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NRDC comments on low power modes and power factor

Additional submitted attachment is included below.

NRDC

NATURAL RESOURCES DEFENSE COUNCIL

NRDC Comments on CEC's Invitation to Participate to Phase 2 Pre-Rulemaking – Low Power Mode and Power Factor Roadmap

2017 Appliance Efficiency Pre-Rulemaking
Docket Number 17-AAER-12

June 16, 2017

Submitted by:
Pierre Delforge, Natural Resources Defense Council

On behalf of the Natural Resources Defense Council and our more than 380,000 members and online activists in California, we respectfully submit these comments on the California Energy Commission's (CEC) Invitation to Participate to the Phase 2 Pre-Rulemaking on Low-Power Modes and Power Factor.

The Natural Resources Defense Council is an international nonprofit environmental organization with more than 1.3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment. NRDC's top institutional priorities are curbing global warming and creating a clean energy future. Energy efficiency is one of the quickest, cleanest, cheapest solutions to global warming and other energy-related problems. Cost-effective energy efficiency standards help to ensure that consumer and commercial products provide the same level of comfort and service using less energy, with benefits for consumers, the environment and the electricity grid.

Appliance standards are a key strategy to achieve California's clean energy and climate goals. California's long track record of leadership on appliance and building efficiency standards has saved Californians $75 billion since 1975.[1] With changing federal government priorities and the continuing proliferation of electric devices in buildings, California's leadership is needed more than ever to enable the state, the country, and the world to stave off the worst impacts of climate change while developing a prosperous and equitable clean energy economy.

In 2015, NRDC released the findings of a study called "Home Idle Load: Devices Wasting Huge Amounts of Electricity When Not in Active Use".[2] The study estimated that **23 percent of California's entire residential electricity consumption** came from devices that were not being actively used. This encompasses devices that are in a "sleep" or "off" mode but still drawing substantial amounts of power,

[1] http://www.energy.ca.gov/renewables/tracking_progress/#efficiency
[2] https://www.nrdc.org/resources/home-idle-load-devices-wasting-huge-amounts-electricity-when-not-active-use

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and devices that remain in active mode even when unused for prolonged periods of time, either because they don't have an off or sleep mode, or because they do not transition into these modes despite having them.

While idle power draw may be relatively modest on some devices compared to active power draw, collectively across the dozens of electrical devices found in the average home, idle power represents one of the largest end use of energy in California residences. Moreover, this energy wasted while providing no service to the user can often be reduced very substantially at little cost. We therefore strongly support the commission's inclusion of idle mode energy efficiency (a.k.a. low-power modes) as a Phase 2 roadmap.

Power factor distortion is caused by switched mode power supplies, used by every electronic product and sometimes also by electronic components within larger products such as the displays and controls embedded in refrigerators and other household appliances. Poor power factor causes energy losses in the building wiring and on the grid, wasting energy unnecessarily, and adding cost to consumers both directly through their own consumption and indirectly through the higher cost of grid electricity. NRDC's research suggests that while the impacts of poor power factor may be modest for each individual device they add up to substantial energy, reliability, and longevity impacts at both the building and grid level.

Power factor quality affects many different types of products, although not necessarily the same products as those with high idle energy use. Both energy saving opportunities can be addressed by a cross-cutting "horizontal" approach. We therefore support CEC's consideration of power factor quality together with low power modes, but low power modes and power factor may need to be dealt with in separate roadmaps. This can be determined once CEC has sufficient data and analysis to determine the scope for each opportunity

NRDC supports CEC's new "roadmap" concept

CEC is proposing a new approach called "roadmap development" for three of the eight product categories in phase 2: Set-top boxes, low power modes and power factor, and solar inverters.

While standards remain a tried and true method for energy efficiency savings for most products, NRDC generally supports this new roadmap approach in limited circumstances where it may be able to achieve greater savings than a traditional standards approach. Such circumstances may include 1) An industry stakeholder structure that is conducive to having most of the industry participate; 2) Industry stakeholders' willingness to commit to substantial energy savings over a long period of time, such as 10 years, in order to provide more savings than may be possible through one or two rounds of standards; 3) Products that appear to offer a large savings potential but require further investigation to validate this savings potential and determine how best to achieve it.

We view these new roadmaps as a worthwhile and innovative experiment to assess complementary policy tools to accelerate energy efficiency savings from products.

For these roadmaps to be effective, it is important to develop robust analyses of the savings potential for each product category. This should include market, technology and policy trends, test methods, available energy use and cost data, cost-effectiveness of efficiency improvement opportunities, etc. This is very similar to the Codes and Standards Enhancement (CASE) reports that the Statewide Codes and

Standards team put together for standards development, but without regulatory language. Developing such detailed roadmap analyses will provide CEC the data necessary to establish meaningful milestones, reporting requirements, and to be able to convert these roadmaps to mandatory standards should this prove the better route to achieving the savings potential in each product category.

