# 5.0 ENERGY ANALYSIS

In accordance with Appendix F of the CEQA Guidelines, potentially significant energy implications of a project should be considered in an EIR. Environmental impacts may include:

- Project life cycle energy consumption
- Effects of the project on local and regional energy supplies
- Effects of the project on peak and base period energy demand
- Effects of the project on energy resources
- The project's transportation energy use requirements and its overall use of efficient transportation alternatives

## 5.1 ENERGY CONSUMPTION AND EFFECT ON ENERGY RESOURCES

The construction of the desalination plant and in-system improvements would require a variety of construction equipment. The primary energy demand during construction would be associated with use of gasoline- and diesel-powered mobile construction equipment and use of automobiles to transport workers to and from the construction site(s). Electricity would also be used for construction lighting, field services (trailers), and electrically driven construction devices such as air compressors, pumps and other equipment. At its maximum size, the desalination plant and its appurtenant facilities such as water lines to connect to the county water distribution system would be a small construction project. Therefore, the amount of transportation fuel and electricity required for construction would be very small relative to statewide consumption.

During desalination facility operations, the major power use would be for desalting Bay water through the RO membranes. Other power requirements include pumping the water from the Bay to the desalination facility and pumping the treated water into the distribution system. The major power use for MF/UF pretreatment system (the proposed pretreatment method) includes the energy to pump the feedwater through the feed strainers, the filtrate pumps to draw the water through the hollow membrane fibers, backwash pumps and air-scour blowers or compressors. Based on the pilot study, the average pressure drop across the feed strainers is 3 psi. The average trans-membrane pressure across the submerged MF/UF membranes is 8 psi. The major power use for a conventional pretreatment system (an alternative pretreatment method) includes continuous rapid mix and flocculation mixing, backwash pumps and airwash blowers.

Operation of the proposed desalination plant would require a considerable amount of additional electrical energy compared to MMWD's current electricity consumption of approximately 26 million kilowatt-hours per year (kWh/yr). Projected electricity requirements for the proposed desalination plant at 5 MGD, 10 MGD, and 15 MGD for average and drought conditions are shown in **Table 5-1**. These data are based on power estimates from the *Engineering Report MMWD Seawater Desalination Pilot Program* (Kennedy/Jenks Consultants 2007).

Average annual operation of the desalination plant would be about one-half of plant capacity and require less power than in droughts due to the lower salinity of water in the Bay. In droughts, the desalination plant would operate near full capacity and require more power due to the higher salinity of the Bay.

**Table 5-1**
**Estimated Electricity Demand for Proposed Desalination Project**

| 5 MGD Average Conditions[1] (kWh/yr) | 5 MGD Drought Conditions[2] (kWh/yr) | 10 MGD Average Conditions[1] (kWh/yr) | 10 MGD Drought Conditions[2] (kWh/yr) | 15 MGD Average Conditions[1] (kWh/yr) | 15 MGD Drought Conditions[2] (kWh/yr) |
|---|---|---|---|---|---|
| 10,037,500 | 25,550,000 | 18,615,000 | 51,100,000 | 28,470,000 | 76,650,000 |

[1] Based on 10 kilowatt-hours (kWh) per 1,000 gallons to desalinate water from the Bay and pump it to the San Quentin Ridge tanks

[2] Based on 14 kWh per 1,000 gallons to desalinate water from the Bay and pump it to the San Quentin Ridge tanks

For long-term energy impacts, the data for average operations are the most appropriate. For short-term energy impacts, the data for drought operations are the most appropriate.

In 2005, total electricity consumption in California was 272,464 million kWh (California Energy Commission 2005). Energy consumption in Marin County totaled 1,421 million kWh that year, which was about 30 percent of the electricity consumption for the average county in California (4,679 million kWh/yr). Marin County used approximately the same amount of electricity in 2005 as Butte, Imperial, Kings, Santa Cruz, and Shasta counties (California Energy Commission 2005).

During average water years, water production from the plant would be relatively low, and the corresponding energy consumption would be approximately 10 million kWh higher than MMWD's current consumption of approximately 26 million kWh per year. This would increase MMWD's portion of electricity consumption in Marin County from 1.8 to 2.5 percent of the total. During a drought, the plant would run at its 5 MGD capacity year-round, which would double MMWD's annual consumption of electricity to 3.6 percent of the Marin County total. During drought conditions with a 15 MGD capacity desalination plant, MMWD's electricity use would increase to 7.2 percent of the county's total consumption. Within the context of the entire State of California, the maximum use of the desalination plant would increase state electricity consumption by about 0.03 percent.

