PALOMAR ENERGY PROJECT
INFORMATION CONCERNING ADVANTAGES AND DISADVANTAGES OF WET AND DRY COOLING SYSTEMS

Introduction

The Palomar Energy Project Siting Committee Order dated October 7, 2002 in response to the petition by intervenor Mr. Bill Powers for a dry cooling workshop required the applicant, Palomar Energy, LLC (Palomar Energy) to submit information concerning the advantages and disadvantages of dry cooling for this project. This information is set forth below.

As a preliminary matter, Palomar Energy notes that the Committee Order also states that the standard of review on the topic of alternative cooling is whether use of reclaimed water will result in significant adverse environmental effects that cannot be mitigated. Palomar Energy submits that no such effect has been established. Ample supplies of reclaimed water are available as verified by the City of Escondido in the letter from Mr. John Hoagland dated May 28, 2002 (previously filed in response to data request 135 on June 3, 2002). According to Mr. Hoagland's evaluation, current and projected customers, <u>including Palomar Energy</u>, would use only 6,636-acre feet/year of a capacity of 9,900-acre feet/year at the Hale Avenue Resource Recovery Facility. Use of reclaimed water for power plant cooling is consistent with and encouraged by State law concerning recycled water (Water Code sec. 13550, 13552.8) and by the State Water Resource Control Board inland waters power plant cooling policy (Resolution 75-58). Such use is also consistent with numerous other past and current siting cases before the Commission. Finally, there is no evidence of a significant impact being caused by use of reclaimed water, which is subject to well-established requirements of Department of Health Services regulations concerning use of reclaimed water in cooling towers (22 Cal. Code Regs. Sec. 60306). Therefore, consistent with the Commission's Final Decision in the High Desert Power Project (97-AFC-1) case, which raised somewhat similar issues, Palomar Energy submits that there is no requirement for the Commission to consider alternative cooling methods where this is not necessary to prevent or avoid a significant impact caused by the cooling method proposed by the applicant. However, Palomar Energy also recognizes and intends to be fully responsive to the Committee's interest in providing a complete analysis of issues associated with this proceeding.

Cooling System Selection

Dry cooling is generally only selected when sufficient water is not available or there are potentially significant impacts associated with wet cooling (see discussion below). Evaporative (wet) cooling is generally the method of choice due to compelling economic, fuel efficiency and overall environmental advantages.

With dry cooling, low grade steam exhausted from the steam turbine generator is ducted directly to a finned-tube heat exchanger and cooled by ambient air blown by fans over the tubes, much like an automobile radiator. The condensing steam and cooling air are completely segregated, so there is no evaporation of water from the system. Since there is no evaporation of water, there is no makeup or blowdown cooling water needed as there is for a traditional wet tower. Although dry cooling represents a useful alternative for projects with a shortage of raw water available, some water (about 200,000 gal/day) is generally still needed.

In dry cooling towers, as the ambient air temperatures rise, the rate at which the towers can transfer thermal energy from the steam to the air decreases. This leads to higher energy costs for cooling fans and higher steam turbine back pressures since the steam must be condensed at a higher temperature and associated saturation pressure. As the temperature rises, the amount of mechanical work that can be taken from the steam decreases. Therefore, during the hot weather (typically corresponding to peak electrical demand), there is less electricity produced from the facility with dry cooling compared with the evaporative cooling alternative.

Other Power Plant Cooling Analyses

Dry cooling has been utilized for a limited number of combined-cycle generation projects under certain circumstances. For example, the Final Decision for the Sutter Power Project (97-AFC-2) required the use of dry cooling to eliminate potentially significant impacts to biological resources from wastewater discharge to agricultural field drains and the Sutter Bypass and to avoid potential draw down and contamination of groundwater (no other water supplies were available). Wet cooling is generally used in situations where dry or wet/dry cooling are not required to avoid significant adverse impacts. For example, the Final Decision for the High Desert Power Plant Project (97-AFC-1) concluded that dry or wet-dry cooling were feasible but not necessary. For perspective, Table 1 summarizes cooling technologies included in projects previously approved by the Commission. All but two of the 18 projects listed will employ wet cooling. Seven projects on the list will use reclaimed water. Table 2 summarizes other projects over 300 MW that are currently before the Commission. None propose to use dry cooling.

