Chapter 8

Energy

8.1 Introduction

This chapter describes the hydroelectric generation facilities and power demands for the Central Valley Project (CVP) and State Water Project (SWP) related to changes that could occur as a result of implementing the alternatives evaluated in this Environmental Impact Statement (EIS). Implementation of the alternatives could affect CVP and SWP power generation and energy demands through potential changes in operation of the CVP and SWP facilities.

Changes in CVP and SWP operations are described in more detail in Chapter 5, Surface Water Resources and Water Supplies.

8.2 Regulatory Environment and Compliance Requirements

Potential actions that could be implemented under the alternatives evaluated in this EIS could affect CVP and/or SWP hydroelectric generation and electricity use. The changes in power production and energy use would need to be compliant with appropriate Federal and state agency policies and regulations, as summarized in Chapter 4, Approach to Environmental Analysis.

8.3 Affected Environment

This section describes CVP and SWP hydroelectric generation and electricity use of the generated electricity within the study area.

The study area includes CVP and SWP hydroelectric generation facilities at the CVP and SWP reservoirs; transmission of the generated electricity; and the CVP and SWP facilities and other users throughout California that rely upon electricity generated by the CVP and SWP hydroelectric facilities. These CVP and SWP energy generation facilities are located in the Trinity River and Central Valley regions. CVP and SWP energy use primarily occurs in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions, as defined below.

8.3.1 Central Valley Project and State Water Project Electric Generation Facilities

Hydroelectric facilities are located at most of the CVP and SWP dams, as shown on Figure 8.1. As water is released from the CVP and SWP reservoirs, the generation facilities produce power that is used by the CVP and SWP pumping plants, respectively. The SWP also generates hydroelectricity along the

California Aqueduct at energy recovery plants (California Department of Water Resources [DWR] 2013a, 2013b). Between 1983 and 2013, the DWR owned a portion of the Nevada Power Company's coal-fired Reid Gardner Unit 4 Powerplant. However, this agreement was not renewed upon expiration in 2013.

Power generated by the CVP is transmitted by Western Area Power Administration (Western) to CVP facilities. Power that is excess to CVP needs is marketed by Western to electric utilities, government and public installations, and commercial "preference" customers who have 20-year contracts (Bureau of Reclamation [Reclamation] 2012a). Power generated by the SWP is transmitted by Pacific Gas & Electric Company, Southern California Edison, and California Independent System Operator through other facilities (DWR 2013a, 2013b). The SWP also markets energy in excess of the SWP demands to a utility and members of the Western Systems Power Pool.

Hydropower is an important renewable energy and supplies between 14 and 28 percent of electricity used in California depending upon the water year type (The California Energy Commission [CEC] 2014a; Hydropower Working Group [HWG] 2014). In 1992, at the end of the 1987-to-1992 drought, hydropower provided less than 11 percent of the electricity used in California. However, during a wetter year (1995), hydropower provided approximately 28 percent of electricity used in California. Between 1982 and 2012, approximately 33,927 gigawatt-hours were generated in California by hydropower, including approximately 4,810 and 2,613 gigawatt-hours generated by the CVP and SWP, respectively.

8.3.1.1 CVP Hydroelectric Generation Facilities

The CVP power facilities include 11 hydroelectric powerplants and have a total maximum generating capacity of 2,076 megawatts, as presented in Table 8.1. Hydrology can vary significantly from year to year, which then affects the hydropower production. Typically, in an average water year, approximately 4,500 gigawatt-hours of energy is produced (Reclamation 2012a). Major factors that influence powerplant operations include required downstream water releases, electric system needs, and project use demand. The power generated from CVP powerplants is dedicated to first meeting the requirements of the CVP facilities. The remaining energy is marketed by Western to preferred customers in northern California.

Table 8.1 Central Valley Project Hydroelectric Powerplants

Facility	Installed Capacity (Megawatts)
Trinity Powerplant	140
Lewiston Powerplant	0.35
Judge Francis Powerplant	154
Shasta Powerplant	710
Spring Creek Powerplant	180
Keswick Powerplant	117
Folsom Powerplant	207
Nimbus Powerplant	17
New Melones Powerplant	383
O'Neill Pump-Generating Plant	14.4
San Luis Powerplant (CVP portion of the William R. Gianelli/San Luis Pump-Generating Plant)	202

Sources: Reclamation 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2013i, 2013j, 2013k, 2013l

8.3.1.1.1 Trinity Division Powerplants

The Trinity Powerplant is located along the Trinity River (Reclamation 2013b). Primary releases of Trinity Dam are made through the powerplant. Trinity County has first preference to the power from this plant.

The Lewiston Powerplant is located at the Lewiston Dam along the Trinity River (Reclamation 2013c). It is operated in conjunction with the spillway gates to maintain the minimum flow in the Trinity River downstream. The turbines are usually set at maximum output with the spillway gates adjusted to regulate river flow. The turbine capacity is less than the Trinity River minimum flow criteria, as described in Chapter 5, Surface Water Resources and Water Supplies. The Lewiston Powerplant provides power to the adjacent fish hatchery.

The Judge Francis Carr Powerplant is a peaking powerplant located on the Clear Creek Tunnel (Reclamation 2013d). It generates power from water exported from the Trinity River Basin. Similar to Trinity Powerplant, Trinity County has first preference to the power benefit from this facility.

8.3.1.1.2 Sacramento River Powerplants

The Shasta Powerplant is a peaking powerplant located downstream of Shasta Dam along the Sacramento River (Reclamation 2013a, 2013e). Until early 1990s, concerns with downstream temperatures resulted in the bypasses of outflows around the powerplant and lost hydropower generation. Installation of the Shasta Temperature Control Device enabled operators to decide the depth of the reservoir from which the water feeding into the penstocks originates. The system has shown significant success in controlling the water temperature of powerplant releases through Shasta Dam. The Shasta Powerplant also provides water supply for the Livingston Stone National Fish Hatchery.

The Spring Creek Powerplant is a peaking plant located along Spring Creek, at the foot of Spring Creek Debris Dam (Reclamation 2013f). Water discharged via the Judge Francis Carr Powerplant flows into the Whiskeytown Reservoir and then provides the source of water for the Spring Creek Powerplant generation. Trinity County has first preference to the power benefits from Spring Creek Powerplant. Water from Spring Creek Powerplant is discharged into Keswick Reservoir. Releases from Spring Creek Powerplant also are operated to maintain water quality in the Spring Creek arm of Keswick Reservoir.

The Keswick Powerplant is located at Keswick Dam along the Sacramento River downstream of Shasta Dam and regulates the flows into the Sacramento River from both Shasta Lake and Spring Creek releases and can be considered as a run-of-the-river powerplant (Reclamation 2013g).

8.3.1.1.3 American River Powerplants

The Folsom Powerplant is a peaking powerplant located at Folsom Dam along the American River (Reclamation 2013h). The Folsom Powerplant is operated in an integrated manner with flood control operations at Folsom Lake. One of the integrated operations is related to coordinating early flood control releases with power generation. It also provides power for the pumping plant that supplies the local domestic water supply. Folsom Powerplant supports voltage support for the Sacramento Region during summer heavy load times.

The Nimbus Powerplant is located at Nimbus Dam along the American River, downstream of Folsom Dam (Reclamation 2013i). The Nimbus Powerplant regulates releases from Folsom Dam into the American River and can be considered as a run-of-the river powerplant.

8.3.1.1.4 Stanislaus River Powerplants

The New Melones Powerplant is a peaking powerplant located along the Stanislaus River (Reclamation 2013j). Primary reservoir releases are made through the powerplant. This plant provides significant voltage support to the Pacific Gas and Electric Company system during summer heavy load periods.

