

**CALIFORNIA ENERGY COMMISSION**1516 NINTH STREET  
SACRAMENTO, CA 95814-5512

**DATE:** October 26, 2007

**TO:** Interested Parties

**FROM:** Paula David, Compliance Project Manager

**SUBJECT:** Palomar Energy Center (01-AFC-24C)  
Staff Analysis of Proposed Modifications To Add Inlet Air Chiller

On July 25, 2007, the California Energy Commission received a petition from San Diego Gas and Electric Company to amend the Energy Commission Decision for the Palomar Energy Center.

The Palomar Energy Center is a 546 MW combined cycle power plant located in the City of Escondido in San Diego County. The project was certified by the Energy Commission on August 6, 2003, and began commercial operation on April 1, 2006.

The proposed modification will allow SDG&E to install and operate a centralized chiller to cool inlet air to the two combustion turbines at the Palomar Energy Center. The facility currently uses an evaporative cooling system to reduce the temperature of inlet air. The modification will provide up to approximately 40 MW of additional capacity to serve summer peak load. This project modification will not significantly change air emissions, and no increase in concentration, hourly, or annual emission limits is requested. Installation of the equipment was approved by the San Diego Air Pollution Control District in November 2006. The modification also includes a thermal energy storage tank to be installed at an unspecified future date.

Energy Commission staff reviewed the petition and assessed the impacts of this proposal on environmental quality, public health and safety. Four analyses were prepared by technical staff, and are attached to this notice. Two of these propose additions to existing conditions of certification: Air Quality (AQ SC-12) and Transmission System Engineering (TSE-10). It is staff's opinion that, with the implementation of two new conditions, the project will remain in compliance with applicable laws, ordinances, regulations, and standards and that the proposed modifications will not result in a significant adverse direct or cumulative impact to the environment (Title 20, California Code of Regulations, Section 1769).

The amendment petition has been posted on the Energy Commission's webpage at [www.energy.ca.gov/sitingcases](http://www.energy.ca.gov/sitingcases). Staff's analysis is enclosed for your information and review. Staff's analysis and the order (if the amendment is approved) will also be posted on the webpage. Energy Commission staff intends to recommend approval of the petition at the November 21, 2007 Business Meeting of the Energy Commission. If you have comments on this proposed modification, please submit them to me at the address below prior to November 9, 2007.

Paula David, Compliance Project Manager  
California Energy Commission  
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Comments may be submitted by fax to (916) 654-3882, or by e-mail to [pdavid@energy.state.ca.us](mailto:pdavid@energy.state.ca.us). If you have any questions, please contact me at (916) 654-4228.

Enclosures:

Air Quality Analysis  
Efficiency, Reliability, Facility Design and Noise Analysis  
Transmission System Engineering Analysis  
Visual Resources Analysis

Mail List # 7152

**Palomar Energy Center**  
**Amendment to Install Inlet Air Chiller**  
**Transmission System Engineering Analysis**  
Prepared by Ajoy Guha, P. E. and Mark Hesters  
October 17, 2007

## **INTRODUCTION**

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SDG&E has submitted a petition (01-AFC-24C, dated July 25, 2007) for amendment of the project design of the existing Palomar Energy Center (PEC) generating plant. The amendment would allow the installation and operation of a centralized chiller to improve cooling of the inlet air to the gas combustion turbines and would increase the summertime output of the existing generator. According to the petition, installing the inlet chillers would increase the net electrical power output of the plant to 565 Megawatts (MW) about 20 MW above the 545 MW originally approved by the California Energy Commission (Energy Commission). The target date for completion of the proposed changes in the plant is 2008 summer (SDG&E 2007a).

The Transmission System Engineering (TSE) analysis examines whether the facilities associated with the proposed interconnection conform to all of the applicable LORS required for safe and reliable electric power transmission. The proposed amendment would not impact the proposed interconnection of the PEC and no changes are required to the analysis of the direct interconnection facilities. Additionally, under California Environmental Quality Act, the Energy Commission must conduct an environmental review of the “whole of the action,” which may include facilities not licensed by the Energy Commission (California Code of Regulations, title 14, §15378). The Energy Commission must therefore identify the system impacts and necessary new or modified transmission facilities downstream of the proposed interconnection that are both required for interconnection and represent the “whole of the action.”

Energy Commission staff relies upon the interconnecting authority, in this case the California Independent System Operator (California ISO), for the analysis of impacts on the transmission grid from the proposed interconnection, as well as the identification and approval of new or modified facilities downstream that could be required for mitigation.