Most of the project's life cycle energy requirement is for plant operation. This energy requirement would result in a significant increase in energy consumption in Marin County during drought years if the plant is operating at a capacity of 15 MGD. To help minimize the energy requirements for the desalination facility, the plant design would incorporate high-efficiency pumps and the most advanced energy recovery systems available. The facility's system operations would also be designed to minimize energy use depending on the salinity and temperature of the Bay water.

## 5.2 EFFECT ON ENERGY SUPPLIES

In 2005, PG&E delivered 81,626 gigawatt-hours (GWh) of electricity. Of that amount, 32,680 GWh was generated by PG&E facilities, and the rest was purchased by PG&E or delivered through PG&E transmission lines (PG&E 2006). Of the total delivered, customers purchased 72,727 GWh, or 89 percent of the total electricity delivered. At its highest predicted energy use, the proposed desalination plant would consume less than 1 percent of the electricity available to PG&E customers in 2005 that was not purchased by those customers. Therefore, the project would not require construction of additional electrical generation capacity.

## 5.3 EFFECT ON PEAK AND BASE DEMAND FOR ELECTRICITY

Peak demand for electric energy occurs when so much electrical equipment is in use at one time that it places a strain on the entire electric system. In California this generally occurs during summer heat waves in the weekday afternoon hours when air conditioners at both homes and businesses are running at full strength.

The proposed desalination plant would operate on a continuous basis when it is used to augment MMWD's water supplies. Operations would not increase during peak periods of electrical demand; however, the plant would contribute a new source of electrical demand during peaks, as well as add to the base demand in Marin County. Because of the plant's high energy demand during maximum output, it would place significant additional demand on the electrical system in Marin County during peak and base load periods.

MMWD plans to explore the use of alternative renewable energy sources to power the desalination facility. MMWD could purchase alternative energy from various suppliers including PG&E. Alternative renewable energy sources could include:

- Solar energy
- Wind energy
- Wave/tidal energy
- Landfill gas energy

MMWD completed a screening level assessment of a number of alternative energy supply scenarios for the project (URS 2003a), including:

- PG&E-supplied electricity (base case)
- Landfill gas-fired generation
- Solar energy
- Fuel cells
- Natural gas-fired combustion turbine

These alternative energy supplies are discussed further in Section 6.3.11.

## 5.4 TRANSPORTATION ENERGY USE

As discussed in Section 5.1, the desalination plant and its appurtenant facilities such as water lines to connect to the county water distribution system would be a small construction project requiring the short-term use of a minimal amount of gasoline- and diesel-powered equipment. During operations, the plant would be staffed by four workers per shift; therefore, little additional vehicular traffic would be created. For these reasons, the project would result in a less-than-significant increase in transportation energy use requirements in Marin County.

## 5.5 ENERGY CONSERVATION

The California Energy Commission implements a number of programs that are designed to increase the efficiency of statewide energy utilization. With regard to electricity, the Commission

has been actively funding local electricity efficiency-improvement and demand-side management programs for many years. Recent efforts have included funding to support the installation of more energy-efficient lighting in public buildings and schools as well as implementation of energy-efficiency standards for new buildings. These programs are expected to continue to reduce the rate of demand growth.

In addition to these statewide conservation efforts, MMWD will continue to explore, in consultation with PG&E, possible ways to improve its energy efficiency and lower its overall energy costs. For the desalination plant and in-system improvements, MMWD will implement engineering features designed to minimize electricity consumption to the extent that they are feasible and cost-effective, including but not limited to energy recovery equipment, high-efficiency motors, and variable frequency motor drives.

## 5.6 CONCLUSIONS

The desalination process requires a substantial amount of energy to force water through the semi-permeable membranes that are at the heart of the reverse osmosis process. During average water years, water production from the plant would be relatively low and the corresponding increase in the consumption of electricity would be less than significant (about 1.3 percent of Marin County electricity consumption). During drought conditions when the plant is operated at maximum capacity, it would use a significant amount of electricity (5.4 percent of Marin County electricity consumption) even though facility systems would be designed to be energy efficient. Existing electricity generation capacity and supply systems can meet this increased demand. In addition, MMWD would continue to explore the use of alternative renewable energy sources to power the desalination facility and possible ways to improve its energy efficiency and lower its overall energy costs. Therefore, while the project may result in a substantial increase in energy use, it would not result in the wasteful, inefficient, and unnecessary consumption of energy.