Idle energy use (also known as vampire loads) are one of the largest and fastest growing energy uses, and a large energy saving opportunity

NRDC's 2015 study performed in partnership with Home Energy Analytics found that there was an average of 65 electric devices in California homes, two thirds of which draw more than one watt of power idle even when the owners aren't using them or think they have been turned off. Some devices use as much as 100 watts 24/7, which is $100 a year or more in electricity costs.

Idle load includes devices in off or "standby" mode but still drawing power (such as many home audio equipment); devices in "sleep" mode ready to power up quickly (like game consoles); and devices left fully on but not actively used (some computers left on 24/7, heated towel racks, or hot water recirculation pumps in the middle of the night when no one is drawing hot water).

Always-on energy use is responsible for roughly 18 billion kWh per year in California homes, equal to the output of 50 large power plants, costing consumers $3 billion worth of electricity bills annually. By addressing this issue, CEC can reduce this energy waste not just in California, but across the country and the world, saving hundreds of millions of tons of GHG emissions annually.

Reducing vampire loads requires a cross-cutting (horizontal) approach across many products categories

Contrary to conventional standards that focus on a few top energy-using appliances like furnaces, water heaters and refrigerators, vampire loads require a broad cross-cutting approach, because the savings opportunity comes from many small energy-using devices rather than a small number of large energy users. Cross cutting approaches can still be cost-effective because they rely on low-cost approaches that can be replicated at scale for very little cost, such as software changes, chip design changes such as for ground fault circuit interrupter (GFCI) outlets where the engineering costs can be spread over millions of units sold annually.

In fact, CEC has already very successfully implemented such horizontal approaches on at least two occasions before: external power supplies and battery chargers. Both standards have been widely succesful and have transformed the market nationwide and worldwide, leading to billions of tons of GHG emissions avoided since they went into effect.

In fact, CEC's battery charger standards include horizontal low-power mode requirements for rechargeable products. This low power modes and power factor horizontal roadmap is an opportunity to extend these low-power mode requirements beyond rechargeable products.

A roadmap makes sense to refine the scope, and the feasibility and cost effectiveness of efficiency improvements. Once this investigation work has been completed, CEC will be in a position to determine which of the product categories lend themselves to a roadmap and which require conventional standards.

The European Union already has horizontal "standby" standards in place, which demonstrates their feasibility and provides CEC with a starting point to evaluate and build upon as needed.

Low-power modes scope: NRDC encourages CEC to keep the scope as broad as possible at this stage of the roadmap and only narrow it down as needed once a detailed analysis is available.

Other than federally preempted products, we recommend CEC keeps the scope as broad as possible for the analysis phase of the roadmap development. The idle energy use of individual products is relatively small in most cases, and the few products with high idle loads like some always-on recirculation pumps are typically present is few homes which limits their average impact per home. What makes idle loads a large energy consumer and savings opportunity is that there are 50 or more of them per home, and hundreds or even thousands per commercial building. Capturing a significant share of this energy saving opportunity requires keeping most of products with vampire loads and that are not preempted by federal appliance efficiency standards in scope.

Low-power modes framework: NRDC encourages CEC to consider auto-power down in its proposed framework.

NRDC supports CEC's proposed approach to set low-power mode power levels based on functions that need to be active in each mode.

The other important consideration in the framework is that of auto-power down (APD): a large part of the savings opportunity in this roadmap comes from ensuring that products that do not need to be in full active mode 24/7, do auto-power down to lower power modes when not actively used. For example, a heated towel rack doesn't need to stay on 24/7, such as in the middle of the night when people are asleep, or in the middle of the day when they are away from home, wasting most of the energy it uses on a daily basis (and possibly requiring that wasted heat to be extracted from the home through air conditioning). Heated towel racks should only go on during periods of time in the morning and evening as needed by the user. Most products don't need to be fully on 24/7 and should include an auto-power down capability, whether based on a simple timer, sensors, or smart logic that learns the occupants' usage patterns.

When grouping products, and determining how to apply standards, the framework should consider the usage of the product (how much time it needs to remain fully active to perform its intended function), the functions that need to be active in lower-power modes such as sensors, voice command, and network connectivity, and the time it takes for the product to wake-up from low-power mode and can deliver expected user functionality (latency).

