Codes and Standards Enhancement Initiative
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Comments on Metal Halide Luminaire and General Service Lamp Draft Standards

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PG&E Final Comments on 45-Day Language Proposing Standards for Metal Halide Luminaires, Reflector Lamps, and General Service Incandescent Lamps

Pacific Gas and Electric Company (PG&E) is pleased to have this opportunity to provide additional input on the "45 day language" for Metal Halide Luminaire, Reflector Lamp, and General Service Lamp Title 20 standards. These standards, developed over the last three years by the California Energy Commission (Commission) with input from stakeholders, are estimated to provide California customers with energy annual energy savings well over 1,000 GWh and peak demand reductions of over 900 MW by 2015. Our comments hereunder are funded by California Public Utility Commission-approved public purpose funds and are presented in the best interests of the approximately 15 million people PG&E provides with natural gas and electric service in northern and central California -- one in every twenty Americans.

Metal Halide Luminaire Standards

First we discuss standards requiring use of pulse start ballasts and then we discuss standards for electronic ballasts.

Pulse Start Ballasts

PG&E supports the 45-day language. The Commission has previously set standards requiring use of pulse-start ballasts for vertical base-up lamps effective Jan. 1, 2006 for vertical base-down lamps effective Jan. 1, 2008. The present proposal extends this requirement to luminaries for the other two types of metal halide lamps – horizontal and universal. This standard on luminaries for horizontal and universal lamps has already been adopted in Arizona, Oregon and Washington; California should follow suit as these other states adopted their standards based on an expectation that California would adopt the same standard. We strongly recommend sticking with the 2008 proposed effective date in order to coordinate with these other standards. One manufacturer already produces many horizontal position lamps and some universal position lamps. Other manufacturers are now developing complying products and while all manufacturers may not have complying products in all sizes, our understanding is that the four major manufacturers will have many complying products by Jan. 1, 2008. We also oppose the NEMA request to exempt universal-position lamps as these lamps can be used in all fixtures and would be a major loophole in both the existing and proposed new metal halide luminaire requirements.

Electronic Ballasts

We are glad to see that manufacturers are now fully engaged in this rulemaking and providing detailed commentary on proposals that have been under discussion for more than two years. Based on the comments received recently, we now recommend that the Commission adopt a standard to require use of electronic ballasts, effective Jan. 1, 2009, for metal halide luminaries using 150-500 watt lamps.

A requirement for use of electronic ballasts will save substantial amounts of energy because these ballasts have higher efficiencies than most magnetic ballasts and also because most electronic ballasts have better lamp lumen depreciation than magnetic ballasts, providing higher mean lumens and allowing use of a somewhat lower wattage lamp while providing approximately the same illumination. Specifically, we estimate that such a standard would reduce energy use of metal halide fixtures by about 9%, which is much better than the approximately 1% savings that would be achieved by a standard proposed by NEMA that allows many magnetic ballasts to pass.

Relative to the ballast efficiency equation that is in the 45-day language (and that we helped to develop and previously supported), a prescriptive requirement for electronic ballasts:

- Is simpler and easier to understand
- Does not allow use of magnetic reactor ballasts, achieving higher energy savings than reactor ballasts and avoiding power factor problems that can result from widespread use of reactor ballasts
- Avoids the need for ballast efficiency testing and the need to immediately refine the existing ANSI ballast testing standard to address some issues unique to electronic ballasts
- Allows all electronic ballasts to comply including both high- and low-frequency products. This allows these two products to compete in the market and also gives ANSI some more time to develop its standard for high-frequency ballasts.

While in the long-term we prefer a performance standard to a prescriptive standard, given uncertainties as to when revised test procedures will be available and to inability of the ballast efficiency metric to differentiate products with improved lumen maintenance, we believe a prescriptive standard is a better choice at this time. This is similar to the recently adopted Commission standard for walk-in refrigerators and freezers. With walk-ins, the Commission adopted prescriptive requirements, but has expressed interest in moving toward a performance standard when appropriate test procedures and performance data are available.