Table 1
Approved Combined Cycle Projects (Greater Than 300 MW)

Project	AFC File Date	Commission's Decision Date	Cooling Type
Huntington Beach	12/01/00	05/10/01	Wet - once through
Contra Costa	01/31/00	05/30/01	Wet - reclaimed water
Mountainview	02/01/00	03/21/01	Wet - reclaimed water and ground water
Western Midway	12/22/99	03/21/01	Wet - reclaimed water
Blythe Energy	12/09/99	03/21/01	Wet - groundwater
Pastoria	11/30/99	12/20/00	Wet – fresh water
Otay Mesa	08/02/99	04/18/01	Dry
Moss Landing	05/07/99	10/25/00	Wet – once through
Three Mountain	03/03/99	05/16/01	Wet/Dry – fresh groundwater
Metcalf	04/30/99	09/24/01	Wet – reclaimed water
Elk Hills	02/24/99	12/06/00	Wet – groundwater
Sunrise	12/21/98	12/06/00	Wet (simple cycle)
Delta Energy Project	12/18/98	02/09/00	Wet – reclaimed water
La Paloma	08/12/98	10/06/99	Wet – fresh water
Los Medanos	06/15/98	08/17/99	Wet – reclaimed water
Sutter Power Project	12/15/97	04/14/99	Dry
High Desert	06/30/97	05/03/00	Wet – fresh water
Russell City	05/22/01	09/11/02	Wet/Dry – recycled water

Table 2
Pending Combined Cycle Projects (Greater Than 300 MW)

Project	AFC File Date	Preliminary ("P") or Final ("F") Staff Assessment	Cooling Type
Avenal	10/09/01	P – 9/9/02	Wet - fresh/ground water
East Altamont	03/29/01	F – 9/19/02	Wet - fresh/recycled water
El Segundo	12/21/00	F – 9/12/02	Wet - once through – potable/reclaimed water
Inland Empire	08/17/01	P – 7/19/02	Wet - recycled/fresh water
Morro Bay	10/23/00	F- Supplemental 09/25/02	Wet - once through – sea water; Dry cooling proposed by staff (in dispute)
Palomar	11/28/01	P – 08/28/02	Wet – reclaimed water
Potrero	05/31/00	F – 02/14/02	Wet – once through proposed by applicant; Staff recommends wet/dry - reclaimed water in FSA
San Joaquin	10/31/01	P – 07/16/02	Wet – reclaimed water
Tesla	10/12/01	P – 09/16/02	Wet – fresh/reclaimed water

It has been suggested by Mr. Powers that the Palomar Energy facility use a “dry” (non-water using) air cooling system instead of wet cooling towers. This submittal summarizes the key characteristics of the two types of cooling systems and shows how Sempra Energy Resources’ (SER) evaluation process led to the selection of a mechanical-draft, plume-abated cooling system as the most appropriate system for the Palomar Energy Project.

Although wet cooling is more widespread, both wet and dry cooling are available technologies for power plants. Conceptually, each has its advantages and disadvantages -- power plants with wet cooling systems are less costly to build and are more efficient in generating power, but dry cooled plants require minimal amounts of water. As part of the development process for each individual project, SER evaluates cooling system alternatives and selects the technology and system most appropriate for that particular project. SER has selected both wet and dry cooling systems for recent projects. For example, SER’s 480 MW combined-cycle El Dorado Energy Project, an operating plant in Nevada, uses dry cooling.

