Comments of Southern California Edison Company on
Electricity and Natural Gas Committee Workshop on Combined Heat and Power Guidelines

2008 Rulemaking on Implementation of the Waste Heat and Carbon Emissions Reduction Act	)))	Docket No. 08-WHCE-1

I. INTRODUCTION

SCE appreciates the opportunity to provide the following comments on the California Energy Commission's (CEC) workshop held on April 13, 2008 to discuss the implementation of the Waste Heat and Carbon Emissions Reduction Act (AB 1613). SCE respectfully submits the following comments on the workshop and questions presented in the workshop notice.

The goals of AB 1613 form the basis for SCE's comments. AB 1613 seeks to "***dramatically advance the efficiency of the state's use of natural gas*** by capturing unused waste heat."[1] In so doing, AB 1613 assumes that combined heat and power (CHP) systems will "recover heat that would otherwise be wasted in separate energy applications, and use this heat to avoid consumption of fuel that would otherwise be required to produce heat."[2] To meet these goals, AB 1613 requires the CEC to adopt guidelines requiring eligible CHP systems to:

- Reduce waste heat;
- Be sized to meet the customer's thermal load;
- Operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat; and
- Be cost effective, technologically feasible, and environmentally beneficial.[3]

Further, the guidelines developed by the CEC cannot permit customers to operate as de facto wholesale generators with guaranteed purchasers for their electricity.[4] SCE supports these legislative goals, and offers the following comments to assist the CEC in developing guidelines that are consistent with the intent of AB 1613.

1 P.U. Code Section 2840.6(a) (emphasis added).
2 P.U. Code Section 2840.4 (b).
3 P.U. Code Section 2843(a).
4 P.U. Code Section 2843(b).

II. COMMENTS

A. AB 1613 Systems Must Reduce Waste Heat

AB 1613 provides that "Combined heat and power systems produce both electricity and thermal energy from a single fuel input, thus achieving much greater efficiency than the usual separate systems for producing these forms of energy, and reducing consumption of fuel."[5] To accurately address this concept, it should be noted that two types of CHP systems exist – bottoming cycle and topping cycle. Topping cycle CHP systems create two products – electricity and thermal energy – both of which must be needed by a customer for fuel savings to result. It is only when the customer has a need for both products that a CHP unit has the potential to be environmentally beneficial and actually "reduce fuel consumption." Without a need for both products, fuel could be used unnecessarily to create a product without a useful purpose. If a customer has little or no need for thermal energy, one should not be "created." Efficient electrical options are available that could serve the customer more appropriately. Similarly, if the customer has little or no electrical load, the customer should consider installing an efficient state-of-the-art boiler to meet the facility's thermal needs without "creating" a need on the electrical side.

For this reason, SCE urges the CEC to ensure that eligible CHP systems will in fact reduce waste heat by requiring an appropriate balance between a customer's electrical and thermal needs. As the CEC has previously noted, "To effectively utilize CHP, a facility must have at least a portion of its electric and thermal load that coincides with the right ratio of thermal to electric energy. For best economic performance, this coincident thermal and electric load should be fairly steady for as many hours per year as possible . . . . Facilities with intermittent electric and thermal loads are progressively less attractive as the number of hours of coincident load diminishes."[6] Thus, the CEC's guidelines should seek to ensure that a customer has sufficient electrical and thermal load to ensure that fuel is not consumed unnecessarily.

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[5] P.U. Code Section 2840.4(a).

[6] CEC Draft Consultant Report, Assessment of California CHP Market and Policy Options for Increased Penetration (2005), p. 2-5.

SCE also urges the CEC to revise its proposed guideline allowing customers to merely make their thermal energy "available for use" and instead require that the thermal energy be "used and useful." Recent regulations implementing the Public Utility Regulatory Policies Act of 1978 (PURPA) dealt with a similar issue, and have required (1) that the thermal energy output of the CHP system be used in a productive and beneficial manner; and (2) that the electrical, thermal, chemical, and mechanical output of the cogeneration facility be used fundamentally for industrial, commercial, residential, or institutional purposes.[7] If there is no requirement that the thermal energy have a beneficial purpose and actually be used, fuel consumption may increase to create a product that is unnecessary and superfluous. Such a result would be contrary to the requirements and goals of AB 1613.