## **CALIFORNIA ISO’S ROLE**

The California ISO is responsible for ensuring electric system reliability for all participating transmission owners and is also responsible for developing the planning standards necessary to achieve system reliability. The California ISO will perform a System Impact Study (SIS) and/or Facility Study (FS) to determine the reliability impacts of the PEC modification on the San Diego Gas & Electric (SDG&E) transmission system in accordance with all applicable reliability criteria. On satisfactory completion of the studies the California ISO would proceed with a modified Facility Interconnection Agreement or a Large Generator Interconnection Agreement (LGIA), as applicable.

## LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

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The following LORS have been updated since the project was certified in 2003. The PEC, with the proposed amendment, will remain in compliance with these LORS.

<u>Applicable Law</u>	<u>Description</u>
Federal	
North American Reliability Council (NERC) Reliability Standards	Provides national policies, standards, principles and guidelines to assure adequacy and security.
State	
NERC/Western Electricity Coordinating Council (WECC) Planning Standards	System performance standards for reliability.
California ISO/FERC Electric Tariff	Provides guidelines for all generation and transmission.

## ANALYSIS

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The purpose of staff's TSE analysis is to determine the likelihood of downstream transmission system upgrades needed as a result of the proposed PEC capacity increase and the need for a staff analysis of indirect significant environmental impacts related to those downstream upgrades. Staff typically relies on the SIS and/or FS to determine whether or not downstream facilities are required for the reliable interconnection of new generation. A SIS or FS is not currently available for a staff determination of whether or not downstream facilities will be needed for the interconnection. As of September 28, 2007, the California ISO stated San Diego Gas and Electric had not initiated the study process. Therefore, a SIS will likely not be available until after November 2007. While staff typically relies on the SIS to determine the need for downstream facilities, staff believes that this amendment contains special circumstances and should receive conditional approval from the Energy Commission. Staff believes that construction of the inlet chiller may begin before the completion of the SIS but output of the PEC should be limited to the level originally permitted until the project receives California ISO approval for the increased output.

The PEC inlet chiller amendment should be conditionally approved by the Energy Commission because the amendment poses little risk to California's environment and delaying project construction for the SIS or FS could mean the additional power is unavailable for the 2008 summer. In addition, approval of the additional 20 MW of capacity would not require any foreseeable major downstream transmission facilities with significant environmental impacts. In the unlikely event that downstream facilities are required, these facilities are most likely to be categorically exempt from CEQA analysis and would be permitted through the established California Public Utilities Commission (CPUC) Permit to Construct process. Staff proposes that the Energy Commission allow the construction of the inlet chiller to commence prior to the completion of the SIS or FS because:

- Delaying construction of the inlet chiller until the completion of a SIS/FS could mean that the additional 20 MW of summer peaking power is not available until after the 2008 summer. The additional 20 MW could provide power to over 1,250

homes in the San Diego area with little or no impact on the California environment.

- SDG&E recently looped in a 230 kV transmission line into the Palomar Substation and has stated that they have no concerns with congestion for the increase in PEC output. The additional 230 kV transmission line connected to the Palomar Substation will likely increase the transmission system ability to reliably accommodate new generation from the PEC. Also, while congestion is not a measure of reliability, it is a good indication that reliability issues are less likely.
- If downstream transmission upgrades are required they will most likely be small and would be permitted by the CPUC using established processes. The vast majority of transmission upgrades required for the reliable interconnection of new generation are circuit breaker upgrades that occur within the fence line of an existing substation. The other much less common transmission upgrade needed for the reliable interconnection of new generation is the reconductoring of existing transmission lines. Reconductoring is the upgrade of the existing transmission lines by replacing the conductors with higher capacity conductors. Reconductoring, which would be permitted by the CPUC, typically has only minimal effects on the environment and is usually exempt from an Environmental Impact Report.

## CONCLUSIONS AND RECOMMENDATIONS

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The construction and operation of the proposed inlet chiller will not require new transmission facilities up to the point of the projects interconnection with the existing transmission network. The increased output of the PEC will not likely require downstream transmission facilities. Providing a conditional approval that will allow construction of the modifications before the study of potential downstream transmission impacts means no environmental risk for California and would increase the capacity available to the San Diego area in the summer of 2008.

Should the Energy Commission approve the amendment petition for an increase in the PEC generating capacity to 565 MW, staff recommends the following condition of certification to ensure system reliability and conformance with Laws, Ordinances, Regulations and Standards.

## PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION

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Staff proposes the following, new condition of certification which will allow construction of the inlet air chiller system to proceed, while restricting the transmission of the PEC's total generating capacity until California ISO authorization is received.