8.3.1.1.5 San Luis Reservoir Powerplants

The O'Neill Pump-Generating Plant is located on a channel that conveys water between the Delta-Mendota Canal and the O'Neill Forebay (Reclamation 2013k). This pump-generating plant only generates power when water is released from the O'Neill Reservoir to the Delta-Mendota Canal. When water is conveyed from the Delta-Mendota Canal to O'Neill Forebay, the units serve as pumps, not hydroelectric generators. The generated power is used to support CVP pumping and irrigation actions of the CVP.

The William R. Gianelli (San Luis) Pump-Generating Plant is located along the along the western boundary of the O'Neill Forebay at the San Luis Dam

(Reclamation 2013l). This pump-generating plant is owned by the Federal government but is operated as a joint Federal-State facility that is shared by the CVP and SWP. Energy is generated when water is needed to be conveyed from San Luis Reservoir back into O'Neill Forebay for continued conveyance to the Delta-Mendota Canal. The plant is operated in pumping mode when water is moved from O'Neill Forebay to San Luis Reservoir for storage until heavier water demands develop. The generated power is used to offset CVP and SWP pumping loads. The powerplant can generate up to 424 megawatts, with the CVP share of the total capacity being 202 megawatts. This facility is operated and maintained by the State of California under an operation and maintenance agreement with Reclamation.

8.3.1.2 SWP Electric Generation Facilities

The SWP power facilities are operated primarily to provide power for the SWP facilities (DWR 2013b). The SWP power facilities and capacities are summarized in Table 8.2. The SWP has power contracts with electric utilities and the California Independent System Operator that act as exchange agreements with utility companies for transmission and power sales/purchases. In all years, the SWP must purchase additional power to meet pumping requirements.

Table 8.2 State Water Project Hydroelectric Powerplants

Facility	Installed Capacity (Megawatts)
Oroville Facilities	–
Hyatt Pumping-Generating Plant	645
Thermalito Diversion Dam Powerplant	3
Thermalito Pumping-Generating Plant	114
William R. Gianelli (San Luis) Pumping-Generating Plant (SWP share)	222
Alamo Powerplant	17
Mojave Siphon Powerplant	30
Devil Canyon Powerplant	276
Warne Powerplant	74

Source: DWR 2012

8.3.1.2.1 Feather River Powerplants

The Hyatt Pumping-Generating Plant is located on the channel between Lake Oroville and the Thermalito Diversion Pool (DWR 2007). Water in the Thermalito Diversion Pool can be pumped back to Lake Oroville to be released through the Hyatt Pumping-Generating Plant and generate more electricity; released through the Thermalito Diversion Dam Powerplant for delivery to the low flow channel upstream of Thermalito Forebay; or conveyed to Thermalito Forebay for subsequent release through the Thermalito Pumping-Generating Plant. The combined Hyatt Pumping-Generating Plant and Thermalito Pumping-Generating Plant generate approximately 2,200 gigawatt-hours of energy in a median water year, while the 3 megawatts generated by Thermalito Diversion Dam Powerplant adds another 24 gigawatt-hours per year (DWR 2013).

8.3.1.2.2 San Luis Reservoir Powerplant

As described above, the William R. Gianelli (San Luis) Pump-Generating Plant is owned by the Federal government and is operated as a joint Federal-state facility that is shared by the CVP and SWP. The SWP water flows from the California Aqueduct into O'Neill Forebay downstream of the CVP's O'Neill Pump-Generating Plant. The pump-generating plant is located along the western boundary of the O'Neill Forebay at the San Luis Dam (DWR 2013a, 2013b, Reclamation 2013l). Electricity is generated when water is transferred from San Luis Reservoir back to O'Neill Forebay for continued conveyance in the California Aqueduct. The plant acts as a pumping plant when water is transferred from O'Neill Forebay to San Luis Reservoir. The generated power is used to offset CVP and SWP pumping loads. The powerplant can generate up to 424 megawatts, with the SWP share of the total capacity being 222 megawatts. This facility is operated and maintained by the State of California under an operation and maintenance agreement with Reclamation.

8.3.1.2.3 East Branch and West Branch Powerplants

Downstream of the Antelope Valley, the California Aqueduct divides into the East Branch and West Branch. The Alamo Powerplant, Mojave Powerplant, and Devil Canyon Powerplant are located along the East Branch which conveys water into San Bernardino County (DWR 2013a, 2013b). The Warne Powerplant is located along the West Branch which conveys water into Los Angeles County. The generation rates vary at these powerplants depending upon the amount of water conveyed.

8.3.1.2.4 Other Energy Resources for the State Water Project

Other energy supplies have been obtained by DWR from other utilities and energy marketers under agreements that allow DWR to buy, sell, or exchange energy on a short-term hourly basis or a long-term multi-year basis (DWR 2013a, 2013b).

For example, DWR jointly developed the 1,254-megawatt Castaic Powerplant on the West Branch with the Los Angeles Department of Water and Power (DWR 2012, 2013). The power is available to DWR at the Sylmar Substation.

DWR has a long-term purchase agreement with the Kings River Conservation District for the approximately 400 million kilowatt-hours of energy from the 165-megawatt hydroelectric Pine Flat Powerplant (DWR 2012, 2013). DWR also purchases energy from five hydroelectric plants with 30 megawatts of installed capacity that are owned and operated by Metropolitan Water District of Southern California (DWR 2012, 2013).

DWR also purchases energy under short-term purchase agreements from utilities and energy marketers of the Western Systems Power Pool (DWR 2012, 2013). In addition, the 1988 Coordination Agreement between DWR and Metropolitan

Water District of Southern Californian enables DWR to purchase and exchange energy (DWR 2012, 2013).

8.3.2 Other Hydroelectric Generation Facilities

Hydroelectric facilities in addition to CVP and SWP hydroelectric facilities in the study area are owned by investor-owned utility companies, such as Pacific Gas & Electric Company and Southern California Edison; municipal agencies, such as Sacramento Municipal Utility District; and by local and regional water agencies. Some of the larger facilities outside the CVP and SWP systems and within or adjacent to the study area include (DWR 2013d; 2013e; YCWA 2012):

- Pacific Gas and Electric Company
  - Helms Pumped Storage (1,200 megawatts) in Fresno County.
  - Pit System (320 megawatts) and McCloud-Pit System (370 megawatts, total) in Shasta County.
  - Upper North Fork Feather River System (360 megawatts) in Plumas County.
- Sacramento Municipal Utility District Upper American River Project System (688 megawatts) in El Dorado County.
- City and County of San Francisco Hetch Hetchy Power System (390 megawatts) in Tuolumne County.
- Southern California Edison
  - Big Creek System and Eastwood Pump Storage (approximately 1,000 megawatts) in Fresno and Madera counties.
  - Mammoth Pool Project (187 megawatts) in Fresno and Madera counties.
- Turlock Irrigation District and Modesto Irrigation District New Don Pedro Project (203 megawatts) in Tuolumne County.
- Yuba County Water Agency Yuba River Development Project (390 megawatts) in Yuba County.

8.3.3 CVP and SWP System Energy Demands

Power generation at CVP and SWP hydropower facilities fluctuates in response to reservoir releases and conveyance flows. Reservoir releases are significantly affected by hydrologic conditions, minimum stream flow requirements, flow fluctuation restrictions, water quality requirements, and non-CVP and non-SWP water rights which must be met prior to releases for CVP water service contractors and SWP entitlement holders.

8.3.3.1 CVP Power Generation and Energy Use

The CVP power generation facilities were developed to meet CVP energy use loads.