SCE's comments above have focused on topping cycle CHP systems. There was a lot of discussion at the April 13, 2009 workshop concerning bottoming cycle systems. SCE supports the eligibility of bottoming cycle systems which capture waste heat created by an industrial or other process and use it to create electricity. SCE suggests that the efficiency standards adopted by the CEC apply only when a facility uses supplemental fuel to increase steam generation. Thus, for a waste heat recovery process that does not utilize any supplemental fuel to boost the electrical production, no operating efficiency standard should apply.

B. AB 1613 Systems Must Be Properly Sized and Operated to Meet Expected Thermal Load and Optimize the Efficient Use of Waste Heat

AB 1613 requires that eligible CHP systems "operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat."[8] The staff proposal requires that the CHP system be sized to be no smaller than the minimum connected on-site thermal load and no larger than the maximum connected on-site thermal load.[9] This should be modified. Given that thermal loads can fluctuate over time, a CHP system sized to meet the maximum thermal load could be underutilized at many other times. This could result in either (1) running the CHP system at partial

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[7] 18 CFR § 292.205(d). SCE discusses this section in more detail in the portion of its comments dealing with AB 1613's prohibition against "de facto wholesale generation."

[8] P.U. Code Section 2843(a)(3).

[9] Power Point Presentation by Arthur Soinski, PhD., Slide 14 (April 13, 2009).

electrical output to match the thermal load, or (2) continuing to run the CHP system electrically base loaded while dumping the unused waste heat. Either operating strategy is contrary to the plain language of AB 1613 and will reduce fuel efficiency and increase GHG emissions. A more efficient approach would be to simply require that the CHP be sized no larger than the minimum thermal load. A system thus sized would "operate continuously in a manner that meets the expected thermal load and optimizes the efficient use of waste heat" as required by the statute.

C. AB 1613 Systems Must Be Environmentally Beneficial and Meet Efficiency Standards

As provided above, AB 1613 seeks to "***dramatically advance the efficiency of the state's use of natural gas.***" Efficiency and environmental benefit are thus key components of AB 1613, which is focused on carbon emissions reductions. AB 1613 requires that systems installed under the Act be "environmentally beneficial" and achieve a minimum efficiency of at least 60%. Stated plainly, a 60% efficiency standard will not "dramatically advance the efficiency of the state's use of natural gas" or provide the carbon reductions sought after in AB 1613 and assumed in CARB's scoping plan. The CEC must do more. SCE recommends that the CEC adopt an efficiency level of 75% to ensure the intended savings and emissions reductions are achieved.

SCE has performed a careful examination of the assumptions used in the AB 32 Scoping Plan (the Plan) concerning carbon reductions from CHP systems. SCE's analysis is summarized in Table 1-1 below. The Plan assumes that 4,000 MW of new CHP will be deployed resulting in 6.7 MMT of carbon reductions. Based on SCE's calculations, the Plan further assumes that the annual thermal energy produced is 145 million MMBTU, and the annual electricity created is about 30 million MWh. The fuel used by the CHP to produce these two products is 3, 206 million therms of natural gas. The Plan also divided the heat, electricity, and fuel use into small and large CHP categories.[10]

From the values of heat, electricity, and fuel input by size, the total efficiency and percentage of thermal output energy can be calculated for both small and large CHP. According to SCE's calculations, CARB's plan assumes that small CHP will be 78% efficient and large CHP will be 71% efficient. Small CHP must have 60% thermal output, and large CHP must have 51% thermal output. If the state seeks to meet these goals in part through AB 1613, the CEC must establish the same total

[10] The division between small and large CHP is set at 5 MW.

efficiency percentage as the Plan for any topping cycle CHP and for any incremental production from supplemental fired bottoming cycle CHP.

Table 1-1

ARB Scoping AB 32 Plan "Measurement Documentation Supplement"

Measure "E-2 Combined Heat and Power"

Percent Total Efficiency and Percent Thermal Output Derived from ARB Scoping Plan

CHP Sizes	Small < 5MW	Large > 5MW	
Installed MW of CHP	80% 3,200	20% 800	Total 4,000 MW