**TSE-10 The PEC owner shall not operate the facility in excess of the net 545 MW power output as originally permitted in the certification by the Commission until such time that the PEC owner has provided to the CPM:**

- a) A copy of the Interconnection Request to the California ISO in accordance with the amendment petition for the proposed increase in the PEC generating capacity to 565 MW.**
- b) The System Impact Study (SIS) and/or final Facility Study (FS) reports performed by SDG&E and/or California ISO based on the net 565 MW PEC generation output under 2008 system conditions. The reports must include the final selected mitigation plan including a description of facility upgrades, operational mitigation measures, and/or Special Protection System (SPS) sequencing and timing applicable.**
- c) A letter from California ISO stating that the mitigation measures or projects selected for each criteria violation are acceptable.**
- d) The executed new Facility Interconnection Agreement or Large Generator Interconnection Agreement (LGIA), as applicable, or a modification of the existing Large Generator Interconnection Agreement as approved by the California ISO.**

**Verification: At least 30 days prior to the operation of the facility in excess of net 545 MW power output, the project owner shall provide to the CPM the documentation as mandated in a through d inclusive above.**

## **REFERENCES**

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- CA ISO (California Independent System Operator) 1998a. CA ISO Tariff Scheduling Protocol posted April 1998, Amendments 1,4,5,6, and 7 incorporated.
- CA ISO (California Independent System Operator) 1998b. CA ISO Dispatch Protocol posted April 1998.
- CA ISO (California Independent System Operator) 2002a. CA ISO Planning Standards, February 7, 2002.
- CA ISO (California Independent System Operator) 2007a. CA ISO, FERC Electric Tariff, confirmed Tariff, September 12, 2007.
- CA ISO (California Independent System Operator) 2007b. Email dated September 20, 2007 from Judy Nickel of California ISO.
- CA ISO (California Independent System Operator) 2007c. Letter dated September 28, 2007 from Judy Nickel of California ISO to SDG&E.
- CEC (California Energy Commission) 2003a. Energy Commission Approval for the PEC project on August 6, 2003.

CEC (California Energy Commission) 2003b. Final Staff Assessment for the PEC project, January 2003.

NERC (North American Electric Reliability Council) 2006. Reliability Standards for the Bulk Electric Systems of North America, May 2, 2006.

San Diego Gas & Electric (SDG&E) 2007a. Petition (01-AFC-24c) dated July 24, 2007 for change of the project design of the existing PEC plant, docketed on July 25, 2007.

WECC (Western Electricity Coordinating Council) 2006. NERC/WECC Planning Standards, August 2002.

**PALOMAR ENERGY CENTER (01-AFC-24C)  
AMENDMENT TO INSTALL INLET AIR COOLING**

**Air Quality Analysis**

Prepared by Matthew Layton

September 18, 2007

## INTRODUCTION

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On July 24, 2007, San Diego Gas & Electric (SDG&E) filed a request to amend the Palomar Energy Center (Palomar) project description by replacing the existing combustion turbine air inlet evaporative coolers with refrigeration chillers (SDG&E 2007b). The chillers are intended to improve inlet air cooling over a broader range of ambient conditions. No changes to existing conditions of certification are proposed since significant changes to project operational conditions are not expected; however, staff is recommending the addition of a greenhouse gas reporting condition.

## LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)

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**Air Quality Table 1** summarizes the applicable LORS for the facility.

**AIR QUALITY Table 1  
Laws, Ordinances, Regulations, and Standards**

<b>Applicable LORS</b>	<b>Description</b>
<b>Federal</b>	
42 U.S.C. §7401 et eq.	Federal Clean Air Act: New Source Review
<b>State</b>	
Health and Safety Code §41700	"... no person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property."
Health and Safety Code §38560(a)	Global Warming Solutions Act of 2006
<b>Local</b>	
Regulation II, Rules 10 – 27	Permits: New Source Review
Regulation XIV, Rules 1401 – 1425 and Appendix A	Title V Operating Permits

## **ANALYSIS**

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Palomar currently uses evaporative coolers to condition, or cool, combustion turbine inlet air to improve the performance of the combustion turbine compressor and the combined cycle project during periods when ambient air temperatures are above ideal or standard (generally 59°F) temperatures. However, the ability of the evaporative coolers to cool the inlet air can be limited by the wet-bulb temperature, or the relative humidity, of the ambient air entering the evaporative coolers. It appears that the proximity of Palomar to the Pacific Ocean and prevailing winds elevate local humidity to the point that the evaporative coolers are not performing as desired by the project owner.