The majority of the energy used by the CVP is needed for pumping plants located in the Delta, at San Luis Reservoir, and along the Delta-Mendota Canal and San Luis Canal portion of the California Aqueduct. Table 8.3 presents historical average annual CVP hydropower generation and use. Monthly power generation pattern follows seasonal reservoir releases, with peaks during the irrigation season, as shown on Figure 8.2. The hydropower generation between January and June decreases after 2007 because the potential to convey CVP water across the Delta during this period was reduced after 2007 to reduce reverse flows in Old and Middle River, in accordance with legal decisions and subsequently through implementation of the biological opinions.

Table 8.3 Hydropower Generation and Energy Use by the CVP

Calendar Year	Water Year Type[a]	Net CVP Hydropower Generation (Gigawatt-hours)	Energy Used CVP Facilities (Gigawatt-hours)
2000	AN	5,667	–
2001	D	4,107	957
2002	D	4,322	1,090
2003	AN	5,483	1,170
2004	BN	5,186	1,172
2005	AN	4,599	1,150
2006	W	7,284	1,037
2007	D	4,276	1,064
2008	C	3,659	923
2009	D	3,560	803
2010	BN	3,624	1,001
2011	W	5,469	1,276
2012	BN	4,849	990

Sources: Reclamation 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008a-l, 2009a-l, 2010a-l, 2011a-l, 2012b-m.

Note:
a. Water Year Type based on Sacramento Valley 40-30-30 Index, as described in Chapter 5, Surface Water Resources and Water Supplies.

Recently, the California Public Utilities Commission (CPUC) evaluated the "energy intensity" of several types of water supplies (CPUC 2010). The energy intensity is defined as the average amount of energy required to convey and/or treat water on a unit basis, such as per 1 acre-foot. Substantial quantities of energy are required by the CVP pumping plants to convey large amounts of water over long distances with significant changes in elevation. The study indicated that the energy intensity of CVP water delivered to users downstream of San Luis Reservoir ranged from 0.292 megawatt-hours/acre-foot for users along the Delta-Mendota Canal; to 0.428 megawatt-hours/acre-foot for users along the San Luis

Canal/California Aqueduct; to 0.870 megawatt-hours/acre-foot in San Benito and Santa Clara counties.

8.3.3.2 SWP Power Generation and Energy Use

The SWP power generation facilities also were developed to meet SWP energy use loads. The majority of the energy used by the SWP is needed for pumping plants located in the Delta, at the San Luis Reservoir, and along the California Aqueduct. Table 8.4 presents historical average annual SWP hydropower generation and use. Monthly power generation pattern follows seasonal reservoir releases, with peaks during the irrigation season, as shown on Figure 8.3.

Table 8.4 presents SWP power use and generation values for the period 2001 through 2012 that indicate the SWP generates approximately 63 percent of the energy needed for deliveries (DWR 2002, 2004a, 2004b, 2005, 2006, 2007, 2008, 2012a, 2012b, 2013). The energy generation and purchases and energy use decreases after 2007 because the potential to convey SWP water across the Delta was reduced in accordance with legal decisions and subsequently through implementation of the biological opinions.

Table 8.4 Hydropower Generation and Energy Use by the State Water Project

Calendar Year	Water Year Type[a]	SWP Hydropower Generation (Gigawatt-hour)	Energy Acquired through Long-term Agreements and Purchases (Gigawatt-hour)	Energy Used by SWP Facilities (Gigawatt-hour)
2000	AN	6,372	5,741	9,190
2001	D	4,295	4,660	6,656
2002	D	4,953	4,610	8,394
2003	AN	5,511	4,668	9,175
2004	BN	6,056	4,429	9,868
2005	AN	5,151	5,367	8,308
2006	W	7,056	5,811	9,158
2007	D	5,577	6,642	9,773
2008	C	3,541	4,603	5,745
2009	D	4,295	4,660	6,656
2010	BN	4,953	4,610	8,394
2011	W	5.511	4,668	9.175
2012	BN	6,056	4,429	9.868

Sources: DWR 2002, 2004a, 2004b, 2005, 2006, 2007, 2008, 2012a, 2012b, 2013

Note:

a. Water Year Type based on Sacramento Valley 40-30-30 Index, as described in Chapter 5, Surface Water Resources and Water Supplies.

The energy intensity values calculated by the California Public Utilities Commission for the SWP ranged from 1.128 megawatt-hours/acre-foot for water users along the South Bay Aqueduct; to 1.157 megawatt-hours/acre-foot for water users in Kern County; to 4,644 megawatt-hours/acre-foot for water users at the terminal end of the East Branch Extension of the California Aqueduct (CPUC 2010).

8.3.4 Energy Demands for Groundwater Pumping

Groundwater provided approximately 37 percent of the state's agricultural, municipal, and industrial water supply of the average water needs between 1998 and 2010, or approximately 16 million acre-feet/year of groundwater (DWR 2013). The use of groundwater varies regionally throughout the State. For example in some areas, groundwater provides less than 10 percent to more than 90 percent, as described in Chapter 7, Groundwater Resources and Groundwater Quality.

The amount of energy used statewide to pump groundwater is not well quantified (CPUC 2010). The California Public Utilities Commission estimated groundwater energy use by hydrologic region and by type of use to evaluate the water and energy relationships. Groundwater pumping estimates were calculated in each DWR Planning Areas for agricultural and municipal water demands. Groundwater energy use was estimated based upon assumptions of well depths and pump efficiencies. Some wells use natural gas for individual engines instead of electricity; however, the amount of natural gas pumping versus electric pumping is generally unknown. In 2010, average groundwater use in the state was approximately 14.7 million acre-feet, or 36 percent of total agricultural, municipal, and industrial water supplies (DWR 2013). The California Public Utilities Commission estimated that in 2010, statewide groundwater pumping accounted for more electricity use between May and August than the total electricity use by the CVP and SWP during that time period (CPUC 2010). Over the entire year, it was estimated that groundwater pumping used approximately 10 percent more electricity than the SWP and approximately 5 percent less than the CVP and SWP combined.

8.4 Impact Analysis

This section describes the potential mechanisms for change in energy generation and analytical methods; results of the impact analyses; potential mitigation measures; and cumulative effects.

8.4.1 Potential Mechanisms for Change and Analytical Tools

The environmental consequences assessment considers changes in energy resources conditions related to changes in CVP and SWP operations under the alternatives as compared to the No Action Alternative and Second Basis of Comparison.

8.4.1.1 Changes in Energy Resources Related to CVP and SWP Water Users

Energy generation is limited on a monthly bases by the average power capacity of each generation facility based upon reservoir elevations and water release patterns. The majority of the CVP and SWP energy use is for the conveyance facilities located in the Delta and south of the Delta. Energy use would change with changes in CVP and SWP deliveries.

Reservoir elevations and flow patterns through pumping facilities output from the CalSim II model (see Chapter 5, Surface Water Resources and Water Supplies) are used with LTGen and SWP Power tools, as described in Appendix 8A, Power Model Documentation. These tools estimate average annual peaking power capacity, energy use, and energy generation at CVP and SWP facilities, respectively. The tools estimate average annual energy generation and use and net generation. When net generation values are negative, the CVP or SWP would purchase power from other generation facilities. When net generation values are positive, power would be available for use by non-CVP and SWP electricity users.

When CVP and SWP water deliveries change, water users would are anticipated do change their use of groundwater, recycled water, and/or desalinated water, as described in Chapter 5, Surface Water Resources and Water Supplies, Chapter 12, Agricultural Resources, and Chapter 19, Socioeconomics. Specific responses by water users to changes in CVP and SWP water deliveries are not known; and therefore, energy use for the alternate water supplies cannot be quantified in this analysis. It is not known whether the net change in energy use for the CVP and SWP would or would not be similar to the net change in energy use for alternate water supplies (e.g., groundwater pumping, water treatment, water conveyance).