As is the case for every project, the choice of wet cooling for Palomar Energy was based on a variety of factors. A wet cooled plant in urbanized Escondido is less costly to build and operate and will generate electrical power more efficiently (increasingly important factors in the current deregulated energy market). A wet cooling system is less intrusive upon the local community because the cooling system is smaller and quieter. A source of reclaimed water is available through a City of Escondido project already under construction and with significant available excess capacity. Finally, other environmental concerns can be successfully mitigated by the planned high-efficiency drift eliminators, plume-abated cooling tower, and operating and maintenance (O&M) practices.

A tabular summary of advantages and disadvantages of cooling methods is given in Table 3. The following sections more specifically address each of the factors that drove the decision for wet cooling for Palomar Energy.

Capital and Operating Cost and Plant Efficiency

It is widely accepted that capital costs for wet cooling systems are lower than dry cooling systems. For example, estimates for the capital costs of alternative cooling systems for the proposed Cosumnes Power Project, a nominal 1,000 MW (two 500 MW phases) combined-cycle plant near Sacramento, are $14.9 million (12 percent) higher for dry cooling than wet cooling for each phase (CEC, 2002a). Analysis of cooling system capital costs for the 500 MW Elk Hills Power Project were $14 million higher for dry cooling than for wet cooling (Elk Hills Power, 2000).

Table 3 Comparison of Advantages and Disadvantages of Cooling Systems

Wet Cooling (Wet Mechanical Draft Cooling Tower)		Dry Cooling (Air Cooled Condenser)	
Pro	**Con**	**Pro**	**Con**
▪ Higher thermal efficiency than dry cooling: The evaporation of water in a wet-mechanical draft cooling tower is inherently more thermally efficient than a air cooled condenser. ▪ Parasitic power consumption lower than dry cooling: The auxiliary power required by a combined cycle power plant is lower when using a wet-mechanical draft cooling tower vs. an air cooled condenser. ▪ Higher net power output than dry cooling: The combination of higher thermal efficiency and lower parasitic energy consumption allows higher overall net power output, on a constant fuel consumption basis, from a water cooled power plant vs. an air cooled power plant. ▪ Smaller power plant site: The higher efficiency of a wet cooling system results in lower space requirements than an air cooled power plant. Also, a wet-mechanical draft cooling tower is a less visually prominent structure than an air cooled condenser. ▪ Less noise: The large fans of an air cooled condenser produce more noise than a wet-mechanical draft cooling tower; noise mitigation packages add to the cost of an air cooled condenser and may still not be able to meet noise limitations. ▪ Lower overall cost: The overall capital cost of a wet cooled power plant is lower than an air cooled plant, even when considering the cost of water and water transport infrastructure. In addition higher thermal efficiency and higher output result in lower electricity production costs.	▪ Consumptive use of water: The proposed Palomar facility will use treated waste-water for cooling which is currently being discharged to the ocean. ▪ Emissions of PM_{10} due to cooling tower drift: Emissions of cooling tower drift are minimized through the use of high efficiency drift eliminators. ▪ Potential for visible cooling tower plume: The proposed wet cooling tower will be equipped with plume mitigation reducing the visual impact of a cooling tower plume to insignificance.	▪ Minimizes consumptive use of water by power plant: The use of an air cooled condenser at a combined cycle power plant minimizes the consumptive use of water. ▪ No emissions of PM_{10} or other constituents of the water due to cooling tower drift: While drift emissions are eliminated, and emissions of PM_{10} and other pollutants could be generated to compensate for efficiency loss. ▪ No visible cooling tower plume: No water vapor is released which can cause a visible plume.	▪ Reduces overall thermal efficiency of power plant: The inherent limitations of air cooling results in a less efficient power plant vs. wet cooling. ▪ Increases fuel consumption required to meet electrical load: Reduced thermal efficiency results in an increase in fuel consumption, thus potentially increasing air emissions. ▪ Reduces the peak output from proposed facility: For a given combustion turbine design the use of an air cooled condenser reduces the potential maximum peak power output from a combined cycle power plant when compared to a water cooled power plant. ▪ Larger structure: Air cooling requires a larger structure than a wet-mechanical draft cooling tower, so requires more space and is more visually prominent. ▪ Produces more noise: The large fans of an air cooled condenser produce more noise than a wet-mechanical draft cooling tower; noise mitigation packages add to the higher cost of an air cooled condenser.