The proposed amendment would replace the evaporative coolers with a closed refrigeration chiller system. Electric motor-driven scroll compressors, located in a new building onsite, would compress R134a refrigerant while rejecting the heat generated during compression to the cooling tower. The proposed system then expands, or evaporates, the refrigerant inside coils to provide chilled water, also in a closed system, to the combustion turbine inlet ducts to chill the air without being limited by the wet-bulb temperature of the inlet air. The use of a refrigeration cycle also enables the chilled water system to operate as an inlet air deicing, or heating, system on cold days when ice might form in the inlet. The amendment also proposes the future addition of a Thermal energy storage tank with a capacity of five million gallons of water. The tank can store chilled water produced with off-peak electricity to reduce parasitic loads from the chiller compressors during the period of peak electricity demand.

The proposed modification can provide up to approximately 40 MW (net of electricity used to operate the compressors) of additional capacity to serve summer peak load needs. Installation of the equipment was approved by the San Diego Air Pollution Control District (District) in November 2006. No permit conditions were modified by the District.

Staff's objectives in completing the air quality analysis for this amendment request are (1) to identify whether there is a potential for a significant air quality impact; and (2) to assure that appropriate mitigation measures have been applied to avoid or mitigate the identified potential air quality impacts. The project sources of air pollutant emissions that could be affected by the proposed amendment are the combustion turbine/heat recovery steam generator (HRSG) stacks and the cooling tower. Palomar was licensed with two General Electric (GE) model FA gas turbine and duct-fired heat recovery steam generator (HRSG) packages, one steam turbine generator, one cooling tower and various support and control systems and equipment, including the evaporative coolers. Palomar electricity output, and therefore, fuel firing depend on electricity demand, ambient conditions, turbine inlet air cooling, equipment degradation, and duct-firing of the HRSG.

## **STACK EMISSIONS**

The use of inlet cooling and duct-firing can increase the thermal efficiency and/or the electricity output of the project, and therefore increase the fuel firing and air pollution emission rates to levels higher than normally achievable during periods of elevated ambient temperatures. However, permit conditions and equipment limitations would not

allow the project to increase fuel firing and air pollution emission rates beyond what the project is already permitted for, and can and does achieve, on a cool winter day. The permit conditions already consider the variability in fuel firing and air pollution emission rates as dictated by seasonal variations and operational demands, and are designed to envelope the maximum rates and emissions. Additionally, the mitigation (emission reduction credits, or offsets) that was surrendered by the project owner when the project was licensed was for the maximum emissions (e.g., the hourly/daily air pollutant emission rates possible on a cold winter day). Air Quality Table 1 shows that current emissions are below permit levels and projected, post-chiller installation emission rates will be below permit levels. The second and third columns of Air Quality Table 1 (from an earlier filing by the project owner) show likely, not permit, emission rates from Palomar with and without the chillers in place. Permit emission rates are shown in the fourth column. Actual air pollutant emissions from the project with chillers in place will vary with electricity output, ambient conditions, turbine inlet air cooling, equipment degradation, and duct-firing of the HRSG, but cannot exceed permit limits.

**Air Quality Table 1**  
**Average Palomar Energy Center Criteria Air Pollutant Emissions**  
**- With and Without Chiller Operation**

	Without Chilling (lbs/hr) <sup>1</sup>	While Chilling (lbs/hr) <sup>2</sup>	Hourly Permit Limit (lbs/hr) <sup>3</sup>
NOx	10.2	10.70	14.9
CO	0.39	0.41	18.1
VOC	Not Detectable	Not Detectable	7.3
PM10	9.8	10.29	14.0
SO2	1.00	1.05	4.5

1. The "Without Chilling" emissions are based on either actual CEMS operating data, Source Testing Data or emissions factors.  
2. The "While Chilling" emissions are computed by multiplying the "Without Chilling" mass emissions by the fuel flow increase percentage.  
3. Hourly Permit Limit corresponds to permitted limits during normal operation with duct-firing, and is generally the maximum rate that was model for air dispersion impacts.

Source: SDG&E 2007a Request to Amend

Therefore, the project owner's request to amend the project description to add combustion turbine inlet air chillers does not require the project to exceed existing hourly, daily or annual permit air pollutant emissions limits. The project owner has not requested changing permit limits and staff does not expect an increase in pollutant emissions from the combustion turbine stacks beyond the maximums, or worst case, already analyzed, mitigated and permitted. Therefore, no significant impacts to the ambient air quality are expected from stack emissions after the chiller amendment.

