Submitted by e-mail to: docket@energy.ca.gov July 27, 2012

California Energy Commission
Dockets Office, MS-4
Re: Docket No. 12-OIR-1
1516 Ninth Street
Sacramento, CA 95814-5512

California Energy Commission
DOCKETED
12-OIR-01
TN # 66367
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In the Matter of:

Rulemaking to Consider Modification of Regulations Establishing a Greenhouse Gases Emission Performance Standard For Baseload Generation of Local Publicly Owned Electric Utilities

Docket No. 12-OIR-1
Rulemaking Workshop

Joint Comments of the
Natural Resources Defense Council and the Sierra Club in Response to the Energy Commission's Notice of Rulemaking Workshop

Introduction:

The Natural Resources Defense Council (NRDC) and the Sierra Club submit the following comments in response to the "Tentative Conclusions and Request for Additional Information" posted on July 9, 2012. We appreciate Energy Commission (Commission) consideration of the ongoing compliance and enforcement of the California Emissions Performance Standard (EPS) and recommend moving forward promptly to ensure California Publicly owned utilities have the guidance they need to fully and transparently comply with the EPS.

This proceeding is particularly timely because several California publicly owned utilities are facing significant investment decisions relating to pollution control requirements at San Juan Generating Station.[1] Clarity is also useful for decision-making regarding other environmental controls at Navajo Generating Station and Intermountain Power Plant. We commend the Commission for taking action to resolve any previous ambiguity in the implementing regulations of the EPS and ensure full and transparent compliance going forward.

We address each of the four points in the "Tentative Conclusions and Request for Additional Information:"

[1] On July 16th, 2012 EPA published a ninety day stay of the Federal Implementation Plan (FIP) rule affecting San Juan Generating Station. The stay does not delay final implementation dates or substantively alter the FIP. http://www.gpo.gov/fdsys/pkg/FR-2012-07-16/pdf/2012-16952.pdf

1) **Establish a filing requirement for all POU investments in non-EPS compliant facilities regardless of whether the investment could be considered a covered procurement.**

The Tentative Conclusions properly find that "it is reasonable and appropriate to require greater transparency regarding POU investments (including those solely for routine maintenance)." To achieve this transparency, information on POU planned expenditures on non-complaint facilities, or links to that information, should be posted on a CEC maintained website prior to expenditure approval.

a. Notification Mechanism

With regard to a notification mechanism, the Tentative Conclusions note that POUs can satisfy notice requirements in Section 2908 if the POU "provides the Commission with the uniform resource locator (URL) that links to" the required information. We agree that URL references to required information is an efficient method to notify the CEC of planned expenditures in non-EPS complaint facilities. We are however, concerned that simply providing URL references to the CEC does not ensure that interested parties are also timely informed. The CEC should also ensure that relevant service lists are simultaneously informed of POU activity and that URL links to POU disclosures are posted on a publicly available CEC website.

It is critical that the public, as well as the Commission, be timely notified of potential POU expenditures on non-compliant facilities. To ensure a fully public process, the CEC should require notice be posted and available to the CEC as soon as the relevant information is available and with sufficient notice to ensure public stakeholders are able to participate. In the case of agendas and agenda descriptions for public meetings, under Brown Act requirements, this may be 72 hours in advance of that meeting. In other cases, information should be available sooner. Unless the Commission ensures timely notice through a service list and on its website, interested members of the public could be denied the opportunity to review and participate in the evaluation of proposed investment decisions.

b. Scope of Information to Be Disclosed

As the Tentative Conclusions recognize, POUs should report and provide public notice on a wider range of investments at non-compliant facilities. First, URLs for the agenda and supporting documentation for all expenditures on non-compliant facilities – whether believed to be a covered procurement or not – deliberated by the POU's governing body should be provided to the Commission within the time frame set forth under the Brown Act. As this information will already be prepared and provided to the local governing agency, also providing the Commission with this same information does not create added administrative burdens.

In addition, significant questions remain as to the extent to which expenditures in non-complaint facilities are presented to the governing body for approval. As discussed in the Tentative Conclusions, POUs appear to have very different standards for whether planned expenditures are subject to staff or city council approval. Given this range of practices, limiting disclosure only to those expenditures currently subject to governing body approval fails to achieve needed

transparency. NRDC and Sierra Club look forward to POU responses to CEC inquiries on the procedures and trigger points for bringing potential investments to the governing body for approval and identifying best practices that maximize transparency.

At this juncture, we recommend that all documents or information needed to allow for an informed understanding of planned capital and debt expenditures or any contractual amendment or new contract affecting a non-complaint facility be made available through the notification methods detailed above. Given the ease with which documents can now be posted and uploaded, the benefits to transparency from disclosing planning expenditures far outweigh the administrative effort need to upload and post this information. Nonetheless, to ease potential administrative burdens, NRDC and Sierra Club are also amenable to a standard such that expenditures under a threshold value, such as $50,000, need not be disclosed.

We also recommend that the CEC request an annual compliance plan from each POU with any interest in a non-compliant facility. Each POU should file a letter with the CEC, annually providing an update on its plans for compliance with the EPS, including any plans for activity, investment, capital expenditure or dent, contractual changes, sale of interest, or other activity at non-compliant facilities.

2) **Establish criteria for, or further define, the term "covered procurement," including specifying what is meant by "designed and intended to extend the life of one or more generating units by five years or more" and "routine maintenance."**

    a. **NRDC and the Sierra Club support the conclusion that activities undertaken to achieve environmental upgrades or comply with legal mandates are covered procurements.**

The Energy Commission cites the Final Statement of reasons extensively to conclude that "there should be no doubt" that activities "undertaken solely or principally for compliance with legal or regulatory requirements or to achieve environmental improvements" "go beyond routine maintenance" and therefore fall outside the exception of "routine maintenance" and are therefore covered procurement.[2] We support this conclusion.