A study by Wayne Micheletti, Inc., cited in Power magazine, compared the capital costs of a 250 MW combined-cycle plant at five different locations around the country. This study concluded that, on average, capital costs for dry cooling were 140 percent higher than wet cooling at the five locations (Power, 2002).

Infrastructure costs to bring water to the power plant site and treat it also must be considered. A dry cooled plant also consumes water for other (non-cooling) process needs, although the quantities are smaller than a wet cooled plant. However, the cost of installing a small water supply pipeline is not significantly lower than the cost of installing a larger supply line and brine return line. This is because the major costs in pipeline installation are associated with excavating the trench, not with the size of the pipe installed within it. Palomar Energy will use disinfected and tertiary-treated reclaimed water that meets regulatory requirements for such uses as parks, golf courses, and highway medians.

Costs for additional treatment for use in the power plant will be minimal. Operating costs for wet cooling systems also are estimated to be lower than dry cooling. The Micheletti study found operating costs to be 94 percent higher on average for the 250 MW combined-cycle plants at five different locations (Power, 2002). These estimates considered the energy penalty of the reduced performance of dry cooling towers during the summer when high temperatures increase turbine back pressure. The energy penalty, as well as the inherently lower efficiency of dry cooling (discussed below), mean that additional fuel must be purchased to generate the same amount of electrical power. Different climatic conditions at different locations affect performance differently.

Dry cooling is inherently less efficient than wet cooling for a number of reasons: 1) the temperature of the condensate leaving the steam condensation system is higher in a dry cooled system, which means that less power is extracted from the steam expansion, 2) the higher temperature also causes higher turbine back pressure, which decreases power output, and 3) a portion of the plant's electrical output is consumed to run the large fans of the dry cooling system, which are not required for a wet cooled system. For the Sutter Power Project, CEC staff concluded that a dry cooling system would reduce the plant's efficiency by 1.5 percent compared to wet cooling. More recently, Commission staff found that the East Altamont Energy Center Project would generate up to 4% less power with dry cooling (CEC, 2002b). Applied to Palomar, this would mean that the plant would generate 1.5 to 4% percent less electrical power while consuming the same amount of fuel.

Burns & McDonnell, SER's engineering consultant for the Palomar project performed a site-specific analysis of power production and costs at the proposed

Escondido site. Burn's & McDonnell's evaluation of power production for the Palomar Project utilizing wet and dry cooling systems revealed results similar to the projects identified in the previous paragraph. The Palomar Project would be expected to produce 1.5 to 4% percent less electrical power with a dry cooling system while consuming the same amount of fuel, depending on the ambient temperature. As the ambient temperature increases the power loss in a dry cooling system compared to a wet cooling system also increases. During summer ambient conditions the power production with a dry cooling system is expected to be approximately 20 MW less than with a wet cooling system. Annually, the loss of power production in a dry cooling system is expected to result in approximately 53,200 Mwh of electricity production loss.

The capital and annual operating cost analysis for the Palomar Project are detailed in Tables 4 and 5. The analysis is preliminary based upon conceptual engineering for the project comparison and does not include additional costs which could be required to attempt to mitigate visual or noise impacts at the Palomar site.