Electricity Generated per Year by CHP using: 85% Capacity Factor

Small	Large	Total
23,827,200 MWh	5,956,800 MWh	29,784,000 MWh
Heat Equivalent of Electricity		
81,322,233.60 MM BTU	20,330,558.40 MM BTU	101,652,792.00 MM BTU
Heat Producted by CHP		
1239.2 MM Therms	209.6 MM Therms	1448.8 MM Therms
Convert to MM BTU		
123,920,000 MM BTU	20,960,000 MM BTU	144,880,000 MM BTU
Fuel used by CHP		
2624 MM Therms	581 MM Therms	3205 MM Therms
Convert to MM BTU		
262,400,000 MM BTU	58,100,000 MM BTU	320,500,000 MM BTU

% Total Efficiency = 100 x (Electricity + Heat) / Fuel	
Small	Large
78%	71%

% Thermal Output = 100 x Heat /(Electricity + Heat)	
Small	Large
60%	51%

Assumed Boiler Efficiency: 80%

Convert Therms to BTU: 100,000 BTU/Therm

Convert kWh to BTU: 3,413 BTU/kWh

Requiring efficiencies in the range of 71-78% for CHP is also consistent with AB 1613's intent that CHP systems achieve "much greater efficiency than the usual separate systems for producing these forms of energy and reducing consumption of fuel."[11] Achieving greater efficiency than the "usual separate systems" and reducing fuel consumption depends on the benchmarks used for comparison and the use of both products – heat and power. As provided above, CHP is not a universal solution for any customer who needs heat. Environmental benefits will only be realized when a site can successfully use both products – electricity and thermal energy – and the CHP system exceeds the efficiency of separate generation.

[11] P.U. Code Section 2840.4.

In today's market, separate generation of heat and power would conservatively be a combined cycle gas turbine (7,000 heat rate) and a premium 85% efficient boiler.[12] The overall efficiencies of these systems can far exceed 60%. Indeed, electric generators alone can achieve efficiencies close to this level. Only CHP systems with higher efficiencies will achieve the fuel savings, emissions reductions, and environmental benefits required by AB 1613. SCE recommends that the CEC adopt an efficiency level of 75% to ensure the intended savings and emissions reductions are achieved. Where a 60% efficient system will essentially maintain – or fall below – the status quo and not provide any emissions reductions compared to a state-of-the-art CCGT alone, a 75% efficient CHP system would use 20% less fuel than separate heat and power, thus achieving the environmental benefits and emissions reductions goals in AB 1613.

D. The CEC's Guidelines Must Prevent De Facto Wholesale Generators

AB 1613 states unequivocally that the CEC's guidelines may "not permit customers to operate as de facto wholesale generators with guaranteed purchasers for their electricity."[13] A wholesale generator is a generator designed with the purpose of producing and selling electricity in a competitive wholesale market. Such a generator would be designed to generate electricity in the most cost-effective manner, consistent with meeting applicable emissions regulations. The existence of a competitive energy market would tend to favor commercial success of the most efficient generators.

In the context of AB 1613, a "de facto" wholesale generator would be a customer who installs a CHP system for the primary purpose of selling electricity. For such a customer, the electrical load may be very small or non-existent, and but for the opportunity to sell electricity, the customer's thermal needs would be satisfied with an efficient boiler. Alternatively, the customer may have sufficient electrical load, but the recovery of waste heat is a secondary, perhaps incidental consideration. In either of these cases, the generator would fall short of meeting the intent of AB 1613 to foster the efficient use of waste heat and reduction of carbon emissions.

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[12] It is worth noting that the CEC's proposed benchmark for separate generation of electricity is the existing interim Emissions Performance Standard. A calculation of the implied heat rate for 1,100 lb CO_2e per MWh using natural gas is about 9,400. SCE maintains that such a heat rate is not consistent with new CCGT units operating in California or in the permitting process at the CEC. Rather, it is more realistic to use 7,000 BTU per kWh or lower as the benchmark resource.

[13] P.U. Code Section 2843(b).

Extensive experience in California and the United States with power purchases from Qualifying Facilities points out the potential for abuse, and also suggests that a remedy lies in the adoption of appropriate operating requirements as part of the guidelines now under development by the CEC. The use of CHP was encouraged by PURPA. One unfortunate artifact of the original PURPA rules was the creation of the so-called "PURPA Machine." A PURPA Machine is essentially a wholesale electricity generator that produces just enough thermal output to meet the applicable annual operating efficiency standards for a QF.[14] The Energy Policy Act of 2005 required, among other things, that the FERC reconsider aspects of PURPA. The FERC opened a Notice of Proposed Rulemaking in 2006 to define the fundamental purpose of a CHP facility. At the conclusion of this proceeding, the FERC issued rules governing the certification of new CHP generators as QFs, requiring such generators to "make a showing that their energy output is used fundamentally for industrial, commercial, residential or institutional purposes and is not intended fundamentally for sale to an electric utility."[15] Under FERC's rules, the CHP facility will be deemed to comply with this rule if at least 50% of the aggregate output, on an annual basis, is used on-site by the customer.