The FSOR[3] makes clear that SB1368 "provides no exception for efficiency or environmental controls" as routine maintenance or otherwise, and that exempting these types of investments from the EPS undermines the goal of SB1368. (33, 41, 44) The conclusion and included citations to the FSOR resolve that activities undertaken to achieve environmental improvements do indeed trigger the EPS, "POUs are able to make environmental improvements beyond routine maintenance so long as those improvements result in the power plant meeting the EPS. The same is true for any investments needed to comply with legal or regulatory requirements." (41) It is evident from the FSOR that activities for environmental improvement do not constitute routine maintenance and to exempt these investments from the EPS "would violate the intent and

[2] CEC, Tentative Conclusions, p. 5, July 9, 2012.

[3] Page numbers below refer to the *Final Statement of Reasons For Adoption of Regulations Establishing And Implementing A Greenhouse Gases Emissions Performance Standard For Local Publicly Owned Electric Utilities*. California Energy Commission, Docket 06-OIR-1. August 31 2007.

provisions of SB 1368." (44) The report states that "allowing POUs to make small environmental improvements in power plants without reducing the greenhouse gases emissions of these power plants to a reasonable level (as determined by the EPS) does not address the potential problems identified in SB 1368 and does not further the purpose of that statute." (41)

The Commission's conclusion will ensure that POUs efforts to reduce and control pollution also instigate a requirement to reduce greenhouse gas emissions and therefore to achieve the goals outlined SB1368.

The Final Statement of Reasons is replete with discussion of this issue and makes it clear that investments made for the purpose of legal and regulatory requirements do trigger the Emissions Performance Standard:

> The Energy Commission has determined that allowing investments for "capital improvements for equipment or plant upgrades and renovations or necessary reconstruction" that go beyond routine maintenance to automatically be exempt from the EPS would violate the intent of SB 1368. (23)
>
> **The language of SB 1368 is not ambiguous – it clearly provides no exception for efficiency or environmental controls.** The CPUC has not provided an exemption for efficiency or environmental controls in its decision. Therefore, the Energy Commission believes that the bill provides no authority for the Energy Commission to provide such an exemption here. (33)
>
> **As discussed above, the Energy Commission has determined that providing a universal exemption for environmental improvements or legal or regulatory obligations contradicts and exceeds the authority granted under SB 1368.** (40)
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> **POUs are able to make environmental improvements beyond routine maintenance so long as those improvements result in the power plant meeting the EPS. The same is true for any investments needed to comply with legal or regulatory requirements.** (41)
>
> Long-term financial commitment is defined as "either a new ownership investment in baseload generation or a new or renewed contract with a term of five or more years, which includes procurement of baseload generation." (Public Utilities Code section 8340(j).) **No exception from this requirement is made for investments needed to make environmental improvements or to comply with legal or regulatory requirements.** (41)
>
> Thus, allowing POUs to make small environmental improvements in power plants without reducing the greenhouse gases emissions of these power plants to a reasonable level (as determined by the EPS) does not address the potential problems identified in SB 1368 and does not further the purpose of that statute. (41)
>
> As discussed in response to comment 9(n) above**, investments to make environmental improvements or to comply with legal or regulatory requirements are not exempted**

from these regulations because that would violate the intent and provisions of SB 1368. (44)

POUs will only be unable to install pollution control equipment if such equipment would extend the life of the power plant by five years or more, or increase its capacity by more than 10% and would not concomitantly reduce its greenhouse gases emissions equal to or below the EPS. **SB 1368 does not place a disincentive on the reduction of pollution, it merely ensures that if POUs are going to make such an investment, with the potential risks that go with it, then POUs should ensure that greenhouse gases emissions are also reduced to an acceptable level.** (46)

While we agree that it is necessary to provide an exemption for routine maintenance activities to ensure that powerplants are adequately maintained and do not deteriorate, **we believe that exempting activities for other purposes, such as plant improvements for environmental or other reasons, goes beyond the intent of SB 1368.** (79)

We support the Commission's conclusion, based on the substantial record in the FSOR, that investments for the purpose of meeting new legal or regulatory mandates for pollution control are not exempted, and therefore trigger the EPS.

3) **Make changes consistent with the requirements of Public Utilities Code section 8341, subdivision (f). This subdivision requires the Energy Commission, in a duly noticed public hearing and in consultation with the California Public Utilities Commission and the State Air Resources Board, to reevaluate and continue, modify, or replace the greenhouse gases emission performance standard when an enforceable greenhouse gases emissions limit applicable to POUs is established and in operation.**

As we stated in our previous comments, we believe the EPS is a critical component of California's long term policy to reduce global warming pollution and should therefore remain in place indefinitely. We support the Commissions initial conclusion that evaluation under Public Utilities Code section 8341, subdivision (f) is not yet appropriate.

4) **Make any other changes to carry out the requirements of SB 1368.**

   a. **The CEC should work with the CPUC to Tighten the EPS.**

SB 1368 recognizes that, to the extent the State's energy and capacity needs cannot be met through energy efficiency and renewable resources, the State will "encourage the development of cost-effective, highly efficient, and environmentally-sound supply resources."[4] It has been over five years since the original EPS of 1,100 tons lbs/MWh was adopted. Updating the standard would continue to fulfill the purpose of SB 1368 by ensuring that California continues to procure only highly efficient energy resources. In addition, updating the EPS to reflect what is now technologically and economically feasible will maintain California's leadership role in setting policies that achieve meaningful reductions in greenhouse gas pollution.

[4] SB 1368 § 1(d).

When initially adopted, the EPS represented a critical early step toward reducing U.S. greenhouse gas emissions. The 1,100 lb limit established by California effectively precluded base load generation of electricity for California utilities by combustion of the most polluting forms of fossil fuels – coal and oil— and by the most polluting of the available natural gas-based technologies, including the use of simple cycle combustion turbines, unless those facilities incorporated carbon capture and sequestration.