Table 4
Capital Cost Comparison of Wet versus Dry Cooling for the Palomar Energy Project
(All Costs in 2002 Thousands of Dollars)

	Wet Cooling	Dry Cooling	Difference
Cooling System Capital Cost	$16,800	$31,300	$14,500
Supply & Brine Pipelines	$857	$200[a]	($657)
Total Capital Cost	$17,657	$31,500	$13,843
a. A dry cooled plant will also require a water supply line to provide for other water needs			

Table 5
Operating Cost Comparison of Wet versus Dry Cooling for the Palomar Energy Project
(All Costs in 2002 Thousands of Dollars)

	Wet Cooling	Dry Cooling	Difference
Reclaim Water Cost	$1,517		
Cooling Tower Chemicals	$300		
Value of Lost Power Production		$1,764.5	
Annual Operating Cost Difference			($52.5)

In summary, a Palomar plant with dry cooling would cost approximately $13.8 million more to build. Annual operating costs are about the same. Under any circumstances, and even more so in California's deregulated energy market, it is unnecessary and unwise to impose these additional costs unless there is a significant environmental effect of using wet cooling which cannot be mitigated. In fact, the wet cooled Palomar Energy plant will be quieter and less visually intrusive, and also will provide a significant benefit to the City of Escondido's water reclamation program as a major, year-round customer for reclaimed water.

Visual Resources and Noise

In numerous meetings over the past several years, the residents of Escondido have consistently expressed concerns about the potential for visual impacts and noise impacts of development at the Palomar site. Palomar Energy has designed the project to be responsive to those concerns.

Palomar intends to use natural topography as well as man-made berms and landscaping to make the facility minimally intrusive visually. The structures of dry cooling systems are both taller and bulkier than those of wet cooling systems, which would make it more difficult (and more costly) to minimize visual impacts at the Palomar Energy site. The larger footprint of the dry cooling system also would be difficult to accommodate at the space-limited Palomar Energy site.

Wet cooling systems emit a visible plume of water droplets from the cooling tower. The Palomar Energy power plant will utilize a plume-abated cooling tower that reduces the size and frequency of visible plumes to low levels (a plume of up to 40 feet no more than five percent of the time in clear winter daylight hours). A small plume visible occasionally in the winter can be considered less visually intrusive than a larger dry cooling system structure that is visible all day every day of the year.

Palomar Energy will take advantage of the natural and manmade topography to also minimize noise impacts on the surrounding community. The project also incorporates extensive noise attenuation into its design (e.g., combustion turbine exhaust stacks will have features which reduce noise). Analysis shows that noise impacts of the project as proposed would be less than significant. Dry cooling systems are noisier than wet cooled systems because of the large fans used to move air through the cooling tower. There are ultra low noise fans that could reduce the noise emissions from a dry cooling system. However, given the greater height of the dry cooling structures, its noise sources would be at a higher elevation. Because perceived noise is strongly affected by line-of-sight (i.e., direct exposure), the higher elevation of the noise sources would diminish the noise reducing effects of the natural and manmade topography. It is not clear whether the ultra low noise fans could reduce noise to acceptable levels in the area surrounding the Palomar Energy site. However, it is quite clear that they would increase project cost.

Water Resources

The primary advantage of dry cooling is that a dry cooled plant requires only small amounts of water (for purposes other than cooling). Availability of sufficient, reliable water supplies obviously is a significant factor in the cooling system selection process. An important factor in Palomar Energy's decision to select the proposed wet cooling system is that a reliable recycled water source with ample, available surplus capacity was under construction by the City of Escondido one mile from the site.

The fact that the available source is recycled water was an important element of the Palomar Energy decision. Recognizing that water is a precious commodity that must be used wisely in California, State Water Resources Control Board Policy 75-58 requires consideration of alternate water sources for power plant cooling in lieu of fresh inland water, and identifies wastewater discharged to the ocean as the first option to be considered. Palomar Energy will use tertiary treated, disinfected reclaimed water from the City of Escondido's Hale Avenue Resource Recovery Facility (HARRF).

