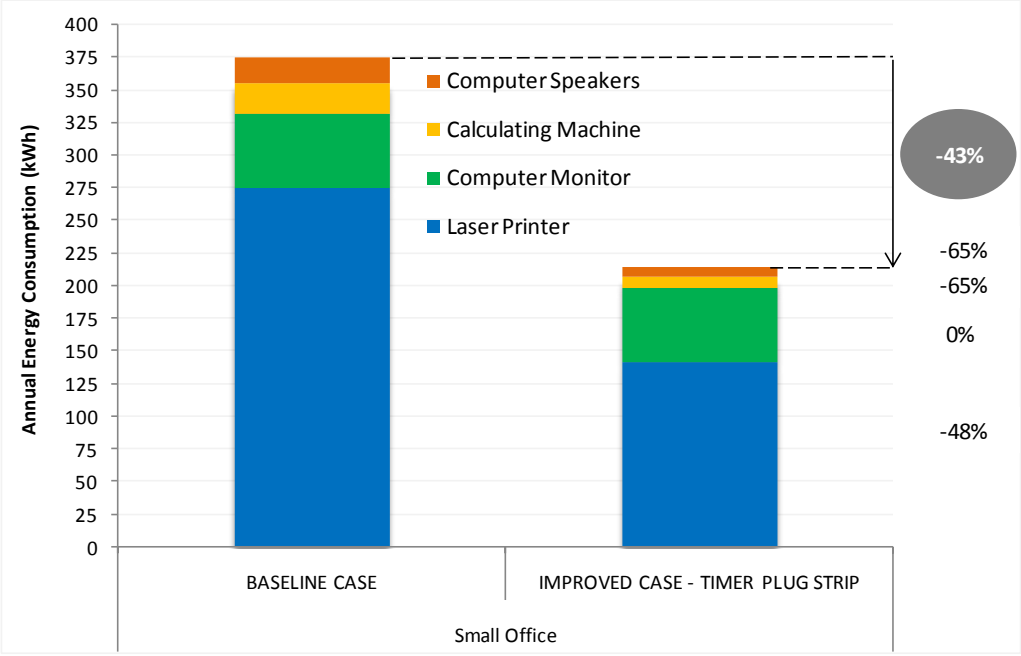


Figure 19: Savings from Digital Timer Plug Strips

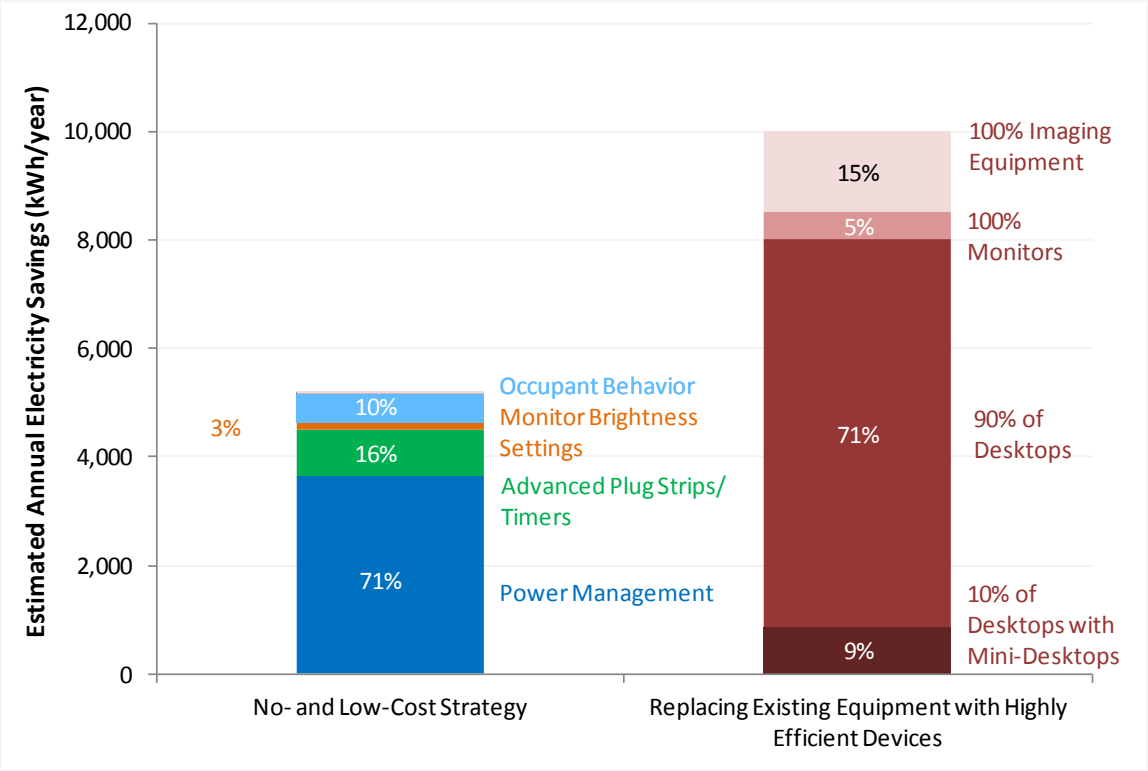
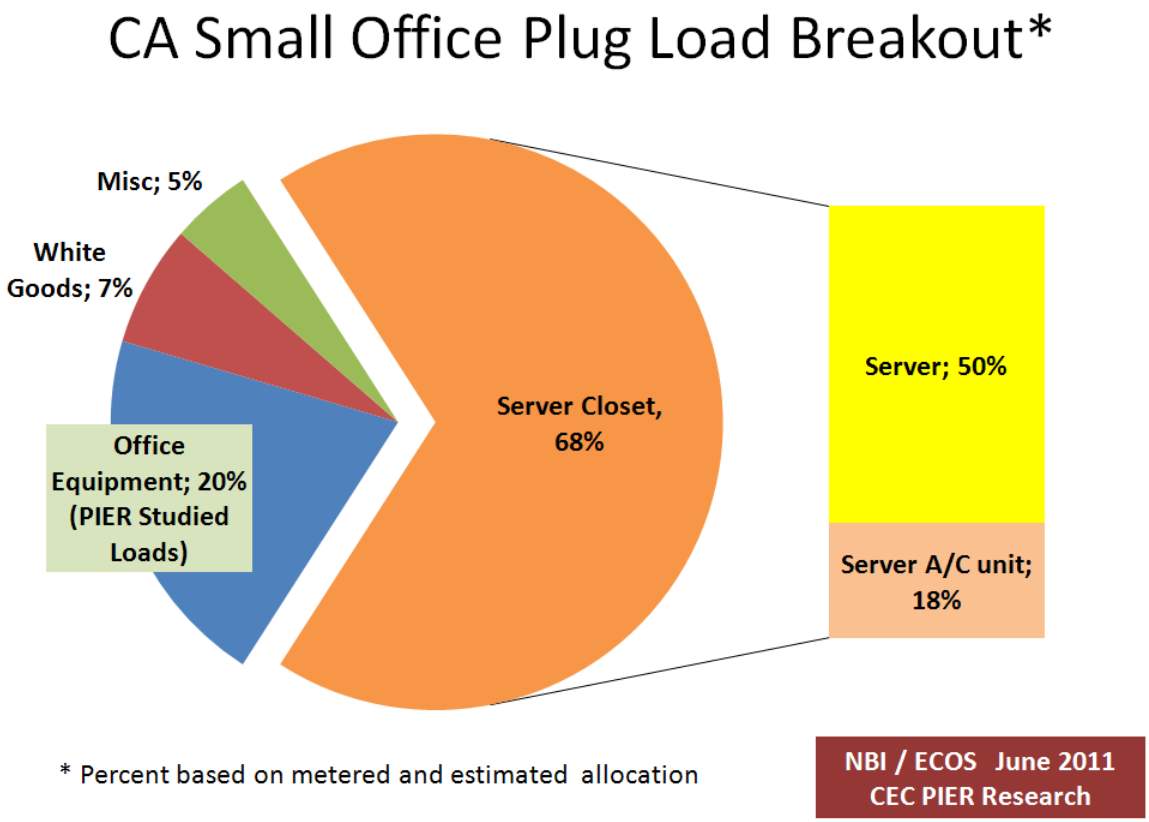


Figure 33: Summary of Savings Findings at the Small Office

Server contribution to small office energy usage

The combination of NBI's overall building energy assessments for the PIER project and Ecos' specific deep-dive analysis of potential savings in non-server office equipment clearly demonstrated the need for further research on small server closet energy usage.