As noted above, we recommend that the standard requiring use of electronic ballasts take effect Jan. 1, 2009. This is slightly later than the 2008/2009 dates in the 45-day language. We now recommend 2009 in order to (1) allow testing to emphasize pulse-start lamps, so that manufacturers are prepared when the pulse metal halide standard takes effect Jan. 1, 2008; (2) provide a little more time for completion of the low-frequency ANSI standard; (3) provide a little more time for product testing; and (4) provide a little more time for products to be developed so reliability can continue to improve and prices can continue to come down. We would strongly recommend such a delay over taking no action at this time for ballast efficiency. We believe it is important for the Commission to set an electronic ballast standard at this time in order to send a clear message to manufacturers and ANSI that they need to expeditiously prepare for a standard. If the Commission does not set such a standard at this time, there is a very good chance the ANSI process will be stretched out because they are not facing a deadline. Also, the Commission has spent a

lot of time on this issue over the past two years, and if a decision is postponed, all this work will need to be repeated during the next rulemaking.

As with the proposal in the 45-day language, the same two exceptions should apply to a requirement for electronic ballasts: (1) exempted outdoor luminaires; and (2) luminaries operating at 480 volts. Neither of these exemptions needs to be changed from what is listed in the 45-day language.

At the Feb. 14 hearing, Advance raised questions about the economics of electronic ballasts, arguing they will cost $100 and only taking credit for savings from higher ballast efficiencies and ignoring savings from improved lumen maintenance. As Stan Walerczyk discussed at the hearing, he has been able to obtain $50 incremental costs on some large jobs and he expects the incremental cost to be no more than $50 by 2009 when we propose that the standard takes effect. Testimony by Aurora and Hollophane supported our argument that as quantities sold increase; incremental costs will decline substantially from the current level of about $100. Even in the unlikely event that incremental costs stay at $100, the proposed standard will still be cost-effective (net benefits of about $98) if savings from improved lumen maintenance are added to the Advance analysis.

To help support development and use of electronic ballasts for metal halide lamps, PG&E presently offers incentives for pulse-start and ceramic metal halide lamps and ballasts. The current program includes magnetic ballasts but PG&E anticipates increased incentives specifically for HID electronic ballasts in the future, helping the market to develop prior to the effective date of a Title 20 standard.

In order to implement a prescriptive standard requiring electronic ballasts, a definition for electronic ballasts for metal halide lamps needs to be included in the regulations. We recommend the following:

"An electronic metal halide ballast is a device that uses semiconductors to control lamp starting and operation. An electronic ballast operates the lamp at a frequency of 75 hertz or higher."

Finally, at the hearing, Advance suggested setting a standard based on rated system efficacy in order to allow improvements to be made at the lamp as well as the ballast. We believe a standard for combined lamp/ballast system efficacy should be explored in the future, but such a standard needs to be based on tested efficacy for specific lamp/ballast pairs. Rated information is not always accurate and does not allow for the fact that some ballasts provide higher mean lumens than a lamp's rating. We think it will take several years to develop a lamp/ballast efficacy system and collect sufficient data to set standard levels. In the interim a requirement that luminaries contain electronic ballasts will produce substantial energy savings and will help ensure that electronic ballasts for HID lamps develop as quickly as possible.

General Service Incandescent Lamps

As noted in the following paragraphs, PG&E fully supports most aspects of the "45 day language" draft version of the General Service Incandescent Lamp standard. We do, however, strongly urge the Commission to reconsider the specific compliance equations used in Section 1605.3, Tables K3 and K4.

Standards Covering "Modified Spectrum" lamps

We believe that it is important that the Commission maintain the proposed standards for enhanced/modified spectrum lamps. Contrary to NEMA's forecasts of limited market share for these products, we believe that the market share for these products is likely to grow significantly in the next several years as result of the marketing efforts, expansion of competing products, and rapidly falling incremental costs. In comments submitted previously by PG&E on November 10, 2005 regarding modified spectrum lamp sales, we noted the following:

"Furthermore, industry argued that this product class is too small to deal with at this point. PG&E disagrees. GE alone has sold 170 million Reveal bulbs since 2001, according to its website. We believe that a significant proportion of these sales occurred after 2002 when marketing efforts scaled up. This suggest that sales of modified spectrum lamps represent 4 to 8% of current unit sales, approximately 7 to 10% of energy use, and perhaps 10 to 20% of dollar sales for the manufacturers. We expect these shares to increase for some time to come. Thus, PG&E believes that modified spectrum lamps category is more than worthy of the Commission's focus."

A product category generating that level of sales should not be considered a niche product. PG&E urges the Commission to continue to include the standards for modified spectrum lamps.