8.4.1.2 Effect Related to Cross Delta Water Transfers

Historically water transfer programs have been developed on an annual basis. The demand for water transfers is dependent upon the availability of water supplies to meet water demands. Water transfer transactions have increased over time as CVP and SWP water supply availability has decreased, especially during drier water years. Water transfers using CVP and SWP Delta pumping plants and south of Delta canals generally occur when there is unused capacity in these facilities, especially in drier years.

Parties seeking water transfers generally acquire water from sellers who have available surface water who can make the water available through releasing previously stored water, pump groundwater instead of using surface water (groundwater substitution); idle crops; or substitute crops that uses less water in order to reduce normal consumptive use of surface water.

Changes in net energy generation could occur statewide during cross Delta water transfers due to following reasons:

- Changed reservoir release patterns at CVP and SWP reservoirs
- Changed conveyance patterns at the CVP and SWP pumping plants

- Increased groundwater pumping in the seller's service area if groundwater substitution is used to make the transferred water available
- Reductions in groundwater pumping in the purchaser's service area if less groundwater would be used due to the water transfer

Reclamation recently prepared a long-term regional water transfer environmental document which evaluated potential changes in surface water conditions related to water transfer actions (Reclamation 2014c). Results from this analysis were used to inform the impact assessment of potential effects of water transfers under the alternatives as compared to the No Action Alternative and the Second Basis of Comparison.

8.4.2 Conditions in Year 2030 without Implementation of Alternatives 1 through 5

The impact analysis in this EIS is based upon the comparison of the alternatives to the No Action Alternative and the Second Basis of Comparison in the Year 2030. Changes that would occur over the next 15 years without implementation of the alternatives are not analyzed in this EIS. However, the changes that are assumed to occur by 2030 under the No Action Alternative and the Second Basis of Comparison are summarized in this section.

Many of the changed conditions would occur in the same manner under both the No Action Alternative and the Second Basis of Comparison. Other future conditions would be different under the No Action Alternative as compared to the Second Basis of Comparison due to the implementation of the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) and 2009 National Marine Fisheries Service (NMFS) BO under the No Action Alternative.

This section of Chapter 8 provides qualitative projections of the No Action Alternative as compared to existing conditions described under the Affected Environment; and qualitative projections of the Second Basis of Comparison as compared to "recent historical conditions." Recent historical conditions are not the same as existing conditions which include implementation of the 2008 USFWS BO and 2009 NMFS BO; and consider changes that would have occurred without implementation of the 2008 USFWS BO and the 2009 NMFS BO.

8.4.2.1 Common Changes in Conditions under the No Action Alternative and Second Basis of Comparison

Conditions in 2030 would be different than existing conditions due to:

- Climate change and sea-level rise
- General plan development throughout California, including increased water demands in portions of Sacramento Valley
- Implementation of reasonable and foreseeable water resources management projects to provide water supplies

These changes would result in a decline of the long-term average CVP and SWP water supply deliveries by 2030 as compared to recent historical long-term average deliveries, as described in Chapter 5, Surface Water Resources and Water Supplies.

8.4.2.1.1 Changes in Conditions due to Climate Change and Sea Level Rise

It is anticipated that climate change would result in more short-duration high-rainfall events and less snowpack in the winter and early spring months. The reservoirs would be full more frequently by the end of April or May by 2030 than in recent historical conditions. However, as the water is released in the spring, there would be less snowpack to refill the reservoirs. This condition would reduce reservoir storage and potential hydropower generation in the summer. These conditions would occur for all reservoirs in the California foothills and mountains, including non-CVP and SWP reservoirs.

8.4.2.1.2 General Plan Development in California

Counties and cities throughout California have adopted general plans which identify land use classifications including those for municipal and industrial uses and those for agricultural uses. Population projections from those general plan evaluations are provided to the State Department of Finance and are used to project future water needs and the potential for conversion of existing undeveloped lands and agricultural lands. Many of the existing general plans for counties with municipal areas recently have been modified to include land use and population projections through 2030. The No Action Alternative and the Second Basis of Comparison assume that land uses will develop through 2030 in accordance with existing general plans.

Statewide the increased population would result in increased energy demands. Under the No Action Alternative and Second Basis of Comparison, it is assumed that energy demands would be met on a long-term basis and in dry and critical dry years using a combination of conservation, increased efficiency in energy generation and transmission, and renewable energy sources.

8.4.2.1.3 Reasonable and Foreseeable Water Resources Management Projects

The No Action Alternative and the Second Basis of Comparison assumes completion of water resources management and environmental restoration projects that would have occurred without implementation of the 2008 USFWS BO and 2009 NMFS BO by 2030, as described in Chapter 3, Description of Alternatives. Many of these future actions involve additional water treatment and conveyance facilities that would change statewide energy demands.

8.4.2.2 Changes in Conditions under the No Action Alternative

Due to the climate change and sea level rise and increased water demands in the Sacramento Valley, CVP and SWP energy generation would be less in the summer months when energy demand is high for water conveyance and air conditioning equipment throughout the state. It is also anticipated that water deliveries would be less in 2030 than under recent historical conditions; and, therefore, energy use for CVP and SWP water conveyance facilities would be less.

8.4.2.3 Changes in Conditions under the Second Basis of Comparison

Due to the climate change and sea level rise and increased water demands in the Sacramento Valley, CVP and SWP energy generation would be less in the summer months when energy demand is high for water conveyance and air conditioning equipment throughout the State. It is also anticipated that water deliveries would be less in 2030 than under recent historical conditions; and, therefore, energy use for CVP and SWP water conveyance facilities would be less.

As described in Chapter 5, Surface Water Resources and Water Supplies, the availability of CVP and SWP water supplies would be greater under the Second Basis of Comparison as compared to the No Action Alternative because CVP and SWP water operations would not include requirements of the 2008 USFWS BO and 2009 NMFS BO. Therefore, CVP and SWP energy use would be greater, and possibly groundwater pumping use would be less, under the Second Basis of Comparison as compared to the No Action Alternative.

8.4.3 Evaluation of Alternatives

As described in Chapter 4, Approach to Environmental Analysis, Alternatives 1 through 5 have been compared to the No Action Alternative; and the No Action Alternative and Alternatives 1 through 5 have been compared to the Second Basis of Comparison.

During review of the numerical modeling analyses used in this EIS, an error was determined in the CalSim II model assumptions related to the Stanislaus River operations for the Second Basis of Comparison, Alternative 1, and Alternative 4 model runs. Appendix 5C includes a comparison of the CalSim II model run results presented in this chapter and CalSim II model run results with the error corrected. Appendix 5C also includes a discussion of changes in the comparison of groundwater conditions for the following alternative analyses.

- No Action Alternative compared to the Second Basis of Comparison
- Alternative 1 compared to the No Action Alternative
- Alternative 3 compared to the Second Basis of Comparison
- Alternative 5 compared to the Second Basis of Comparison

8.4.3.1 No Action Alternative

The No Action Alternative is compared to the Second Basis of Comparison.