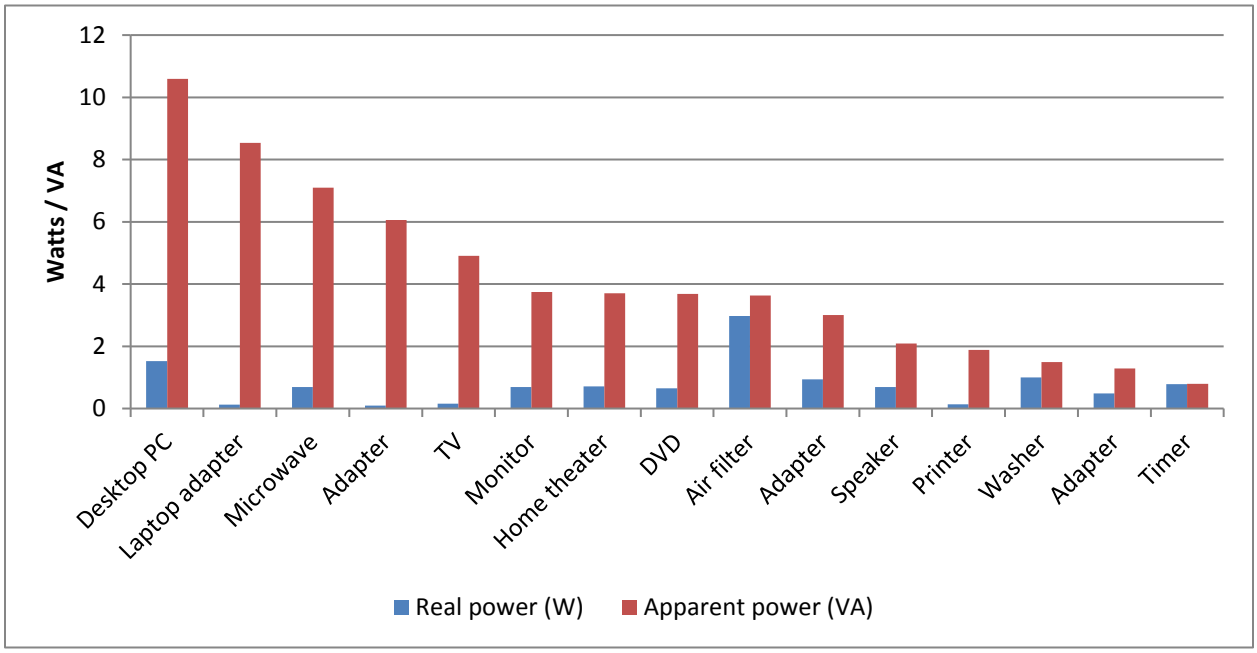
Power factor: an overlooked energy saving opportunity

To date much of the research and analysis on the energy waste due to power factor issues has focused on large electronic loads (such as desktop computers and TVs in active mode). This has led to estimates

that improved power factor could save California ratepayers at least 240 GWh per year[3] (over $40 million per year at current residential rates). Nationally, this would scale to over 3 TWh per year in savings (over $330 million in utility bills).

These estimates did not include small loads (less than 50 watts), not considered significant enough to be a priority. However, with the proliferation of electronic loads in buildings (consumer electronics, LED light bulbs, Internet-of-Things devices), and growing evidence that many of these loads exhibit very poor power factor in standby (as low as 0.1, which means that an LED bulb drawing 0.5 watt in standby may draw as much as 5 volt-amps of apparent power), these distortion loads add up and are responsible for additional energy losses that have not been accounted for so far. Figure 1 shows how sample devices with seemingly low real power standby loads can have high apparent power loads.

Figure 1 – Apparent Power of Sample Devices in Standby Mode[4]



NRDC's 2015 Home Idle Load report demonstrated that idle loads were responsible for 23 percent of residential electricity use in Northern California. The study did not include the effects of low power factor which would have increased this energy waste and savings potential.

In addition, most estimates of the energy losses due to poor power factor, both distortion from electronic loads and displacement from motorized loads, have focused on the customer side of the meter. Though important for customer cost-effectiveness tests, this approach ignores losses on the utility side of the meter. Energy losses and the operational cost of power correction equipment may add up and present a significant indirect savings opportunity for consumers.

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[3] "Consumer Electronics and Motorized Appliances." Prepared by Electric Power Research Institute, Public Interest Energy Research Program. January 2015. Report number: CEC-500-2016-034. http://www.energy.ca.gov/2016publications/CEC-500-2016-034/CEC-500-2016-034.pdf

[4] NRDC measurements

Finally, power factor opportunities may be broader than products that will end up being in scope of the low-power mode roadmap, either because the low-power mode savings potential is not high enough but the power factor savings potential may be substantial, or because they are already regulated (but not federally preempted). CEC should consider a comprehensive scope for power factor, independently from the scope of the low-power mode roadmap.

NRDC recommends that CEC seeks input from stakeholders and performs a comprehensive analysis of power factor correction saving opportunities, including large and small energy users, in active and low-power modes, direct utility bill benefits and indirect grid cost benefits, and low-power mode scope or beyond.

We appreciate the opportunity to provide this input, and thank CEC for its careful consideration of our comments.

Respectfully submitted,

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