Section 13550 et seq of the Water Code provide for the use of recycled water if certain conditions are met: 1) adequate quality and availability, 2) available at reasonable cost, 3) the use is not detrimental to public health, and 4) it will not adversely affect downstream water rights, degrade water quality, and is not injurious to plants, fish or wildlife. Palomar's use of reclaimed water from the HARRF meets each of these criteria of the Water Code:

1) HARRF reclaimed water is of adequate quality for project use; and as discussed below, the City has surplus capacity that is more than enough to meet the Palomar demand;

2) Palomar Energy is negotiating a mutually acceptable price with the City;

3) Title 22 CCR Section 60306 explicitly allows use of disinfected, tertiary treated water reclaimed water in cooling towers if drift eliminators are used to control misting and biocides are used to control Legionella and other bacteria; the Palomar Energy plant will have high-efficiency drift eliminators, and will use biocides, biodispersants, and a rigorous maintenance program to control bacteria such as Legionella; and

4) Power plant cooling water, after recirculation several times through the cooling system, will be discharged to the ocean via the City's outfall system, and will not adversely affect water quality or water rights, and will not harm plants, fish, or wildlife.

In short, the preceding paragraphs show that Palomar Energy is fully consistent with state policy and regulations that are explicitly intended to conserve potable water resources.

The City of Escondido Hale Avenue water reclamation facility will produce nine million gallons per day (mgd) of tertiary-treated, disinfected water. The HARRF project is a key component of the City's water reclamation and conservation program and policy. Moreover, the reclaimed water project also is integral to the City's compliance with a Regional Water Quality Control Board (RWQCB) Cease and Desist order regarding discharges to Escondido Creek of treated effluent during stormy conditions, when the City's outfall system exceeds its capacity. Without Palomar Energy, the City has customers for less than half of the project's capacity, and Palomar's purchase of 3.6 mgd represents a major contribution to the financial viability of the City's reclaimed water program.

Importantly, Palomar represents the type of large, stable, long-term, year-round user that the City considers an extremely desirable customer (City of Escondido, 1998). Irrigators (e.g., landscape watering, agriculture) do not need to purchase reclaimed water when it rains. As stated above, discharging treated effluent to Escondido Creek on several occasions when City outfall system capacity was exceeded during rainstorms led to a RWQCB Cease and Desist Order. Palomar Energy will need 3.6 mgd throughout the year, rain or shine. This supports the City's compliance with the RWQCB Order by significantly reducing the amount of effluent that the outfall system must accommodate during a storm. The City's other reclaimed water customers (irrigators) would be of no help to the City in this water quality compliance issue.

Mr. Powers has argued that there are other uses for the HARRF's reclaimed water production that are preferable to industrial cooling. Specifically, instead of selling the reclaimed water to Palomar Energy, he contends that the City of Escondido should use the reclaimed water to irrigate avocado orchards in the Escondido area, and/or participate in a groundwater recharge project (the San Pasqual Valley Groundwater Management Project, proposed jointly by the Cities of Escondido and San Diego in the early 1990s). It is noteworthy that both of these specific options have been considered by the City of Escondido over the past decade as the City formulated and developed its water reclamation project, and neither has come to fruition.

Local avocado growers questioned whether avocados could be successfully grown with reclaimed water because of elevated salt content in the reclaimed water. The City of Escondido helped fund a research project on the suitability of reclaimed water for avocado irrigation (City of Escondido, 1996). This five-year pilot study showed that crop yields were substantially lower for reclaimed water: 42 percent lower for "pure" reclaimed water and 27 percent lower for mixtures of reclaimed and potable water. While this study may have provided valuable information in the long term, local avocado growers apparently were not persuaded that reclaimed water was a good idea for them -- avocado growers are not among the City of Escondido's reclaimed water customers in 2002.