8.4.3.1.1 Potential Changes in Energy Resources Related to CVP and SWP Water Users

Changes in CVP and SWP operations under the No Action Alternative as compared to the Second Basis of Comparison would result in a reduction of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would result in changes in CVP and SWP energy resources, as summarized in Table 8.5. The CVP net generation over the long-term conditions (averaged over the 81-year model simulation period, as described in Chapter 5) and in dry and critical dry years would be similar (within 5 percent) under the No Action Alternative and the Second Basis of Comparison. The SWP net generation would be reduced by 29 percent over the long-term condition and by 37 percent in dry and critical dry years. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.5 Energy Generation, Energy Use, and Net Generation under the No Action Alternative as Compared to the Second Basis of Comparison

Project	Water Year	Energy (Gigawatt-hours)	No Action Alternative (NAA)	Second Basis of Comparison (SBC)	Changes between NAA and SBC
CVP Facilities	Long-term Average	Energy Generation	4,558	4,604	-46
		Energy Use	1,113	1,289	-177
		Net Generation	3,445	3,315	131
	Dry and Critical Water Years	Energy Generation	2,696	2,773	-77
		Energy Use	699	773	-75
		Net Generation	1,997	2,000	-2
SWP Facilities	Long-term Average	Energy Generation	4,202	4,721	-520
		Energy Use	7,798	9,802	-2,004
		Net Generation	-3,597	-5,081	1,484
	Dry and Critical Water Years	Energy Generation	1,914	2,494	-579
		Energy Use	3,929	5,686	-1,757
		Net Generation	-2,015	-3,192	1,177

Under the No Action Alternative as compared to the Second Basis of Comparison, CVP and SWP water deliveries would be less and it is anticipated that CVP and SWP water users would use more alternate water supplies. These alternate water supplies would require energy. Specific changes in energy use would depend upon specific responses by water users, and are not known at this time. Therefore, it is uncertain whether the increased regional and local water supply energy requirements would be similar to the reduced energy use by the CVP and SWP operations in 2030 under the No Action Alternative as compared to the Second Basis of Comparison. For the purposes of this analysis, a worse-case scenario is assumed, and that total energy use by CVP and SWP water users could be higher under the No Action Alternative than under the Second Basis of Comparison.

8.4.3.1.2 Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c). Potential effects to energy resources were identified as changes in power generation patterns at the reservoirs due to changes in reservoir release patterns and surface water elevation patterns. These potential changes were not considered to be substantial because the total amount of electricity generated would be similar and the power loss would be minimal due to changes in release patterns. For the purposes of this EIS, it is anticipated that similar conditions would occur during implementation of cross Delta water transfers under the No Action Alternative and the Second Basis of Comparison.

Groundwater pumping in areas that purchase the transferred water could be reduced if additional surface water is provided. However, if the transferred water is used to meet water demands that would not have been met (e.g., crops that had been idled), groundwater pumping would be similar with or without water transfers.

Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be less under the No Action Alternative than under the Second Basis of Comparison; however, energy resources conditions would be similar.

8.4.3.2 Alternative 1

Alternative 1 is identical to the Second Basis of Comparison. Alternative 1 is compared to the No Action Alternative and the Second Basis of Comparison. However, because energy resource conditions under Alternative 1 are identical to energy resource conditions under the Second Basis of Comparison; Alternative 1 is only compared to the No Action Alternative.

8.4.3.2.1 Alternative 1 Compared to the No Action Alternative

Potential Changes in Energy Resources Related to CVP and SWP Water Users

Changes in CVP and SWP operations under Alternative 1 as compared to the No Action Alternative would result in an increase of CVP and SWP water deliveries to areas located south of the Delta; and therefore, annual energy use would result in changes in CVP and SWP energy resources, as summarized in Table 8.6. The CVP net generation over the long-term conditions and in dry and critical dry years would be similar under Alternative 1 as compared to the No Action Alternative. The SWP net generation would be increased by 41 percent over the long-term condition and by 58 percent in dry and critical dry years. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.6 Energy Generation, Energy Use, and Net Generation under Alternative 1 as Compared to the No Action Alternative

Project	Water Year	Energy (Gigawatt-hours)	Alternative 1	No Action Alternative (NAA)	Changes between Alternative 1 and NAA
CVP Facilities	Long-term Average	Energy Generation	4,604	4,558	46
		Energy Use	1,289	1,113	177
		Net Generation	3,315	3,445	-131
	Dry and Critical Water Years	Energy Generation	2,773	2,696	77
		Energy Use	773	699	75
		Net Generation	2,000	1,997	2
SWP Facilities	Long-term Average	Energy Generation	4,721	4,202	520
		Energy Use	9,802	7,798	2,004
		Net Generation	-5,081	-3,597	-1,484
	Dry and Critical Water Years	Energy Generation	2,494	1,914	579
		Energy Use	5,686	3,929	1,757
		Net Generation	-3,192	-2,015	-1,177

Under Alternative 1 as compared to the No Action Alternative, CVP and SWP water deliveries would be increased and it is anticipated that CVP and SWP water users would use less alternate water supplies. Specific changes in energy use would depend upon specific responses by water users, and are not known at this time. Therefore, it is uncertain whether the decreased regional and local water supply energy requirements would be similar to the increased energy use by the CVP and SWP operations in 2030 under Alternative 1 as compared to the No Action Alternative. For the purposes of this analysis, a worse-case scenario is assumed, and that total energy use by CVP and SWP water users could be lower under Alternative 1 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c), as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar energy conditions would occur during implementation of cross Delta water transfers under Alternative 1 and the No Action Alternative.

Under Alternative 1, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 1 as compared to the No Action Alternative; however, energy resources conditions would be similar.

8.4.3.2.2 Alternative 1 Compared to the Second Basis of Comparison

Alternative 1 is identical to the Second Basis of Comparison.

8.4.3.3 Alternative 2

The CVP and SWP operations under Alternative 2 are identical to the CVP and SWP operations under the No Action Alternative; therefore, the energy resources conditions under Alternative 2 is only compared to the Second Basis of Comparison.

8.4.3.3.1 Alternative 2 Compared to the Second Basis of Comparison

Changes to energy resources under Alternatives 2 as compared to the Second Basis of Comparison would be the same as the impacts described in Section 8.4.3.1, No Action Alternative.

8.4.3.4 Alternative 3

CVP and SWP operations under Alternative 3 are similar to the Second Basis of Comparison with modified Old and Middle River flow criteria and New Melones Reservoir operations. Alternative 3 would include changed water demands for American River water supplies as compared to the No Action Alternative or Second Basis of Comparison. Alternative 3 would provide water supplies of up to 17 TAF/year under a Warren Act Contract for El Dorado Irrigation District and 15 TAF/year under a Warren Act Contract for El Dorado County Water Agency. These demands are not included in the analysis presented in this section of the EIS. A sensitivity analysis comparing the results of the analysis with and without these demands is presented in Appendix 5B of this EIS.

8.4.3.4.1 Alternative 3 Compared to the No Action Alternative

Potential Changes in Energy Resources to CVP and SWP Water Users

Changes in CVP and SWP operations under Alternative 3 as compared to the No Action Alternative would result in changes in CVP and SWP energy resources, as summarized in Table 8.7. The CVP net generation over the long-term conditions and in dry and critical dry years would be similar under Alternative 3 as compared to the No Action Alternative. The SWP net generation would be increased by 27 percent over the long-term condition and by 16 percent in dry and critical dry years. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.7 Energy Generation, Energy Use, and Net Generation under Alternative 3 as Compared to the No Action Alternative

Project	Water Year	Energy (Gigawatt-hours)	Alternative 3	No Action Alternative (NAA)	Changes between Alternative 3 and NAA
CVP Facilities	Long-term Average	Energy Generation	4,582	4,558	24
		Energy Use	1,238	1,113	125
		Net Generation	3,344	3,445	-102
	Dry and Critical Water Years	Energy Generation	2,798	2,696	102
		Energy Use	715	699	16
		Net Generation	2,084	1,997	86
SWP Facilities	Long-term Average	Energy Generation	4,537	4,202	335
		Energy Use	9,115	7,798	1,317
		Net Generation	-4,578	-3,597	-981
	Dry and Critical Water Years	Energy Generation	2,128	1,914	214
		Energy Use	4,455	3,929	526
		Net Generation	-2,327	-2,015	-312

Under Alternative 3 as compared to the No Action Alternative, CVP and SWP water deliveries would be increased and it is anticipated that CVP and SWP water users would use less alternate water supplies. Specific changes in energy use would depend upon specific responses by water users, and are not known at this time. Therefore, it is uncertain whether the decreased regional and local water supply energy requirements would be similar to the increased energy use by the CVP and SWP operations in 2030 under Alternative 3 as compared to the No Action Alternative. For the purposes of this analysis, a worse-case scenario is assumed, and that total energy use by CVP and SWP water users could be lower under Alternative 3 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c), as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar energy conditions would occur during implementation of cross Delta water transfers under Alternative 3 and the No Action Alternative.