(Ecos PAC review slide 6)

CA Small Office Plug Load Breakout

Plug Area	kWh/sf	Btus/sf	% of total
Server Closet	2.2	7.5	50%
Server A/C unit	0.8	2.7	18%
Office Equipment	0.9	3.1	20%
White Goods	0.3	1.0	7%
Misc / Adjustment	0.2	0.7	5%
Total Plug Loads	4.4	15.0	100%

(Ecos PAC review slide 5)

Cascadia Center for Sustainable Design and Construction
Energy Performance

*By: Denis Hayes with Brian Court, Jim Hanford and Paul Schwer**

In 2007 Congress created a Zero Net Energy Commercial Buildings Initiative, with a goal of achieving a market transition to Zero Net Energy for new commercial buildings by 2030. The Cascadia Center will meet that goal in 2012.

The Cascadia Center will achieve extraordinary levels of energy efficiency through integrated architectural and engineering design, cutting-edge technology and components, carefully selected building materials, and conscious choices by tenants who care about their environmental footprints. These elements will reduce the six-story building's annual energy requirement to the point where it can be provided by a solar array on the building's roof.

High performance envelope
The building envelope greatly exceeds the Seattle Building Code requirements, using a triple-glazed curtain wall system that was engineered in Germany and is produced locally. The well-insulated walls have been designed to eliminate thermal bridging and dramatically reduce air infiltration.

Building mass and orientation, as well as glazing selection, are considerations to control heat gain. To the extent possible on a compact, 5-sided urban site, major glazing areas face south and north to improve daylighting and solar control. The building's windows (which open and close automatically in response to conditions outside) were selected for optimal control of heat loss and solar gain while maintaining superb visibility for daylighting.

Analysis shows that increasing the thermal performance of the envelope beyond current levels would have little overall impact on energy use in the proposed building.

Closed-loop geothermal system and Ventilation
The Center's very modest heating and cooling loads are met by ground source heat pumps and on-site geothermal wells. Water loops provide comfortable radiant heating and cooling to the office spaces. Ventilation is provided through a dedicated 100% outside air unit with an air-to-air heat exchanger, so that incoming fresh air is pre-conditioned by outgoing air.

Radiant floor heating and cooling with passive cooling and natural ventilation
Operable shading systems are designed for glare control to further mitigate solar heat gain. Operable windows provide free cooling and ventilation in response to ambient conditions.

Daylight dimming and efficient lighting design
Lighting loads in office spaces have been limited to 0.4 Watts per square foot, less than half the 0.9 W/ ft^2 currently allowed under the Seattle code. Automatic controls will dim or turn off the LED lights when daylight provides adequate illumination.

Aggressive reduction of plug loads
Plug loads for office equipment, such as computers, monitors, servers, printers, and copiers, will be limited to a maximum of 0.8W/ft^2 (and this will be significantly reduced by plug load occupancy sensors). This is approximately half the 1.5W/ ft^2 typical for new office buildings, while still allowing for a computer-intensive environment. Tenants will employ the most efficient state-of-the-art equipment that meets their professional needs.

Energy Performance
Based on the efforts above, we estimate the following performance data for the building.

Building floor areas:

- Gross Floor Area in square feet (G ft^2): 52,000
- Treated Floor Area in square feet (TFA, common in Europe): 39,000

The building heating, cooling, ventilating and pumping energy combined are only 3.96 kbtu/sf/yr.