FERC's rules seeking to prohibit "de facto wholesale generation" provide a good starting point for a similar rule in the AB 1613 program. SCE urges the CEC to adopt an annual minimum on-site use requirement of at least 50% to ensure that the primary purpose of the CHP is not to sell electricity. Such a rule, in combination with other statutory requirements and programmatic elements proposed by SCE should help to prevent "de facto wholesale generation."

E. Ongoing Monitoring, Verification, and Enforcement is Needed to Ensure AB 1613 Goals Are Met

As SCE commented at the April 13, 2009 workshop, it is imperative that ongoing monitoring, verification, and enforcement (if necessary) be conducted on AB 1613 systems. The benefits of this program, if any, can only be quantified if there is an effective monitoring program. There are a

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[14] These standards required that the useful thermal energy output of the facility must be no less than 5% of the total energy output over any calendar year. Section 216.6 of the P.U. Code contains a similar annual requirement, which the CEC seeks to adopt here. For the reasons discussed in this section, this standard has proven to be inadequate to prevent "de facto wholesale generation" and has been superseded by a more stringent FERC rule.

[15] FERC Docket No. RM05-36-000; Order No. 671, ¶ 49, p. 24. *See also* 18 C.F.R. 292.205(d).

number of specific tasks that must be undertaken for program monitoring and compliance, including (1) the collection of data; (2) the verification of data; and (3) enforcement of the statutory and program requirements. These tasks could be handled under one agency such as the CEC or CARB, or delegated to different agencies. For example, the data collection could be handled by one entity, and the verification and enforcement could be handled by another.

To facilitate program monitoring, SCE proposes the following minimum measurements:

- Electrical Metering: The electrical energy in kWh generated by each generating unit must be metered and recorded with revenue quality devices. The electrical energy in KWh used by the equipment (station use) must also be metered. This metering can be combined into one measurement if the facility is configured to allow net generation output metering as defined in SCE's Rule 21.
- Thermal Output Metering: The thermal output of the CHP facility must be measured and recorded. It is important to determine the useful thermal output by measuring and recording the flow, pressure and temperature of the hot output; be it steam, water, air or some other fluid. The cold fluid returned must also be measured and recorded. The make-up fluid added must also be measured and recorded. The useful thermal output is the difference between the energy sent to process minus the return and make-up energy.
- Fuel Metering: The fuel consumed by a topping cycle cogeneration facility and the supplemental fuel consumed by a bottoming cycle facility must be metered and recorded. In addition, the fuel properties such as HHV must be verifiable by a regular fuel sampling protocol and laboratory analysis or other commercially reasonable methods commensurate with the fuel consumed.
- Emissions Monitoring: The air, water, waste and noise emissions created by the CHP facility must be monitored in accordance with the requirements of the ARB and the local jurisdiction having authority for such matters. It will be an essential component of the determination of whether a CHP is operated in an environmentally beneficial manner that such emissions be reported as part of this program.

Such monitoring and verification should take place on every system participating in the program. AB 1613 is clear that systems installed under the Act must continue to meet efficiency and emissions standards throughout their operation, and thus such monitoring and verification should be ongoing.

SCE agrees with workshop participants that the AB 1613 contract is the appropriate vehicle to address potential non-compliance with program requirements or program ineligibility. The contract should treat failure to comply with the provisions of AB 1613 (including the guidelines developed by the CEC) as default events for which the utility can seek remedies provided by the contract or in law. To support administration of the contracts, one or more agencies such as the CEC, CARB, or the CPUC should provide monitoring during the life of the contract or project. If the contract is the vehicle to address non-compliance, it is essential that both the utility and the customer-generator be promptly notified when a project fails to comply with AB 1613 standards.

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III. CONCLUSION

SCE appreciates the CEC's consideration of these comments, and looks forward to participating in the CEC stakeholder process and working with the CEC and CPUC to implement the AB 1613 Guidelines adopted by the CEC.

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