Under Alternative 3, water could be transferred throughout the year without an annual volumetric limit. Under the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be increased under Alternative 3 as compared to the No Action Alternative; however, energy resources conditions would be similar.

8.4.3.4.2 Alternative 3 Compared to the Second Basis of Comparison

Potential Changes in Energy Resources to CVP and SWP Water Users

Changes in CVP and SWP operations under Alternative 3 as compared to the Second Basis of Comparison would result in changes in CVP and SWP energy resources, as summarized in Table 8.8. The CVP net generation over the long-term conditions and in dry and critical dry years would be similar under Alternative 3 as compared to the Second Basis of Comparison. The SWP net generation would be reduced by 10 percent over the long-term condition and by 58 percent in dry and critical dry years. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.8 Energy Generation, Energy Use, and Net Generation under Alternative 3 as Compared to the Second Basis of Comparison

Project	Water Year	Energy (Gigawatt-hours)	Alternative 3	Second Basis of Comparison (SBC)	Changes between Alternative 3 and SBC
CVP Facilities	Long-term Average	Energy Generation	4,582	4,604	-22
		Energy Use	1,238	1,289	-51
		Net Generation	3,344	3,315	29
	Dry and Critical Water Years	Energy Generation	2,798	2,773	25
		Energy Use	715	773	-59
		Net Generation	2,084	2,000	84
SWP Facilities	Long-term Average	Energy Generation	4,537	4,721	-184
		Energy Use	9,115	9,802	-687
		Net Generation	-4,578	-5,081	503
	Dry and Critical Water Years	Energy Generation	2,128	2,494	-366
		Energy Use	4,455	5,686	-1,230
		Net Generation	-2,327	-3,192	865

Under Alternative 3 as compared to the Second Basis of Comparison, CVP and SWP water deliveries would be decreased and it is anticipated that CVP and SWP water users would use more alternate water supplies. Specific changes in energy use would depend upon specific responses by water users, and are not known at this time. Therefore, it is uncertain whether the increased regional and local water supply energy requirements would be similar to the decreased energy use by the CVP and SWP operations in 2030 under Alternative 3 as compared to the Second Basis of Comparison. For the purposes of this analysis, a worse-case scenario is assumed, and that total energy use by CVP and SWP water users could be higher under Alternative 3 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c), as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar energy conditions would occur during implementation of cross Delta water transfers under Alternative 3 as compared to the Second Basis of Comparison.

Under Alternative 3 and the Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be similar under Alternative 3 as compared to the Second Basis of Comparison; and energy resources conditions would be similar.

8.4.3.5 Alternative 4

Energy resources under Alternative 4 would be identical to the conditions under the Second Basis of Comparison. Alternative 4 is only compared to the No Action Alternative.

8.4.3.5.1 Alternative 4 Compared to the No Action Alternative

Changes in energy resources under Alternative 4 as compared to the No Action Alternative would be the same as the impacts described in Section 8.4.3.2.1, Alternative 1 Compared to the No Action Alternative.

8.4.3.6 Alternative 5

The CVP and SWP operations under Alternative 5 are similar to the No Action Alternative with modified Old and Middle River flow criteria and New Melones Reservoir operations. Alternative 5 would include changed water demands for American River water supplies as compared to the No Action Alternative or Second Basis of Comparison. Alternative 5 would provide water supplies of up to 17 TAF/year under a Warren Act Contract for El Dorado Irrigation District and 15 TAF/year under a Warren Act Contract for El Dorado County Water Agency. These demands are not included in the analysis presented in this section of the EIS. A sensitivity analysis comparing the results of the analysis with and without these demands is presented in Appendix 5B of this EIS.

8.4.3.6.1 Alternative 5 Compared to the No Action Alternative

Potential Changes in Energy Resources to CVP and SWP Water Users

Changes in CVP and SWP operations under Alternative 5 as compared to the No Action Alternative would result in changes in CVP and SWP energy resources, as summarized in Table 8.9. The CVP and SWP net generation over the long-term conditions and in dry and critical dry years would be similar under Alternative 5 as compared to the No Action Alternative. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.9 Energy Generation, Energy Use, and Net Generation under Alternative 5 as Compared to the No Action Alternative

Project	Water Year	Energy (Gigawatt-hours)	Alternative 5	No Action Alternative (NAA)	Changes between Alternative 5 and NAA
CVP Facilities	Long-term Average	Energy Generation	4,552	4,558	-6
		Energy Use	1,110	1,113	-3
		Net Generation	3,442	3,445	-4
	Dry and Critical Water Years	Energy Generation	2,684	2,696	-12
		Energy Use	699	699	0
		Net Generation	1,986	1,997	-11
SWP Facilities	Long-term Average	Energy Generation	4,191	4,202	-11
		Energy Use	7,732	7,798	-66
		Net Generation	-3,541	-3,597	56
	Dry and Critical Water Years	Energy Generation	1,904	1,914	-10
		Energy Use	3,841	3,929	-88
		Net Generation	-1,937	-2,015	78

Under Alternative 5 as compared to the No Action Alternative, CVP and SWP water deliveries would be similar, and it is anticipated that CVP and SWP water users would use similar alternate water supplies. Therefore, for the purposes of this analysis, it is assumed that total energy use by CVP and SWP water users could be similar under Alternative 5 as compared to the No Action Alternative.

Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c), as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar energy conditions would occur during implementation of cross Delta water transfers under Alternative 5 and the No Action Alternative.

Under Alternative 5 and the No Action Alternative, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Overall, the potential for cross Delta water transfers would be similar under Alternative 5 as compared to the No Action Alternative; and energy resources conditions would be similar.

8.4.3.6.2 Alternative 5 Compared to the Second Basis of Comparison

Potential Changes in Energy Resources to CVP and SWP Water Users

Changes in CVP and SWP operations under Alternative 5 as compared to the Second Basis of Comparison would result in changes in CVP and SWP energy resources, as summarized in Table 8.10. The CVP net generation over the long-term conditions and in dry and critical dry years would be similar under Alternative 3 as compared to the Second Basis of Comparison. The SWP net generation would be reduced by 30 percent over the long-term condition and by 39 percent in dry and critical dry years. Changes in monthly energy use are presented in Appendix 8A, Power Model Documentation.