The City of San Diego decided not to participate in the San Pasqual Valley groundwater recharge project, and as stated in a 1998 Environmental Impact Report issued by the City of Escondido on its water reclamation program, the City of San Diego "is not considered a probable customer for reclaimed water produced at the HARRF in the near future" (City of Escondido, 1998). According to the intervenor in the Palomar case, the City of San Diego intends to implement this groundwater recharge project in the future. However, it is difficult to expect the City of Escondido to manage its reclaimed water program on the basis of the City of San Diego's possible future plans. Attached to this document is a letter from Mr. John Hoagland, Utlilties Manager for the City of Escondido, dated November 12, 2002, which provides additional information concerning these issues. Mr. Hoagland also explains why use of recycled water from the HARRF will not increase ammonia emissions and will not negatively impact use of discharged effluent from the HARRF by the San Elijo Joint Powers Authority as asserted by Mr. Powers.

With the City of Escondido's 9 mgd reclamation project under construction and scheduled to come on stream by the end of 2002, and with the reclamation project structured modularly so that an additional 9 mgd of capacity can be added in the future if future customers emerge (e.g., avocado growers, groundwater recharge project), the City has made the eminently prudent and responsible decision: welcome Palomar Energy as a customer for its reclaimed water, rather than reserving capacity for an indeterminate length of time to serve unlikely or speculative possible future markets over which the City has no control.

Air Quality

Air quality is another issue considered in evaluating alternative cooling systems. Wet cooling produces emissions from the cooling tower of particulates and other constituents of the cooling water. On the other hand, as stated earlier, dry cooling is inherently less efficient than wet cooling, which increases fuel consumption for comparable amounts of electrical power generated. Increased fuel use implies increased emissions. If not properly maintained, a wet cooling tower could also be a source of airborne pathogens such as the Legionella bacteria.

Palomar Energy incorporates measures in its design to address concerns about cooling tower particulate emissions. The Palomar cooling tower has high-efficiency drift eliminators, which greatly reduces particulate emissions. Using current high efficiency drift eliminators, potential emissions of particles smaller than ten microns aerodynamic diameter (PM_{10}) from cooling tower drift are minimal. Drift emissions for Palomar Energy have conservatively been estimated at 2.9 tons per year (tpy), which is less than three percent of the total plant PM_{10} emissions. These levels generally overstate the actual PM_{10} that will be emitted as drift, since that value assumes the facility will operate at 100 percent capacity, 8,760 hours per year at the maximum rather than annual average recirculating water rate and with the maximum amount of total dissolved solids (TDS) in the water.

Since a dry tower is less efficient at rejecting heat and uses more parasitic power within the plant, its use leads to an estimated power loss of about 20 MW for the same quantity of fuel in a 500 MW combined cycle facility. Alternatively, this efficiency loss could be characterized as wasted fossil fuel (more fuel must be burned to produce the same power). During peak energy usage (hot summer days when dry cooling is at its least efficient), additional generation may need to be brought on line to make up the difference – potentially with older, less efficient generating units (such as simple cycle turbines) that emit air pollutants at a much higher rate than a state-of-the-art combined cycle project. For example, assuming the replacement power for one 500 MW combined-cycle plant with dry cooling is based on the average emissions of existing peaking power plants in California, about 40 tpy of PM_{10} and PM_{10} precursor emissions could result. This would also add collateral emissions of greenhouse gases such as CO_2 to produce the same amount of power. Alternatively, this lost power might be made up in another generating unit elsewhere in the system which may be as clean as the new combined-cycle plant, or even cleaner (nuclear, wind, etc.), but which could have its own community and/or environmental impact disadvantages.

Mr. Powers also raised the possibility that Legionella and other pathogens could be emitted from a wet cooling tower. Research by the CEC (2002c) has determined that with proper design and maintenance procedures including an aggressive antibacterial program, "the chances of Legionella growing and dispersing would be reduced to near zero." Palomar Energy will use disinfected tertiary treated water, combined with the high-efficiency drift eliminators and planned rigorous operations and maintenance (O&M) procedures, such that risks from airborne exposures will be virtually eliminated. Palomar Energy has powerful incentives for rigorous and effective O&M, including the protection of the health of its employees and neighbors. A poorly maintained cooling system also operates less efficiently and causes lower power output from the facility.