However, the 2007 EPS is not sufficiently stringent to require the use of the most efficient and least polluting base load fossil-fueled technology commonly available today – high efficiency natural gas combined-cycle (NGCC). The following analysis demonstrates that an EPS of 825-850 lbs/MWh, with potentially a higher EPS for smaller facilities is feasible and economic today. We ask the Commission to work with the CPUC to tighten the EPS accordingly and welcome further workshops on this issue.

NGCC technology has been commonly employed in California for decades and, indeed, represents the most likely choice for new fossil fuel-fired generation over the next several decades. However, within the group of NGCC units there are clear distinctions in the efficiency and CO_2/MWh emission rates associated with differences in designs. Similar units, even similar units produced by the same manufacturer, show substantially different rates of CO_2/MWh emissions. The emission rates of some existing NGCC units are twice as high as the best performers. These differences are not serendipitous, but the consequence of deliberate decisions of the designers to incorporate features and systems that enhance combustion and generating efficiency. For example, the performance of NGCC units is improved when the manufacturer designs the turbines to operate at higher temperatures. For every 30 Celsius degree ("°C") rise in gas turbine firing temperature, the combined cycle efficiency increases by about one percent; an efficiency of 60 percent can be reached if the design operating temperature approaches 1500 °C.[5] Improved gas turbine efficiencies can also be achieved through the use of improved thermal coatings, closed circuit steam or water cooling of turbine blades, and use of nitrogen instead of steam as the diluent for reducing NO_x formation. The efficiency of the NGCC unit can also be substantially increased by using fully-fired heat recovery steam generator (HRSG) units, which have higher, but nonetheless reasonable, construction costs than partially fired or unfired HRSGs.[6] These techniques and the relative efficiency improvements that result from their use are well known, and are routinely offered by vendors as optional cost-effective upgrades to standard units.[7]

Publicly available design and emission data for existing units demonstrates that commercially available NGCC EGUs can and have emitted CO_2 at less than 825 – 850 lb/MWh on a net emissions basis. Since the added capital cost of the more efficient designs is more than offset by the reduction in fuel cost, especially in base load applications, the California can reduce CO_2 emissions from affected electricity generation by approximately 25 percent -- without added cost to consumers.

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[5] P. Chiesa and E. Macchi, Trans. ASME, Journal of Engineering for Gas Turbine and Power, v. 126, no. 4, pp. 770-85, 2004.

[6] See, Chase, D.L and Kehoe, P.T. GE Power Systems, *GE Combined-Cycle Product Line and Performance, p.3* http://physics.oregonstate.edu/~hetheriw/energy/topics/doc/elec/natgas/cc/combined%20cycle%20product%20line%20and%20performance%20GER3574g.pdf

[7] Id. at Table 14.

Accordingly, the Sierra Club and NRDC strongly support a substantially lower EPS..

California's 2007 EPS also provided critical leadership in moving the climate change policy discussion forward at the Federal level. Following California's early lead, the United States Environmental Protection Agency (EPA) recently proposed[8], and is now considering, CO_2 emission limits for new fossil-fuel fired EGUs (EGU NSPS).[9] EPA's proposed emission limit is 1,000 lb CO_2/MWh. NRDC and the Sierra Club, along with other environmental organizations, have submitted extensive comments in support of a robust, feasible, and protective Federal limit (Joint Environmental Comment). Much of what follows here is taken from that comment.[10]. Not surprisingly, a number of industry commenters oppose EPA's effort and at least one major industry group comment has cited to California's EPS as support for adoption of the least protective limit within EPA's proposed range.[11] Timely action by the Energy Commission and CPUC to revise the 2007 EPS limits to reflect the demonstrated performance of the better base load NGCC units could therefore assist once again in moving the nation towards a more sensible response to the very real threats posed by climate change.

NRDC and the Sierra Club urge the Energy Commission to take up this important issue now, to ensure that developers of new EGUs choose the most efficient units available. The data on existing units demonstrate that developers did not always choose the most efficient units available to them, even with the higher natural gas prices of a decade ago. Given the urgent need to reduce carbon emissions from the entire electricity sector, a stringent standard is needed to minimize carbon emissions from NGCC units.

Further technical analysis supporting this recommendation is included in Attachment 1. Associated technical work papers available upon request from NRDC.

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Conclusion:

We thank the Commission for this opportunity to comment. We encourage the Commission to move to finalize these conclusions and adopt our requested change to reporting requirements in order to ensure that future investments comply with the EPS. The Commission should also move to adopt a lower EPS as recommended herein, with consultation of ARB and the CPUC.

We look forward to our ongoing participation and collaboration in this proceeding.

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[8] 72 Fed. Reg. 22,392 (Apr. 13, 2012)

[9] EPA is proposing to establish a New Source Performance Standard (NSPS) under section 111 of the CAA.

[10] The full comment can be found at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0660-10887 and includes supporting documentation for a number of the comments provided here.

[11] Comments of the Utility Air Regulatory Group on the Proposed Standards of Performance for Greenhouse Gas Emissions For New Stationary Sources: Electric Utility Generating Units, 77 Fed. Reg. 22,392 (Apr. 13, 2012), Docket ID No. EPA-HQ-OAR-2011-0660, *available at* http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0660-9995

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Appendix 1: Technical Justification for tightening the EPS

a) Emissions Data From Existing Facilities Show That a Substantially Lower EPS is Appropriate

In service CO_2 emissions data that sources have been reporting pursuant to the Federal Clean Air Act's ("CAA") Acid Rain Program clearly demonstrate the feasibility of a substantially reduced EPS. These data are maintained by EPA's Clean Air Markets Division and are commonly referred to as "CAMD data." While the CAMD data file does not report the capacity of the unit,[1] the emissions data have been collected in much the same way that EPS and EPA's proposed standard will be enforced and are subject to legal sanctions if improperly collected or reported.