## COOLING TOWER EMISSIONS

The use of inlet cooling and duct-firing can increase the thermal efficiency and/or the output of the project, but also result in increased or decreased heat rejection to the cooling tower. Cooling tower particulate emissions are directly proportional to cooling tower circulating water flow rates and the tower drift rate. Since the drift rate is fixed by passive drift eliminators, the only variable for Palomar cooling tower particulate emission rates are heat rejection rates and circulating water flow rates. The project owner supplied an assessment of potential changes in heat rejection to the cooling tower with the inclusion of the proposed chillers, which is shown in Air Quality Table 2

below. The heat rejection changes shown could result from likely changes in plant operations as a result of the addition of the chillers.

The owner is not proposing any enforceable limits or conditions to implement the assumed changes in plant operations. Staff does not know how the project can and will be operated in the future in a semi-deregulated electricity market, with or without the proposed chillers. Therefore, staff does not agree with the project owner's claim that the amendment will likely result in a slight decrease in combined cycle annual heat rejection to the cooling tower. However, the existing permit conditions limit hourly, daily and annual air pollutant emissions, including particulate emissions from the cooling tower. Based on staff's analysis and that the project owner has not requested changes to permit emission limits, staff does not expect an increase in pollutant emissions from the facility cooling tower beyond the maximums, or worst-case, already analyzed, mitigated, and permitted. Therefore, no significant impacts to the ambient air quality are expected from cooling tower emissions after the chiller amendment.

**Air Quality Table 2**  
**Summary of Projected Chiller Effects on Cooling Tower Evaporation**

Classification of Cooling Tower Evaporation Effect	Increase (Decrease) in Evaporation (lbs/year)	% Increase or decrease in overall Cooling Tower Evaporation
Reduction in Duct Burner Operating Hours	(69,740,716) lbs/year	1.026% reduction
Increased Steam Condensed due to Chilling	10,500,000 lbs/year	0.154% increase
Chiller Equipment Heat Rejection to Cooling Tower	66,921,606 lbs/year	0.984% increase
Cooling Tower Head Load reduction due to Inlet Heating	(38,592,734) lbs/year	0.568% reduction
Net Overall	(30,911,844) lbs/year	0.455% reduction

Source: SDG&E 2007b Table 2

## CONSTRUCTION EMISSIONS

The construction of the chiller building and thermal energy storage tank can produce equipment exhaust and fugitive dust emissions. Staff recommends that the good engineering practices outlined in Conditions of Certification AQ-SC1 through AQ-SC4 be applied by the project owner to reduce construction emissions.

## GREENHOUSE GAS EMISSIONS

The proposed chiller system will use R134a as the refrigerant. R134a is a known greenhouse gas (GHG) with a global warming potential (GWP) 1,300 times that of carbon dioxide (CO<sub>2</sub>). Europe has already moved to eliminate R134a from automobile air conditioning systems by 2011 (EU 2006), while California, in early action measures under the Global Warming Solutions Act, is proposing both a High-GWP Refrigerant Tracking, Reporting, and Deposit Program and reductions of high-GWP GHGs in consumer products, including, for example, cans of R134a used to recharge automobile air conditioning systems (CARB 2007b).

Alternatives to R134a are available, but they may have differing characteristics, performance and costs. For example propane is an efficient refrigerant with similar properties to R22, (Freon 22) but has no ozone depletion potential and an extremely low global warming potential (GWP = 3). While it is considered environmentally safe, it is also highly flammable. Ammonia is a highly efficient refrigerant that has been used in industrial applications for many years with success. It is, however, highly toxic and very careful consideration must be given to any design or application. Even CO<sub>2</sub>, which was the refrigerant of choice early in the 20<sup>th</sup> century, may be poised for a commercial resurgence.

At a minimum, SDG&E will be required to monitor and report Palomar Energy Center greenhouse gas emissions and may be subject to inspections, controls, reductions and fines for greenhouse gas emissions from Palomar as CARB implements the Global Warming Solutions Act of 2006. Therefore, staff recommends the inclusion of staff's standard greenhouse gas condition of certification that would require SDG&E to report greenhouse gas emissions to the Energy Commission or participate in a climate action registry. Since SDG&E already voluntarily participates in the California Climate Action Registry (<http://www.climateregistry.org/>), it is likely that they will include in their company-wide inventory all greenhouse gases from the Palomar facility, including fugitive emission of refrigerant from the chillers.

## CONCLUSIONS AND RECOMMENDATIONS

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Staff has determined that the Palomar Energy Center is currently operating in compliance with all air quality conditions of certification. The replacement of the evaporative combustion turbine inlet air evaporative coolers with the proposed chillers will not cause criteria air pollutant rates and emissions from the stacks or cooling tower above those already analyzed, mitigated, and permitted. Therefore, no significant impacts to the ambient air quality are expected from the proposed amendment. Staff recommends approval of the proposed replacement of the combustion turbine inlet air evaporative coolers with refrigeration chillers, and the adoption of the proposed greenhouse gas reporting condition.

## PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION

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The condition below is new and would be in addition to the existing conditions of certification in place for the Palomar Energy Center.

**AQ-SC12 Until the California Global Warming Solutions Act of 2006 (AB32) is implemented, the project owner shall either participate in a greenhouse gas (GHG) registry approved by the CPM, or report on an annual basis to the CPM the quantity of greenhouse gases emitted as a direct result of facility electricity production.**

**The project owner shall maintain a record of fuels types and carbon content used on-site for the purpose of power production. These fuels shall include but are not limited to each fuel type burned: (1) all fuel burned in internal combustion engines; (2) fuel used in fuel gas heaters**

and emergency equipment; and (3) all fuels used in any capacity for the purpose of facility startup, shutdown, operation, or emission controls.

The project owner shall perform annual source tests of CO<sub>2</sub> and CH<sub>4</sub> emissions from the exhaust stacks while firing the facility's primary fuel, using the following test methods or other test methods as approved by the CPM. The project owner shall produce fuel-based emission factors in units of lbs CO<sub>2</sub> equivalent per mmBtu of fuel burned from the annual source tests. If a secondary fuel is approved for the facility, the project owner may also perform these source tests while firing the secondary fuel.

<u>Pollutant</u>	<u>Test Method</u>
<u>CO<sub>2</sub></u>	<u>EPA Method 3A</u>
<u>CH<sub>4</sub></u>	<u>EPA Method 18 (POC measured as CH<sub>4</sub>)</u>

Or, as an alternative to performing annual source tests, the project owner may use the Intergovernmental Panel on Climate Change (IPCC) Methodologies for Estimating Greenhouse Gas Emissions (MEGGE). If MEGGE is chosen, the project owner shall calculate the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions using the appropriate fuel-based carbon content coefficient (for CO<sub>2</sub>) and the appropriate fuel-based emission factors (for CH<sub>4</sub> and N<sub>2</sub>O).

The project owner shall convert the N<sub>2</sub>O and CH<sub>4</sub> emissions into CO<sub>2</sub> equivalent emissions using the current IPCC Global Warming Potentials (GWP). The project owner shall maintain a record of all SF<sub>6</sub> that is used for replenishing on-site high voltage equipment. At the end of each reporting period, the project owner shall total the mass of SF<sub>6</sub> used and convert that to a CO<sub>2</sub> equivalent emission using the IPCC GWP for SF<sub>6</sub>. The project owner shall maintain a record of all PFCs and HFCs used for replenishing on-site refrigeration and chillers directly related to electricity production. At the end of each reporting period, the project owner shall total the mass of PFCs and HFCs used and convert that mass to a CO<sub>2</sub> equivalent emission using the IPCC GWP.

On an annual basis, the project owner shall report the CO<sub>2</sub> and CO<sub>2</sub> equivalent emissions from the described emissions of CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, SF<sub>6</sub>, PFCs, and HFCs.

Verification: The project annual greenhouse gas emissions shall be reported, as a CO<sub>2</sub> equivalent, by the project owner to a climate action registry approved by the CPM, or to the CPM as part of the fourth quarterly operation report (AQ-SC7) or the annual air quality report, until such time that GHG reporting requirements are adopted and in force for the project as part of the California Global Warming Solutions Act of 2006.

## REFERENCES

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California Air Resources Board (CARB) 2007a. Global Warming Environmental Justice Advisory Committee Recommendations on Proposed Early Actions to Mitigate Climate Change in California: List of Early Actions, May 30, 2007  
[http://www.arb.ca.gov/cc/ejac/ghg\\_eamcommitteelist.pdf](http://www.arb.ca.gov/cc/ejac/ghg_eamcommitteelist.pdf)

California Air Resources Board (CARB) 2007b. Expanded List Of Early Action Measures To Reduce Greenhouse Gas Emissions In California Recommended For Board Consideration, Draft September 2007.

European Union (EU) 2006. Directive 2006/40/EC Of The European Parliament And Of The Council Of 17 May 2006 Relating To Emissions From Air-Conditioning Systems In Motor Vehicles And Amending Council Directive 70/156/EEC, June 14, 2006.

San Diego Gas & Electric (SDG&E) 2007a. Palomar Energy Center (01-AFC-24C) Palomar Center Petition for Change of Equipment Pursuant to Condition GEN-2 or Proposed Amendment of the Final Decision, January 19, 2007.

San Diego Gas & Electric (SDG&E) 2007b. Petition For Change Of The Project Description In The Final Decision To Install And Operate A Gas Combustion Turbine Inlet Air Chiller In Place Of An Evaporative Chiller System. July 24, 2007.