Conclusion

Conceptually, wet cooling and dry cooling each has its advantages and disadvantages. Both utilize proven technologies. At the early stages of each project, SER evaluates alternative cooling system approaches, and makes a decision based on project-specific and site-specific factors. For Palomar Energy in Escondido, the evaluation led to the selection of a plume abated, wet cooling system.

Palomar Energy's proposed wet cooling system would be cheaper to build and operate than a dry cooling system, and would generate electrical power more efficiently. A wet cooled facility would be more responsive to the local community's concerns about visual impacts and noise, because the cooling system would be smaller and quieter. A source of reclaimed water with available surplus capacity is available nearby from the City of Escondido, who welcome Palomar Energy as the type of long-term, year-round customer they need to assure the viability of their water reclamation program. Thus, Palomar Energy is fully consistent with statewide goals and policies to conserve potable water resources, and indirectly supports the overall water conservation policies of its host community without causing any significant environmental impact which cannot be mitigated.

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Pages = 2
Original will be mailed

Re: Palomar Energy Project

Dear Mr. Jackson:

As you know, I am Utilities Manager at the City of Escondido with responsibility for management of the Hale Avenue Resource Recovery Facility. Mr. Bill Powers raised several issues at the CEC public meeting on the comparison of cooling methods that relate to the nature of treated water produced by the facility or to opportunities for use of reclaimed water in the Escondido area. You requested that I address some of these issues. The requested information is set forth below.

1. Ammonia - The chemistry (pH) of both the recycled water and in the cooling tower is such that the ammonia will stay in solution and not be released as a gas. The recycled water pH will be in the range of 7.2 to 7.7. Ammonia will not form the gas until the pH is over 8.8. Although your project technical staff can address this as well, there is incentive to keep the pH lower in the cooling tower to prevent the formation of salt deposits. The low pH will keep the ammonia in the water. Thus I see no basis for concern about additional ammonia emissions from the cooling tower.

2. An assertion was made at the CEC meeting that the recycled water production from the HARRF could be utilized in the San Pasqual Groundwater Recharge program or in some other groundwater recharge program. The San Pasqual area is an agricultural preserve area within the City Limits of the City of San Diego. The City of San Diego is not interested in using recycled water from any other entity for a potential recharge project in the San Pasqual area due to their need to find usage

sites for the huge quantities of treated and desalted recycled water that they have available from their North City Water Reclamation plant. There are no other potential groundwater basins in or around Escondido. All of the basins are too small, too shallow, too contaminated or too vulnerable for reasonable use.

3. Concerns were raised that the increased concentration of brine in the HARRF effluent as a result of the evaporative process in the Palomar cooling towers would negatively impact the potential use of Escondido effluent for making tertiary water by Escondido's Ocean Outfall partner, the San Elijo Joint Powers Authority (SEJPA). The City and SEJPA have a draft agreement on that very subject, in which Escondido agrees to restrict the discharge of brine to certain hours to allow the beneficial use of the effluent by SEJPA during other times. The only remaining detail is the number of hours over which Escondido will discharge the brine. Maximum potential usage of the effluent will be preserved.

4. A final "potential" usage suggested at the CEC meeting was to use HARRF recycled water on avocado orchards. First, the City conducted a five-year production experiment in conjunction with local growers in the early 1990's in which it was demonstrated that the use of Escondido Recycled water reduced avocado production due to the relatively high level of salts in the recycled water. Currently there is no interest on the part of the commercial growers to use the recycled water. Secondly, the groves are mostly located at the opposite end of the city and it would require an uneconomic capital investment to construct infrastructure to deliver the recycled water. Finally, due to the increased land values in the North San Diego county region, agriculture may not prove to be an economic, long-term use of the land. Already, many grove areas are converting from large commercial groves to residential usages or smaller semi-commercial/residential groves. Neither of the uses are appropriate for recycled water use.

Please let me know if I can provide any further information.

Sincerely,

John E. Hoagland
Utilities Manager