Table 1, below, lists a substantial number of NGCC units that commenced operation since 2005, where the highest annual average CO_2 emission rate during the period from 2006 to 2011, on a net basis, is less than 850 lb/MWh.[2] As identified in Appendix A to the Joint Environmental Comment, certain data were excluded as outliers. The gross emission rates were converted to net emissions by applying a 3 percent conversion factor, but no adjustment is made for load, temperature, NOx controls or decay in performance over time as these are reflected in the data itself. These units include units with different in-service dates, some with NOx controls, some in warm climates (many are in MS and FL, some at low altitudes (Astoria, 3 feet), some at high altitudes (Lakeville, 4500 feet) and with varying loads (as shown in the underlying data on gross CO2 emissions). As Table 1 shows, there were 30 units that commenced operation since 2005, whose highest reported annual emissions have been below 850 lb/MWh (net) since 2005. The average of the highest reported annual emissions of this group is 817 lb/MWh (net). The average of the highest reported annual emissions of the top 10 performers is 791 lb/MWh (net).

Table 1 – Highest Reported Annual Average CO_2 Emission Rate – 2006 -2012 (Units < 850 lb/MWh(net)[3]

Facility ID	Facility Name	State	Unit ID	Emission rate (gross)	Emission Rate (net)
55375	Astoria Energy	NY	CT2	741	763
7845	Lagoon Creek	TN	LCC1	743	765
56237	Lake Side Power Plant	UT	CT01	766	789

[1] The capacity data reported herein are from information collected and maintained by the Energy Information Administration (EIA).

[2] These data generally reflect operations in the first year where the HRSG may not yet have been operating. If the "outlier" data are included, the average of the top 10 units increases slightly to 807 lb/MWh (net) and the number of existing units that have demonstrated an ability to comply with a standard of 850 lb/MWh is reduced to 20. We have also excluded the Kleen Energy Center and Jack County units, where substantial variability in the data prevented us from ascertaining the representative high emission rate, and the Sand Hill Energy Center, where questions concerning the reported emission rate (603-655 lb) are as yet unresolved. Where less than a full year's data is reported, all available data was used.

[3] This table is derived from data included in Appendix D of the Joint Environmental Comment to EPA.

56237	Lake Side Power Plant	UT	CT02	767	790
56031	Fox Energy Company LLC	WI	CTG-1	768	791
7845	Lagoon Creek	TN	LCC2	775	798
55375	Astoria Energy	NY	CT1	778	801
56407	West County Energy Center	FL	WCCT3C	778	801
55853	Inland Empire Energy Center	CA	1	780	803
56407	West County Energy Center	FL	WCCT3A	781	804
56407	West County Energy Center	FL	WCCT3B	781	804
55230	Jack County Generation	TX	CT-4	783	806
55694	Quantum Choctaw Power,	MS	AA-002	790	814
710	Jack McDonough	GA	4A	802	826
7082	Harry Allen	NV	**6	803	827
7082	Harry Allen	NV	**5	804	828
56407	West County Energy Center	FL	WCCT1A	806	830
564	Curtis H. Stanton	FL	CCB	807	831
55694	Quantum Choctaw Power	MS	AA-001	810	834
56407	West County Energy Center	FL	WCCT1C	811	835
55853	Inland Empire Energy Center	CA	2	811	835
56407	West County Energy Center	FL	WCCT2B	811	835
56234	Caithness Long Island Energy	NY	0001	812	836
56407	West County Energy Center	FL	WCCT2C	815	839
56407	West County Energy Center	FL	WCCT2A	816	840
2720	Buck	NC	12C	816	840
2720	Buck	NC	11C	816	840
56407	West County Energy Center	FL	WCCT1B	817	842
621	Turkey Point	FL	TPCT5B	824	849

Table 2, below, provides the same information for older sources in EPA's CAMD data set constructed prior to 2005

Facility ID	**Facility Name**	**State**	**Unit ID**	**Emission rate (gross)**	**Emission Rate (net)**
50292	Bethpage Energy Center	NY	GT2	770	793
50292	Bethpage Energy Center	NY	GT1	762	785
55221	Oswald Gen Sta	GA	G5	812	837
55294	Westbrook Energy Center	ME	1	776	800
55112	Calpine Sutter	CA	CT02	786	810
56102	Currant Creek	UT	CTG1B	789	812
55294	Westbrook Energy Center	ME	2	797	821
56102	Current Creek	UT	CTG1A	797	821
55112	Calpine Sutter	CA	CT01	800	824
55123	Magic Valley Generating Sta	TX	CTG-1	802	826
55386	Columbia Energy Center	SC	CT-2	803	827
55123	Magic Valley Gen Sta	TX	CTG-2	808	833
55641	Riverside Energy Center	WI	CT-01	814	838
3	Barry	AL	7A	814	839
3	Barry	AL	6B	814	839
7897	E B Harris	AL	1A	814	838
55641	Riverside Energy Center	WI	CT-02	815	840
55333	Delta Energy Center	CA	1	815	839

7897	E B Harris	AL	2A	819	843
55182	Sunrise Power	CA	CTG1	819	844
55182	Sunrise Power	CA	CTG2	815	839
7897	E B Harris	AL	1B	821	845
7897	E B Harris	AL	2B	812	836
55386	Columbia Energy Center	SC	CT-1	822	846

These data incorporate substantial allowances for variability in performance as they are based on the highest annual average reported for each of these units from 2006-2011 and because they include emissions from turbine models that have or will soon be replaced by more efficient models. Accordingly, no further allowance is called for. These data, along with the performance specification data discussed below, clearly establish that the EPS for new units should be no greater than a range of 825 -850 lb CO_2/MWh. The CAMD data for these existing units represent a ceiling which the EPS for new generation or procurement should not exceed.