Table 8.10 Energy Generation, Energy Use, and Net Generation under Alternative 5 as Compared to the Second Basis of Comparison

Project	Water Year	Energy (Gigawatt-hours)	Alternative 5	Second Basis of Comparison (SBC)	Changes between Alternative 5 and SBC
CVP Facilities	Long-term Average	Energy Generation	4,552	4,604	-52
		Energy Use	1,110	1,289	-179
		Net Generation	3,442	3,315	127
	Dry and Critical Water Years	Energy Generation	2,684	2,773	-89
		Energy Use	699	773	-75
		Net Generation	1,986	2,000	-14
SWP Facilities	Long-term Average	Energy Generation	4,191	4,721	-530
		Energy Use	7,732	9,802	-2,070
		Net Generation	-3,541	-5,081	1,540
	Dry and Critical Water Years	Energy Generation	1,904	2,494	-590
		Energy Use	3,841	5,686	-1,845
		Net Generation	-1,937	-3,192	1,255

Under Alternative 5 as compared to the Second Basis of Comparison, CVP and SWP water deliveries would be decreased and it is anticipated that CVP and SWP water users would use more alternate water supplies. Specific changes in energy use would depend upon specific responses by water users, and are not known at this time. Therefore, it is uncertain whether the increased regional and local water supply energy requirements would be similar to the decreased energy use by the CVP and SWP operations in 2030 under Alternative 5 as compared to the Second Basis of Comparison. For the purposes of this analysis, a worse-case scenario is assumed, and that total energy use by CVP and SWP water users could be higher under Alternative 5 as compared to the Second Basis of Comparison.

Effects Related to Cross Delta Water Transfers

Potential effects to energy resources could be similar to those identified in a recent environmental analysis conducted by Reclamation for long-term water transfers from the Sacramento to San Joaquin valleys (Reclamation 2014c), as described above under the No Action Alternative compared to the Second Basis of Comparison. For the purposes of this EIS, it is anticipated that similar energy conditions would occur during implementation of cross Delta water transfers under Alternative 5 as compared to the Second Basis of Comparison.

Under Alternative 5, the timing of cross Delta water transfers would be limited to July through September and include annual volumetric limits, in accordance with the 2008 USFWS BO and 2009 NMFS BO. Under Second Basis of Comparison, water could be transferred throughout the year without an annual volumetric limit. Overall, the potential for cross Delta water transfers would be reduced under Alternative 5 as compared to the Second Basis of Comparison; however, energy resources conditions would be similar.

8.4.3.7 Summary of Impact Analysis

The results of the environmental consequences of implementation of Alternatives 1 through 5 as compared to the No Action Alternative and the Second Basis of Comparison are presented in Tables 8.11 and 8.12.

Table 8.11 Comparison of Alternatives 1 through 5 to No Action Alternative and Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
Alternative 1	CVP annual net generation would be similar. SWP annual net generation would be increased by 41 percent over the long-term condition; and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.	None needed.
Alternative 2	No effects on energy resources.	None needed.
Alternative 3	CVP annual net generation would be similar. SWP annual net generation would be increased by 27 percent over the long-term condition and by 16 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to decrease.	None needed.
Alternative 4	Same effects as described for Alternative 1 compared to the No Action Alternative.	None needed.
Alternative 5	CVP and SWP annual net generation would be similar. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to be similar.	None needed.

Table 8.12 Comparison of No Action Alternative and Alternatives 1 through 5 to Second Basis of Comparison

Alternative	Potential Change	Consideration for Mitigation Measures
No Action Alternative	CVP annual net generation would be similar. SWP annual net generation would be reduced by 29 percent over the long-term condition and by 37 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.
Alternative 1	No effects on energy resources.	Not considered for this comparison.
Alternative 2	Same effects as described for No Action Alternative as compared to the Second Basis of Comparison.	Not considered for this comparison.
Alternative 3	CVP annual net generation would be similar. SWP annual net generation would be reduced by 10 percent over the long-term condition and by 58 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.
Alternative 4	No effects on energy resources.	Not considered for this comparison.
Alternative 5	CVP annual net generation would be similar. SWP annual net generation would be reduced by 30 percent over the long-term condition and by 39 percent in dry and critical dry years. Total energy use by CVP and SWP water users, including energy for alternate water supplies, is assumed to increase.	Not considered for this comparison.

8.4.3.8 Potential Mitigation Measures

Changes under Alternatives 1 through 5 as compared to the No Action Alternative would result in similar or increased net energy generation, and reduced potential for energy use by CVP and SWP water users for alternate water supplies. Therefore, there would be no adverse impacts to energy resources, and no mitigation measures are needed.

8.4.3.9 Cumulative Effects Analysis

As described in Chapter 3, the cumulative effects analysis considers projects, programs, and policies that are not speculative; and are based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other information that establishes them as reasonably foreseeable.

The No Action Alternative, Alternatives 1 through 5, and Second Basis of Comparison include climate change and sea level rise, implementation of general plans, and completion of ongoing projects and programs (see Chapter 3, Description of Alternatives). The effects of these items were analyzed quantitatively and qualitatively, as described in the Impact Analysis of this chapter. The discussion below focuses on the qualitative effects of the alternatives and other past, present, and reasonably foreseeable future projects identified for consideration of cumulative effects (see Chapter 3, Description of Alternatives).

8.4.3.9.1 No Action Alternative and Alternatives 1 through 5

Continued coordinated long-term operation of the CVP and SWP under the No Action Alternative would result in reduced CVP and SWP water supply availability as compared to recent conditions due to climate change and sea level rise by 2030. These conditions are included in the analysis presented above.

Future water resource management projects considered in cumulative effects analysis (see Chapter 3, Description of Alternatives) could increase statewide energy demands, including programs for groundwater banks, water treatment, and water conveyance. Future major surface water storage projects could include additional hydropower generation facilities, such as the Shasta Lake Water Resources Investigation, Upper San Joaquin River Basin Storage Investigation, North-of-the-Delta Offstream Storage, and Los Vaqueros Reservoir Expansion Project (Reclamation 2013a, 2014j; DWR 2013bb; Reclamation, CCWD, and Western 2010).

There also are several ongoing programs that could result in changes in flow patterns in the Sacramento and San Joaquin rivers watersheds and the Delta that could reduce hydropower generation during the late summer and fall months when the peak power demands occur in the State. These projects include renewals of hydroelectric generation permits issued by the Federal Energy Regulatory Commission (FERC 2015) and update of the Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary by the State Water Resources Control Board (SWRCB 2006, 2013). Based upon the available information related to these projects, the cumulative effects would be to change flow patterns in the rivers that could result in the need for energy users in the State to purchase energy in the late summer and fall months.

There would be no adverse energy resource impacts associated with implementation of Alternatives 1 through 5 as compared to the No Action Alternative. Therefore, implementation of the alternatives would not contribute to cumulative impacts.