**Palomar Energy Center  
Visual Resources Analysis  
Amendment to Install Gas Turbine Inlet Air Chiller**  
David Flores and Dale Edwards  
October 18, 2007

## **INTRODUCTION**

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Staff reviewed the proposed replacement of the evaporative cooler with a centralized chiller to cool inlet air to the two combustion turbines. This change will allow the PEC to increase electrical generation during periods of high ambient temperature and humidity during the summer peak, beyond the capacity of the existing evaporative cooler.

## **LAWS, ORDINANCES, REGULATIONS, AND STANDARDS - COMPLIANCE**

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There are no changes to the Visual Resources LORS specified in the Commission Decision for the PEC. The PEC, with the addition of the proposed air inlet chiller system, will remain in compliance with Visual Resources LORS.

## **ANALYSIS**

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The Petition to Amend submitted by San Diego Gas and Electric Company includes the following components for the proposed gas combustion turbine inlet air chiller:

- A centralized chiller plant housed in a metal enclosure mounted on a concrete slab foundation. The structure will measure 140 feet by 60 feet and 22 feet high at the highest point.
- Thermal energy storage tank (50 feet high with a diameter of 128 feet)

The proposed chiller equipment would be sited on a newly graded pad and located at the south side of the cooling tower. The area was already filled and graded during construction of the PEC. The tank would be located at the southwest corner of the plant site, adjacent to the chiller building and near the cooling tower.

Staff has reviewed the proposed air inlet chiller system addition and determined that the key changes that would affect the visual appearance of the project are the new chiller unit building and thermal storage tank. The chiller unit would be located on the southern portion of the project site near the existing cooler towers, with the thermal storage tank adjacent to the proposed chiller building.

For this review, staff chose Key Observation Point (KOP) 3 from the original five KOPs in the Application for Certification (AFC) to represent the existing visual setting and visual change that would occur with the installation of the chiller system.

### **KOP 3: VIEW FROM 1189 OAK VIEW WAY**

The view from KOP 3 is representative of views from the nearest residential neighborhood, looking east-northeast towards the PEC. The approximate distance is 0.3-mile. Due to its residential component, this view area is considered to have high visual sensitivity. The chiller building and tank would appear spatially prominent but subordinate to the existing industrial setting.

Views from KOP 3 toward the northeast include the existing PEC site with prominent geometric forms and complex lines of the HRSG structures, stacks, and seven-cell cooling tower, and a substantial berm that blocks the view of the lower portion of the PEC. The berm has numerous young, tall-growing trees and shrubs planted along the face of the berm from top to bottom that will, within a few years, provide partial visual screening for elements of the PEC, including the proposed chiller building and thermal storage tank. In addition, the proposed chiller building and tank would be consistent with the forms and lines established by the existing power plant structures. The project owner proposes to paint the chiller system structures to match the existing plant structures.

The chiller building and thermal storage tank would be added to a view that includes a variety of large-scale industrial structures (i.e., existing power plant with exhaust stacks, cooling tower and transmission lines supported by large steel poles). Overall, the addition of the chiller building and thermal storage tank to the PEC would be noticeable, but due to the similar nature of the structural forms of the chiller system to that of the existing PEC, the overall visual change would not be substantial. Considering the few number of residents with views, the industrial nature of the existing view, and the existing berm with a large number of trees that have been planted in the sightline between the residences and the PEC, staff has determined that the addition of the chiller system would have a less than significant visual resources impact.

### **COOLING TOWER AND HRSG WATER VAPOR PLUMES**

Staff analyzed the effect the proposed addition of the air inlet chiller would have on the plume potential of the PEC cooling tower and the Heat Recovery Steam Generators (HRSGs). Based on information supplied by the project owner, staff has determined that the addition of the air inlet chiller system would not significantly affect the frequency or size of the water vapor plumes produced by the PEC cooling tower and HRSGs (W.Walters, 2007). Although there would be an increase in cooling load due to the use of the chiller, generally this increase would occur during warm ambient conditions when plumes would not be expected to occur, and the chiller caused cooling increase may be more than offset by cooling load reductions from reduced duct burner use.

### **CUMULATIVE IMPACTS AND MITIGATION**

The AFC and Final Staff Assessment identified the PEC as increasing the industrial character of this area. Since the approval of the PEC, a large brewery is currently in the view from KOP 3, and a large 12-story hospital (currently under construction) will become a part of the view from KOP 3. Given the presence of these other industrial-type facilities, the addition of the chiller building and thermal storage tank would be generally compatible with the area's overall visual character.