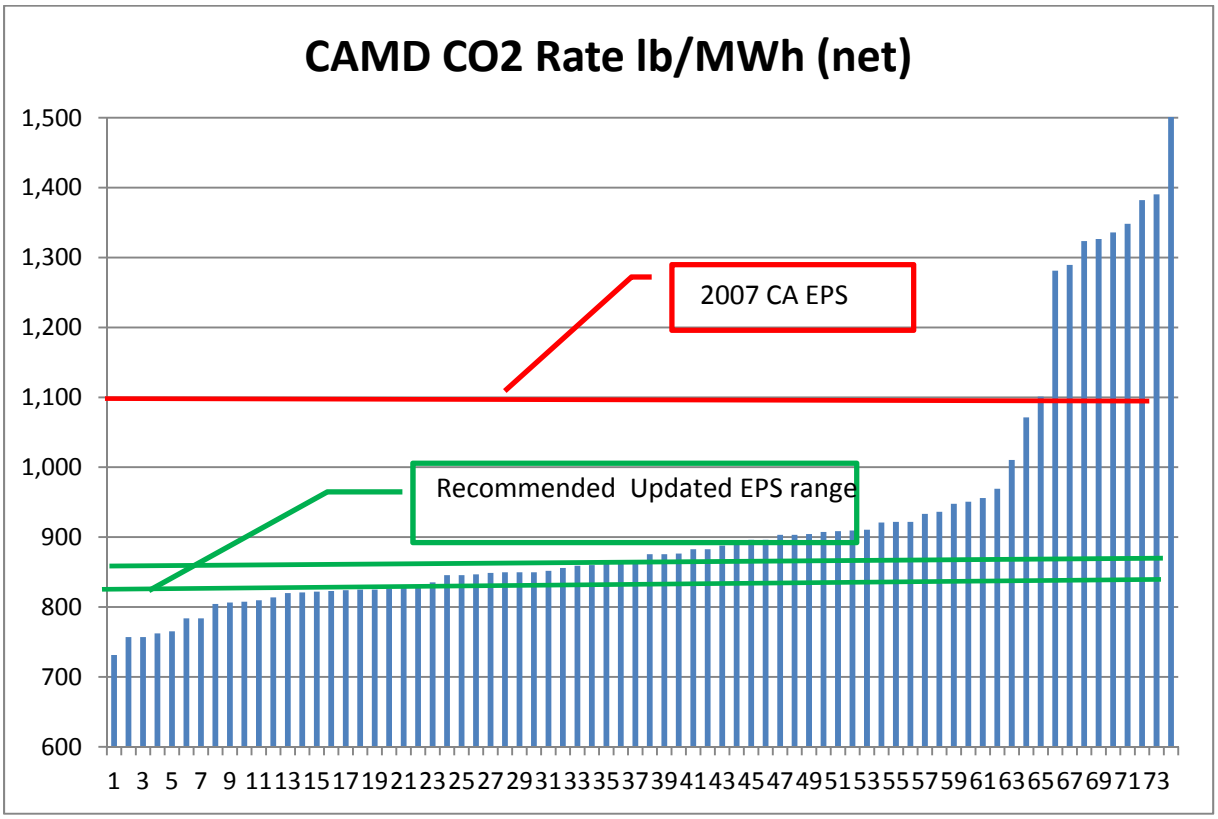
We have reviewed the CAMD emission data for units that are shown in the Energy Commission's records as having been constructed since 2007. This information is provided in Table 3, below and demonstrates that (1) all such units emit substantially below the current EPS and (2) that the majority of those units emit at rates at or near the levels we recommend for a revised RPS.

Table 3. Annual CO_2 emission rates for California units constructed since 2007.

Facility Name	**Facility ID/ Unit ID**	**Capacity base/peak (MW)**	**Average rate 2007-2011 (gross)**	**Representative rate (gross)**	**Representative rate (net)**
Gateway Generating Station	56476/ GT1	265	848.0	837	862.1
Gateway Generating Station	56476/ GT2	265	868.9	855.0	880.7
Roseville Energy Park	56298/ CT001	60/80	891.4	890.0	916.7
Roseville Energy Park	56298/ CT002	60/80	895.3	890.0	916.7
Inland Empire Energy Center	55853/ 2	405	793.3	790.0	813.7
Inland Empire Energy Center	55853/ 1	405	795.2	770.0	793.1
Otay Mesa Energy Center, LLC	55345/ CTG-1	260/305	828.7	829.0	853.9
Otay Mesa Energy Center, LLC	55345/ CTG-2	260/305	832.0	832.0	857.0
Colusa Generating Station	56532/ CT2	330	900.0	920.0	947.6
Colusa Generating Station	56532/ CT1	330	901.3	941.0	969.2

In the course of developing its proposed EGU NSPS EPA reviewed CAMD emission data for newer units. These data[4] are set out in Figure 1 and clearly demonstrate the feasibility of a substantially reduced EPS.[5]

Figure 1. Annual CO_2 Emission Rates for Newer Units – EPA CAMD Data (lb/MWh net)



b) Manufacturer Specifications for Existing Unit Designs, Adjusted for Real World Conditions, Also Support an EPS Substantially Lower Than the 2007 EPS

In addition to the in-use CAMD emissions data, there is another body of information that supports a substantial reduction in the EPS – the performance specifications for heat rate and net plant efficiency established by the manufacturer. EPA recently reviewed these specifications for models introduced since 2005 in support of its EGU NSPS proposal ("EPA Performance Specification Analysis").[6] EPA's review included the performance specifications developed by major manufacturers of NGCC units for "new and clean" performance of 89 commercially available models that have been introduced since 2005 from a publication titled Gas Turbine

[4] *available at* http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2011-0660-0029

[5] EPA's data is collected on a gross emissions basis, We have applied a three percent correction factor to convert this data to a net emissions basis, but have not otherwise altered EPA's file.