Furthermore, if enhanced spectrum lamps are not covered in the standard, this could present potential confusion to consumers when purchasing incandescent bulbs. If exempted, enhanced spectrum bulbs would remain at common wattage levels of 40, 60, 75 and 100 watts, whereas soft white and frosted/clear bulbs would presumably have migrated to lower wattage levels. Consumers in a retail setting would likely be able to compare these bulbs side-by-side and might choose to purchase the less efficient enhanced spectrum lamps simply because they display a wattage level that is familiar to them, especially given the highly stylized packaging that these products receive in comparison to their soft white and frosted/clear counterparts. In short, we feel that a standard on general service incandescent lamps would be most effective if <u>all</u> incandescent lamps migrated to lower wattages.

The new definition provided in Section 1602 for modified spectrum lamps seems to be appropriate, based on our limited understanding of the arcane technical references. We suggest that the Commission request data for the manufacturers' existing modified spectrum bulbs indicating whether they do or don't fall within the range proposed by the

definition and to indicate any lamps that are marketed as "full spectrum" that don't fall within that range. This information would help assure the Commission that this definition is properly scoped.

Scope of Coverage

We support the Commissions coverage of 40 and 150 watt lamps. PG&E continues to believe that the 40 watt category for general service incandescent lamps is significant in volume (between 12 and 17% depending on data source). Given the greater percentage of savings yielded by krypton gas fill in this lower wattage category (as much as 8 to 10% savings expected), we believe that NEMA's estimate of 7% of potential statewide savings for the standard is too conservative. While we agree with NEMA that current share of sales of 150 watt lamps is low (on the order of one percent), given the aging of the U.S. population, we expect sales to increase in the near term. For that reason, and because nominal savings are highest with these high wattage products, we support the Commission in covering these product categories in the standard. The Commission has already proposed to phase in the requirements for the 40 and 150 watt products, which addresses the industry concerns about changing too many products at once.

We also note that NEMA assertions that lamp wattages should not be reduced for 150 watt lamps because the aging population needs all of the light, is irrelevant, because the intent of the standard is reduce the wattage products while providing as much or more than the lumens expected from typical 150 watt incandescent. This assertion further convinces us of the risk that manufacturers may be hoping to comply with the proposed standards largely through dimmer bulbs (reduced lumen lamps).

Compliance Equations

PG&E continues to encourage the Commission to reconsider the specific performance requirements (equations) set forth in the 45 day language. We strongly recommend that the Commission use the equations shown in the table below. These equations preserve the existing "plateaus" evident in the 45 day language equations, but provide several subtle advantages over the previous equations, including:

1. Consistency in the width of the plateaus
2. Maintaining a minimum incremental stringency between the Tier 1 and Tier 2 lines to help prevent manufacturers from complying simply by dimming products
3. Ensuring that the soft white and frosted/clear standards equations are essentially parallel to each other but with differing stringency levels (the frosted/clear equation is slightly more stringent because, as industry has noted, frosted/clear bulbs are capable of producing 1% - 3% more light than soft white bulbs at the same wattage)

PG&E has commented on several occasions about the importance of having the diagonal portions of the Tier 2 compliance curve fall below the Tier 1 curve by 4 watts. It is this distance between the two lines that will help ensure against the very fears NEMA and

manufacturers raise in references to a "grand experiment". By maintaining a 4 watt distance between the diagonal portions (using the PG&E formulae) and the Tier 1 line, the Commission can reduce the risk that manufacturers will comply with Tier 2 primarily by producing dimmer bulbs. It is ironic that manufacturers express grave concerns about the prospects for customers shifting up to 71 from old 60 watt lamps to achieve equivalent light output, and yet at the same time advocate for less stringent standards equations that drastically increase the odds of this market response occurring. If manufacturers truly think that there will be a significant amount of up-shifting to new, compliant 71 lamps when replacing old, non-compliant 60 watt lamps (and attending loss in statewide savings), they should be supporting compliance equations more in line with those proposed by PG&E.

PG&E is disheartened by the mounting evidence that industry may be planning to comply with Tier 2 standards by producing lower wattage, lower lumen lamps. Higher efficacy lamps and significant statewide energy savings are the intended and highly probably outcomes of a properly designed general service incandescent standard. It is true that future consumer behavior cannot be predicted with complete certainty, but past successes on similar initiatives in California are instructive in assessing Tier 2's potential for energy savings. We note the success that the lamp industry has had in California selling compact fluorescent lamps (CFLs) on the basis of lumens rather than watts. This success has occurred despite substantial market barriers including high incremental cost, unfamiliar appearance, different light quality, size constraints, non-dimmability, temperature limitations, etc. Furthermore, this CFL market share was achieved while the same old and familiar 60, 75, and 100 watt lamps sat right next to CFLs on the shelf (and of course enjoyed more shelf space). These barriers dwarf what will be faced by higher efficacy general service incandescent lamps, whose only distinction will be superior performance and slightly lower wattage.