## **CONCLUSIONS AND RECOMMENDATIONS**

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1. As discussed in this analysis, staff has determined that the installation of the air chiller building and thermal storage tank, as seen from KOP 3 (residents at 1189 Oak View Way), would not result in a significant adverse visual impact. The existing berm and tree and shrub plantings along the berm face will reduce the chiller system structure's direct visual impact and contribution to cumulative visual impact to a less than significant level.
2. The installation of the inlet air chiller system is predicted to result in a less than significant change to the PEC cooling tower's water vapor plume frequency and size.

## **PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION**

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None. Continued compliance with the conditions of certification adopted in the August 6, 2003 Commission Decision on the PEC will ensure that any visual impacts remain less than significant.

## **REFERENCES**

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SE 2007. San Diego Gas and Electric. Petition for change of the project description in the Final Decision to install and operate a Gas Combustion Turbine Inlet Air Chiller in place of an evaporative chiller system. Submitted to the California Energy Commission, July 25, 2007.

CEC 2003. California Energy Commission. Final Commission Decision for the Palomar Energy Project. August 6, 2003.

W. Walters. William Walters. October 18, 2007 e-mail regarding HRSG and cooling tower plumes.

**Palomar Energy Center 01-AFC-24C  
Amendment Petition to Install Inlet Air Chiller  
Efficiency, Reliability, Facility Design and Noise Analysis**

Prepared by Steve Baker  
September 19, 2007

## **INTRODUCTION**

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San Diego Gas and Electric, owner of the Palomar Energy Center, petitions to replace the evaporative inlet air coolers on the two gas turbine generators with a centralized chiller system.

## **LAWS, ORDINANCES, REGULATIONS AND STANDARDS (LORS)**

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No LORS apply to Efficiency or Reliability.

Two LORS apply to Noise:

- City of Escondido General Plan Community Protection and Safety Element, Policy E1.2; and
- City of Escondido Municipal Code, Article XI, Sections 17-226 through 17-260.

LORS applicable to Facility Design include 24 CCR, the California Building Standards Code.

## **ANALYSIS**

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The original project owner, Palomar Energy, LLC, installed evaporative inlet air coolers on the two gas turbine generators. Cooling inlet air on hot days reduces the degradation in both generating capacity and fuel efficiency that afflicts all gas turbines. In actual operation, the cooling system has not performed as expected, due in part to higher than expected humidity at the site. In order to maximize generating capacity and enhance fuel efficiency on hot days, the new owner, San Diego Gas and Electric, desires to replace the evaporative cooling system with mechanical chillers, which are insensitive to humidity. San Diego Gas and Electric expects this modification to increase plant generating capacity by 40 MW, five percent higher than with the evaporative cooling system.

Additionally, installation of the chiller system will be accomplished to allow the future installation of a thermal energy storage (TES) tank. TES is a proven technology, underutilized in California, that can maximize power plant output on hot days without burning more fuel during the hot period. Instead, the chiller is operated during off-peak periods, when electricity is cheap, to store cold (in this case, in a five million gallon tank of water). This cold is then employed to cool the gas turbines' inlet air without the electric power consumption of the chiller; this reduces plant parasitic loads and frees up more electricity for delivery to the grid.

The Amendment Petition explains that there will be no adverse impacts on plant Efficiency or Reliability. Mechanical chiller technology is mature and reliable, and the switch to mechanical chilling will increase, not reduce, fuel efficiency on hot days when the plant will certainly be dispatched.

There will likewise be no adverse impacts on plant Noise, since the centralized chiller equipment will be installed in a sound attenuating building. The Noise conditions of certification embodied in the Commission Decision will still apply.

There will likely be no adverse impacts on Facility Design, because all work must be accomplished in compliance with applicable building codes, as required by the Facility Design conditions of certification embodied in the Commission Decision.

## **CONCLUSIONS AND RECOMMENDATIONS**

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Replacing the evaporative inlet air cooling system with a centralized mechanical chiller system will not result in any adverse impacts in the areas of Efficiency, Reliability, Noise or Facility Design. Staff recommends that this petition be approved. This recommendation is based on the following conclusions:

1. There will be no new or additional significant environmental impacts associated with this action. The operating noise levels will remain in compliance with applicable LORS and will not result in an increase in ambient noise levels. All work will be performed in accordance with applicable building codes.
2. The proposed modification retains the intent of the original Energy Commission Decision and conditions of certification.
3. The amendment is based on new information that was not available during the licensing proceedings.

## **PROPOSED MODIFICATIONS TO CONDITIONS OF CERTIFICATION**

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No changes are required in any Noise or Facility Design conditions of certification. There are no Efficiency or Reliability conditions of certification.