[6] Memorandum from OQAPS to EGU NSPS Docket, *Design Data for New Combined Cycle Facilities*, Attachment Entitled "Gas Turbine World Performance Specifications (Apr. 12, 2012), Document ID No. EPA□HQ□OAR□2011□0660□0068 ("EPA Data Set")

World Handbook.[7] These data ("EPA Data Set") are included in the EPA docket as an attachment to the EPA Performance Specification Analysis and are attached to this comment. The manufacturers' performance specifications are based on "new and clean" gas turbine ratings for net plant output and base load operation of a standardized reference plant, including losses and auxiliary loads, on natural gas fuel, at 59°F, sea level, and reasonably realistic steam cycle conditions.[8] Thus, they do not reflect the range of operating conditions that will be experienced by NGCC units. For this reason, the EPA Performance Analysis includes adjustments to the manufacturers' specifications to account for altitude, temperature, part load performance and in-service degradation over time to create an emissions profile of recent commercially available NGCC models.

EPA's adjustments amount to an increase in the net heat rate of nearly 13 percent over the standard design conditions.[9] NRDC and the Sierra Club agree that some correction to design data is needed to address certain operational variables. However, in some instances EPA's proposed corrections were not supported by information in the record and were either overly large or entirely unwarranted. In sum, where EPA has proposed to correct the manufacturers' heat rate and unit efficiency specifications at ISO conditions by a factor of 11 percent plus 125 Btu/Kwh. We believe that this correction factor has not been shown to be larger than 7-8 percent plus 50 Btu/kWh.[10] These technical differences, in total, represent a difference in emission rate estimates of about 36 lb CO_2/MWh. Thus, while they are not trivial, these differences are also not the dominant reason for our view that EPA's proposed limit is too lenient or that a substantially reduced EPS is appropriate.

EPA noted that, after employing its adjustment factors, almost all of the designs represented in the EPA data set would meet its proposed limit of 1000 lb CO_2/MWh and suggests that this fact supports adoption of that limit. Joint Environmental Commenters have observed that a NSPS is not intended to serve as the lowest common denominator for existing units and commented that EPA should instead base its limit on the best performing units and reasonably anticipated advances in technology.

Similarly, the Sierra Club and NRDC believe that California's EPS should reflect the performance of the better performing commercially available units rather than the most polluting options available in the marketplace.

Figure2 shows the emission rates from the units in the EPA data set using the our correction factors

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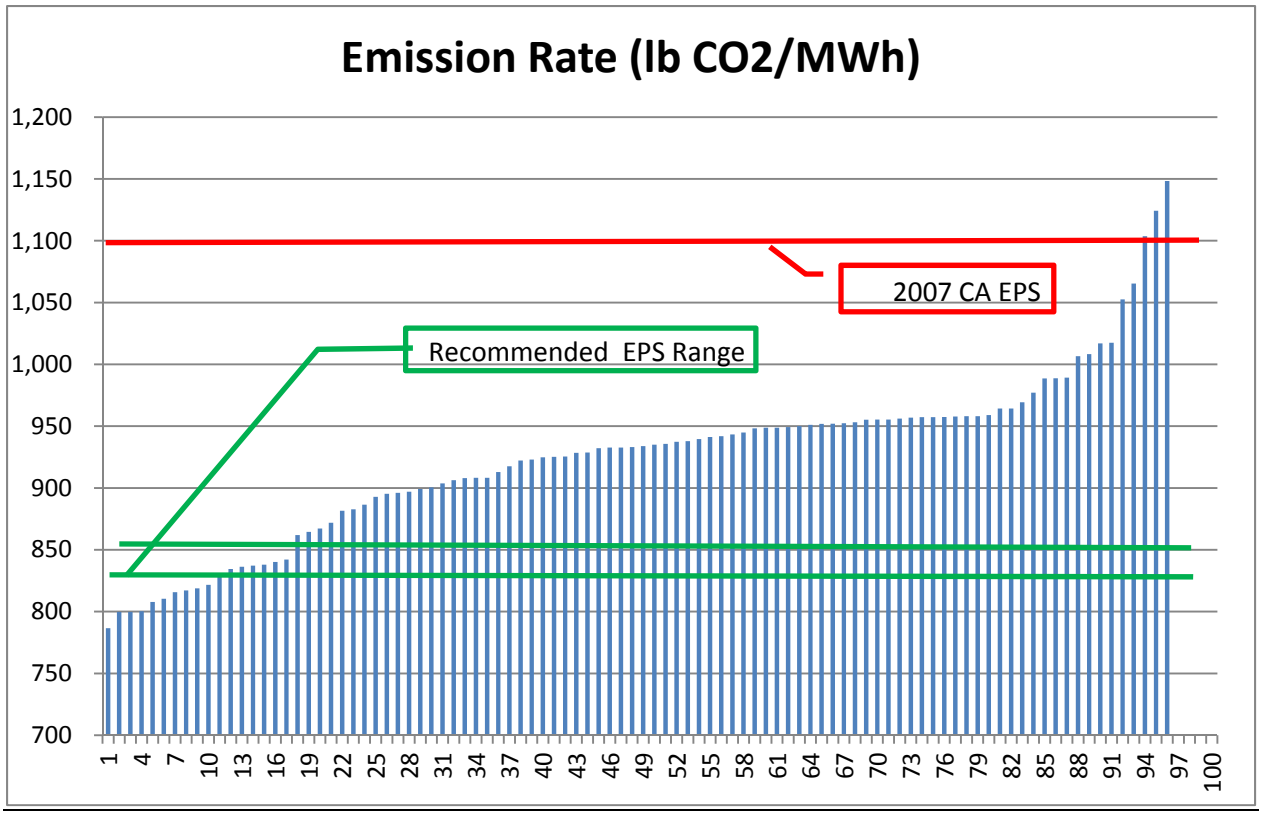
[7] 2011 Performance Specifications, Gas Turbine World, 27th Ed., Available at: http://www.gtwbooks.com/GTW-Archive.html. See also, Gas Turbine World, 2012 GTW Handbook, v. 29 ("2012 GTW Handbook")
[8] 2012 GTW Handbook, p. 64.
[9] 125 Btu/kW is slightly less than two percent of the heat rate of the better performing units.
[10] See, Joint Environmental Comment at p. 47 for the full discussion of these issues.