Annual End Use Energy Breakdown (in KWH, multiply by 3.412 to convert to kBtu)

Lights	53,000 KWH
IT Server	20,000 KWH
Computers, Monitors, Printers, Copiers and other misc equipment	104,000 KWH
Space Heating	6,000 KWH
Space Cooling	5,600 KWH
Pumps (includes pumps to run water treatment system at about 5000 KWH/yr):	21,000 KWH
Ventilation fans	12,000 KWH
Elevator	7,000 KWH
Domestic HW	7,800 KWH
Total	236,400 KWH

The resulting EUI (Energy Use Intensity) for the project is as follows:

- 16 kBtu/ ft^2 based on G ft^2
- 21 kBtu/ ft^2 based on TFA

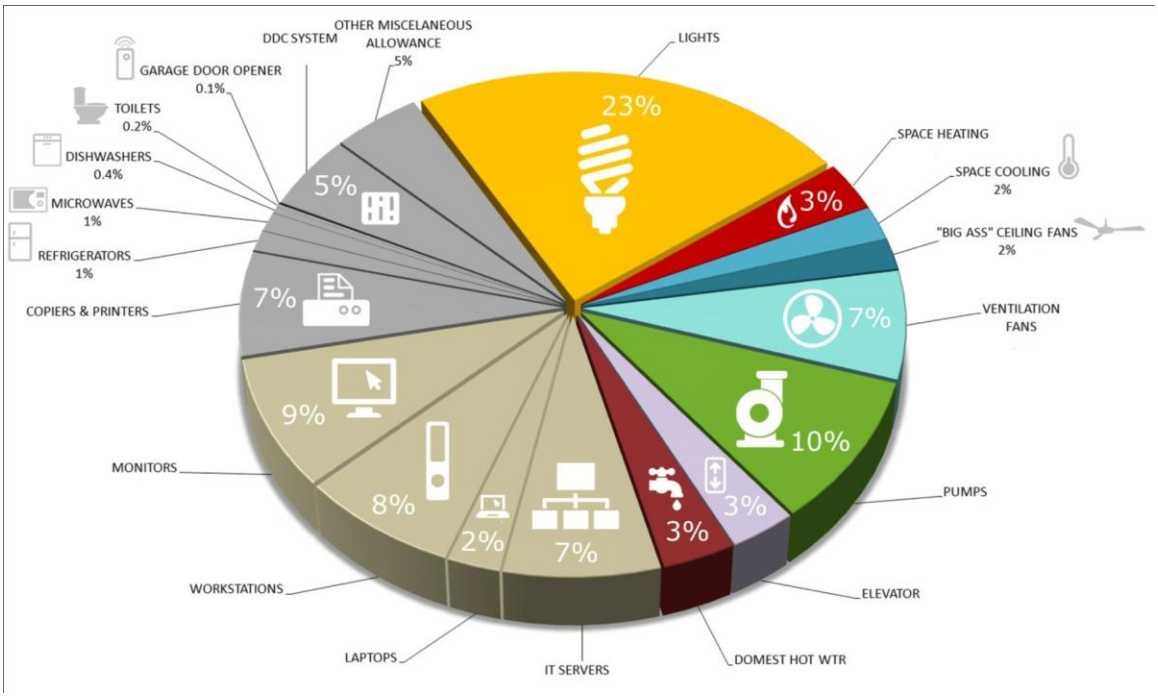


Figure 1: Cascadia Center for Sustainable Design and Construction - Energy Use

Comparisons with other high-performing buildings

There is a lack of good data on high-performing buildings in North America, but from the data that is available it appears the Cascadia Center will perform at the forefront of energy efficiency.

The U.S. Department of Energy (DOE) “Zero Energy Building” database currently contains no comparable buildings. The only urban commercial building is a tiny, 6,500 square foot lighting consultancy on the outskirts of San Jose, CA. The other net zero buildings are nature centers, recreation centers, and classroom buildings, all but two of which (a 3,500 square foot tennis club and a 2,200 square foot instructional facility) have higher EUIs than the Cascadia Center. (http://zeb.buildinggreen.com/)

In the DOE “High Performance Building” database, the Cascadia Center is significantly more efficient than any comparably sized urban commercial building currently listed. (http://eere.buildinggreen.com/mtxview.cfm?CFID=104739059&CFTOKEN=76487704)

While we are confident we have taken many steps to push the limits of building performance, this is not a competition with winners and losers. All the buildings in these databases have taken important strides in the right direction, and while the Cascadia Center plans to take yet another step forward, we too expect to be surpassed soon in this vibrant, creative field.

**Denis Hayes is president of the Bullitt Foundation, Brian Court is an associate at Miller Hull Partnership, Jim Hanford is an architect at Miller Hull Partnership and Paul Schwer is a principal at PAE Consulting Engineers.*