It seems highly unlikely, therefore, that intelligent lamp package labeling, modest retailer awareness campaigns, and education programs from California utilities that promote lumens over watts or watt equivalent choices will not consistently convince the typical customer to shift to the lower wattage higher efficacy lamps rather than up to a higher wattage, much higher lumen lamp. It is important to note that in this "experiment", the customers do not have the choice of staying with their regular old lamp. They must make a change. The product labeling, marketing and education programs need only direct the change not induce it. That is a great distinction we believe that industry is missing.

Updated Equations for Table K-3
Standards Equations for General Service Incandescent Lamps

Lamp Type		Maximum Power Use (Watts)	Maximum Allowed Wattage (W) as a Function of Lumens (L)
	Lumens (L)	January 1, 2006	PG&E Proposal for Tier II Standards
Frost or Clear	$L \leq 280$	(0.0500 * Lumens) + 21 [The standards for Frost or Clear in this column were adopted by the Energy Commission on December 15, 2004.]	$W = \frac{L}{20} + 21$
	$280 < L \leq 550$		$W = 35$
	$550 < L \leq 600$		$W = \frac{6}{25}L - 97$
	$600 < L \leq 800$		$W = \frac{L}{20} + 17$
	$800 < L \leq 950$		$W = 57$
	$950 < L \leq 1000$		$W = \frac{1}{5}L - 133$
	$1000 < L \leq 1080$		$W = \frac{L}{20} + 17$
	$1080 < L \leq 1300$		$W = 71$
	$1300 < L \leq 1350$		$W = \frac{27}{100}L - 280$
	$1350 < L \leq 1560$		$W = \frac{L}{20} + 17$
	$1500 < L \leq 1850$		$W = 95$
	$1850 < L \leq 1900$		$W = \frac{17}{50}L - 534$
	$1900 < L \leq 2560$		$W = \frac{L}{20} + 17$
	$2500 < L \leq 3000$		$W = 145$
Soft White	$L \leq 250$	(0.0500 * Lumens) + 22.5 [The standards for Soft White in this column were adopted by the Energy Commission on October 19, 2005.]	$W = \frac{L}{20} + 22.5$
	$250 < L \leq 500$		$W = 35$
	$500 < L \leq 550$		$W = \frac{11}{50}L - 75$
	$550 < L \leq 770$		$W = \frac{L}{20} + 18.5$

Updated Equations for Table K-3 (continued from previous page)
Standards for General Service Incandescent Lamps

1		2	3
Lamp Type		*Maximum Power Use (Watts)*	*Maximum Allowed Wattage (W) as a Function of Lumens (L)*
	Lumens (L)	*January 1, 2006*	*Potential Standards for January 1, 2008*
	$770 < L \leq 900$		$W = 57$
	$900 < L \leq 950$		$W = \frac{11}{50}L - 143$
	$950 < L \leq 1050$		$W = \frac{L}{20} + 18.5$
	$1050 < L \leq 1250$		$W = 71$
	$1250 < L \leq 1300$		$W = \frac{1}{4}L - \frac{483}{2}$
	$1300 < L \leq 1530$		$W = \frac{L}{20} + 18.5$
	$1530 < L \leq 1800$		$W = 95$
	$1800 < L \leq 1850$		$W = \frac{8}{25}L - 481$
	$1850 < L \leq 2530$		$W = \frac{L}{20} + 18.5$
	$2530 < L \leq 3000$		$W = 145$
Enhanced Spectrum	$L \leq 270$	No Requirement	$W = \frac{L}{20} + 21.5$
	$270 < L \leq 455$		$W = 35$
	$455 < L \leq 595$		$W = \frac{4}{25}(L - 600) + 57.5$
	$600 < L \leq 695$		$W = 57$
	$695 < L \leq 790$		$W = \frac{3}{20}(L - 800) + 72.5$
	$790 < L \leq 1090$		$W = 71$
	$1090 < L \leq 1195$		$W = \frac{9}{40}(L - 1200) + 95$
	$1195 < L \leq 1450$		$W = 95$
	$1450 < L$		$W = \frac{2}{15}L - \frac{295}{3}$