Figure 2. Unit Emission Rates for Combined Cycle Units – EPA Data Set



In addition to considering the demonstrated in-service and performance specifications of existing units and commercially available models, the Energy Commission should also evaluate those performance improvements that can be reasonably anticipated. Over the past few years there has been an across the board effort by turbine manufacturers to significantly increase the efficiency of gas turbine design under full and part-load conditions in both simple and combined cycle mode.[11] New, more efficient models, not reflected in the performance data relied on by EPA, have recently been introduced or announced by vendors for entry into the market in the near future. Finally, we note that the Gas Turbine World Handbook points out that the performance specifications are conservative[12] and that better performance is possible – as much as a 1.5 percent gain in overall plant efficiency – for higher, but none the less reasonable, costs.[13]

c) Small NGCC Emission Rates

The EPS applies to baseload power generated by or for affected utilities irrespective of the size of the generating unit. The efficiency of NGCC units is largely a function of gas turbine

[11] See discussion in Gas Turbine World, 2012 GTW Handbook, pp. 6 -24.

[12] This is not inappropriate as the manufacturer may be liable for damages if the promised performance is not achieved.

[13] 2012 GTW Handbook, p. 64.

operating temperature; the use of enhancement techniques, such as inlet air cooling; and the use of fully fired HRSGs. There is nothing in the laws of physics that prevents smaller NGCC units from achieving the efficiencies of larger units. However, the CAMD emission data show that best performing existing units less than 150-200 MW in size generally have higher emissions than larger units. In addition the manufacturers' performance specifications for small units generally had efficiencies less than 55 percent while the better performing larger units had efficiencies of 59 to 60 percent.

NRDC and the Sierra Club recommend that the California not allow the theoretical existence of a potential market for a few small units to serve as a basis for setting a standard that is overly lax when applied to the larger units that are more likely to be responsible for most of the emissions from the category. To the extent that the Energy Commission is concerned that smaller units may not be able to meet the same limits as larger units, the agency should establish a size-based subcategory and set a separate limit for smaller units.

The Sacramento Power Authority and Roseville units appear to be the lowest emitting "small" NGCCs. The reported annual emission rate for these units for the years 2006-2012 ranges from 826-863 lb/MWh (Sacramento) and 877-926 lb/MWh (Roseville) on a gross emissions basis. If we assume that these units are the benchmark for a small NGCC emission standard and apply a 3 percent conversion factor to the highest years' emissions the resulting limit for small NGCCs would be 900-950 lb/MWh (net).

Table 4 displays the highest reported annual average emission rate (gross) and the highest reported emission (net) for each of the small units that we have been able to identify. Thirteen of these 15 units would have complied with EPA's proposed 1000 lb (gross) emission limit but none of these units would have met the 825-850 lb (net) range recommended above.

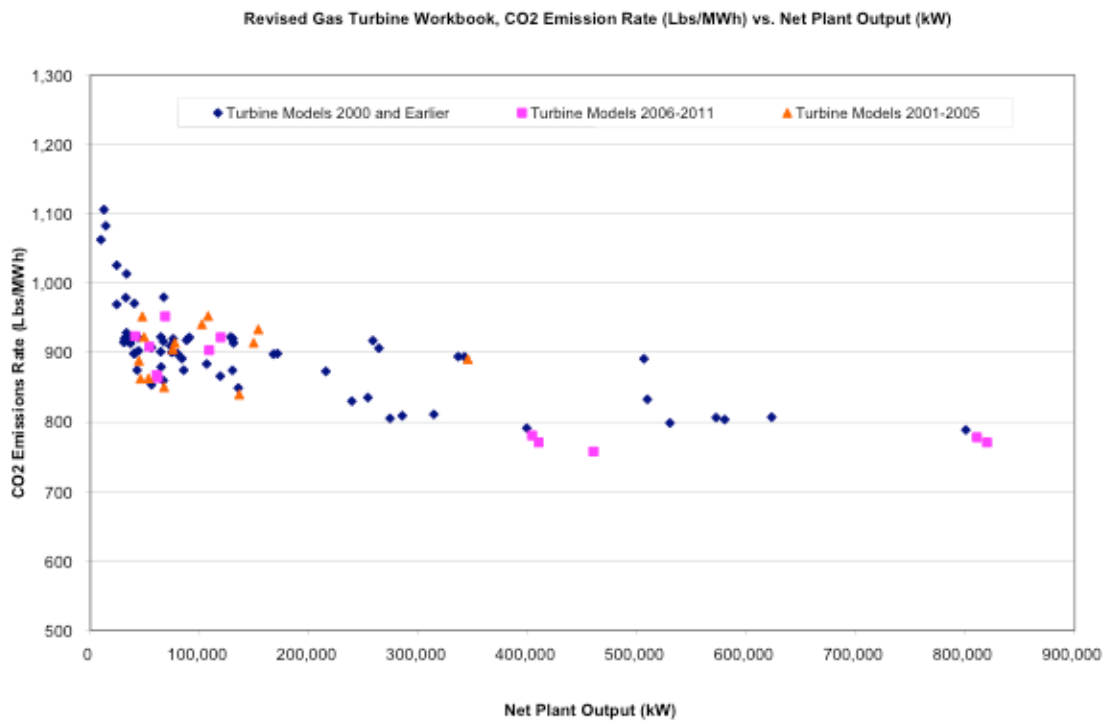
Table 4. Small (<= 200 MW) combined cycle CO_2 emission rates (lb/MWh)

FacilityID_	Facility Name	State	UnitID	Rate (gross)	Rate net)
7552	Sacramento Power Authority	CA	1	863	889
55818	Frederickson	WA	F1CT	911	938
56298	Roseville	CA	CT001	922	950
56298	Roseville	CA	CT002	926	954
56026	Raesfeld	CA	PCT2	937	965
56026	Raesfeld	CA	PCT1	941	969
7527	Carson Cogen	CA	D1	959	988
50458	Indeck Corinth	NY	1	963	992
56188	Pinelawn	NY	00001	974	1,003
54586	L'Energia	MA	2	977	1,007
55026	Dighton	MA	1	984	1,014
55977	Bluffview	NM	CTG-1	986	1,015
55200	Arapahoe	CO	CT6	994	1,024

55200	Arapahoe	CO	CT5	1,016	1,046
54076	Indeck Olean	NY	1	1,043	1,074

The manufacturer's performance specifications show a substantial number of potential small combined cycle designs where the demonstrated emission rate at ISO conditions is at or below 900 lb/MWh. See Figure 3.[14] With the application of reasonable factors to account for operation at non-ISO conditions, an emission limitation of 1000 lb/MWh (net) appears to be attainable by these units. If California determines that subcategories by size are justified, the data demonstrate that the "cut point" in capacity between large and small units should be somewhere between 150 MW and 200 MW. Further analysis could identify where, within this range, the subcategories should be divided.

Figure 3. CO2 Emission Rate (Lbs/MWh) vs. Net Plant Output (kW)[15]



d) Opportunities to improve efficiencies of existing NGCC power plants

[14] See also Appendix C to the Joint Environmental Comment.

[15] This figure uses EPA's data from the Gas Turbine Workbook, Combined Cycle tab, modified to reflect the adjustments discussed above: pollution control heat rate increase 50 Btu/kWh; degradation factor of 2.5%; part load adjustment of 5% and no temperature adjustment.

There are a number of options that may be available to utilities subject to the EPS to make modifications to existing units, or the manner in which they are operated to reduce CO_2 emission rates. These options include limiting part load operation and supplemental firing to the extent possible, increased frequency of cleaning and other routine maintenance to limit degradation; increased frequency of major overhauls to restore degraded units to near new performance levels and by optimizing the performance of the HRSG.[16] We note that the Energy Commission has commissioned research in this area.[17] One project funded by the Energy Commission successfully demonstrated the feasibility of increasing NGCC efficiency by 0.5% using an ejector-diffuser to reduce the pressure losses in the transition section between a gas turbine exhaust diffuser and the heat recovery steam generator. Such an improvement would reduce CO_2 emission rates by approximately 8 lb/MWh. By itself, such a change might not be considered significant, but can be combined with other options that incrementally improve efficiency. Greater improvements can be achieved by larger projects such as converting unfired or partially fired HRSGs to fully-fired designs and by replacing single pressure turbines with multi-pressure designs.

Importantly, as a number of older NGCC units in California near the end of their useful lives, today's market offers a wide array of options to upgrade those units with new, highly efficient units. The offerings of General Electric are typical of the choices available to publicly owned utilities.[18]

Table 5. GE Combined Cycle Product Line and Performance

Combined Cycle Designation	Net Plant Power (MW)	Net Plant Heat Rate (LHV)	Thermal Efficiency (%, LHV)
S106B (4)	64.3	6960	49.0
S206B (4)	130.7	6850	49.8
S406B (4)	261.3	6850	49.8
S106FA (5)	107.1	6440	53.0
S206FA (5)	217.0	6355	53.7

[16] http://soapp.epri.com/papers/CC_Heat_Recovery.pdf

[17] See also, http://www.energy.ca.gov/2011publications/CEC-200-2011-008/CEC-200-2011-008.pdf http://www.energy.ca.gov/pier/portfolio/Content/Completed97to06/Completedprior05plusEISG05/Method%20of%20Improving%20Efficiency.htm

[18] Chase, D.L and Kehoe, P.T. GE Power Systems, *GE Combined-Cycle Product Line and Performance*, *supra*, at Table 4. Notes: 1. Site conditions =59 F, 14.7 psia, 60% RH (15 C, 1.013 bar)
2. Steam turbine exhaust pressure = 1.2 inches Hg,A (30.48 mm Hg,A)
3. Performance is net plant with allowance for equipment and plant auxiliaries including those associated with a once-through cooling water system
4. Three-pressure, non -reheat, heat-recovery feedwater heating steam cycle
5. Three-pressure, reheat, heat-recovery feedwater heating steam cycle with integrated fuel, gas-heating system
6. Three-pressure, reheat, heat-recovery feedwater heating steam cycle with integrated turbine steam- and air-cooling and fuel-heating systems

S107EA (4)	130.2	6800	50.2
S207EA (4)	263.6	6700	50.9
S107FA (5)	262.6	6090	56.0
S207FA (5)	529.9	6040	56.5
S107FB (5)	280.3	5950	57.3
S207FB (5)	562.5	5940	57.5
S107H (6)	400.0	5690	60.0

Thus, if a utility desires to purchase a new GE NGCC in the 270 MW size range, it can choose from the S406B, the S207EA, the S107FA or the S107FB Model. The efficiencies and heat rates of these choices vary by 15 percent, which, given the size of these units, represents a significant difference in CO_2 emissions over the life of the unit. We recommend that the EPS be revised to assure that in such a situation, the most efficient and least polluting option must be exercised.