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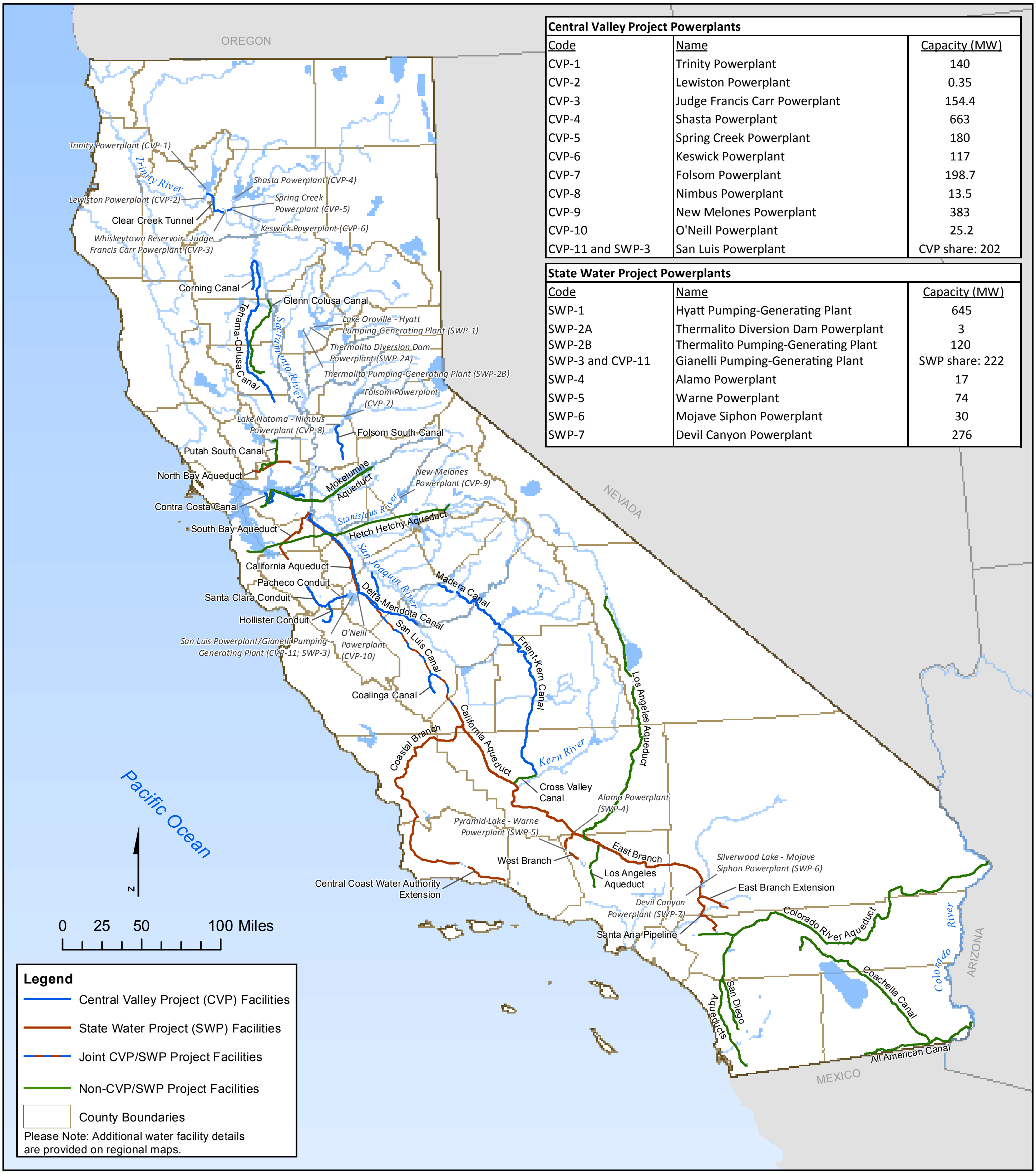

Central Valley Project Powerplants

Code	Name	Capacity (MW)
CVP-1	Trinity Powerplant	140
CVP-2	Lewiston Powerplant	0.35
CVP-3	Judge Francis Carr Powerplant	154.4
CVP-4	Shasta Powerplant	663
CVP-5	Spring Creek Powerplant	180
CVP-6	Keswick Powerplant	117
CVP-7	Folsom Powerplant	198.7
CVP-8	Nimbus Powerplant	13.5
CVP-9	New Melones Powerplant	383
CVP-10	O'Neill Powerplant	25.2
CVP-11 and SWP-3	San Luis Powerplant	CVP share: 202

State Water Project Powerplants

Code	Name	Capacity (MW)
SWP-1	Hyatt Pumping-Generating Plant	645
SWP-2A	Thermalito Diversion Dam Powerplant	3
SWP-2B	Thermalito Pumping-Generating Plant	120
SWP-3 and CVP-11	Gianelli Pumping-Generating Plant	SWP share: 222
SWP-4	Alamo Powerplant	17
SWP-5	Warne Powerplant	74
SWP-6	Mojave Siphon Powerplant	30
SWP-7	Devil Canyon Powerplant	276

Figure 8.1 Central Valley Project and State Water Project Hydroelectric Generation Facilities
Sources: Reclamation 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h, 2013i, 2013j, 2013k, 2013l; DWR 2012

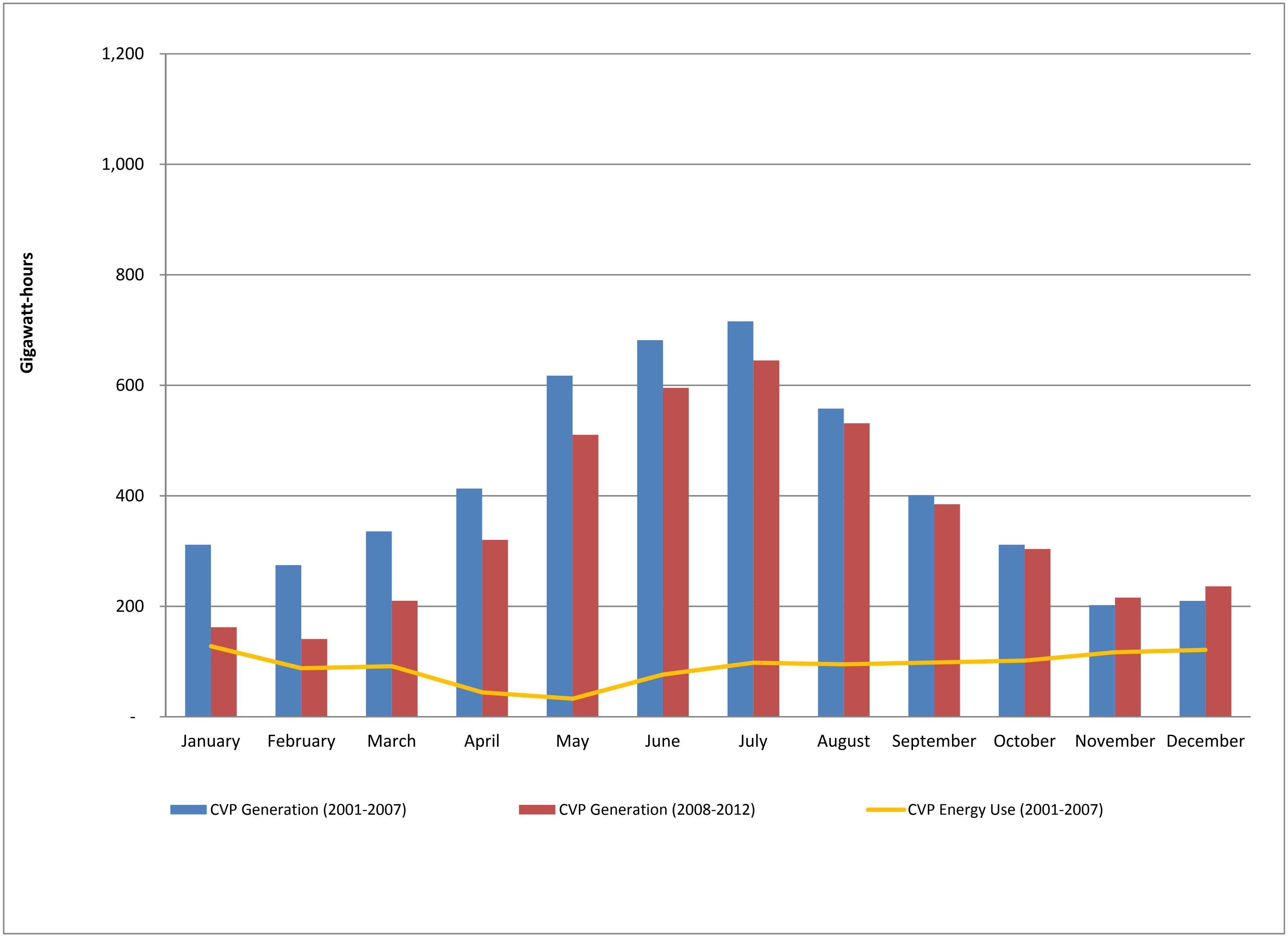

Figure 8.2 Central Valley Project Energy Generation and Energy Use
Sources: Reclamation 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 a-l, 2009a-l, 2010a-l, 2011a-l, 2012a-l

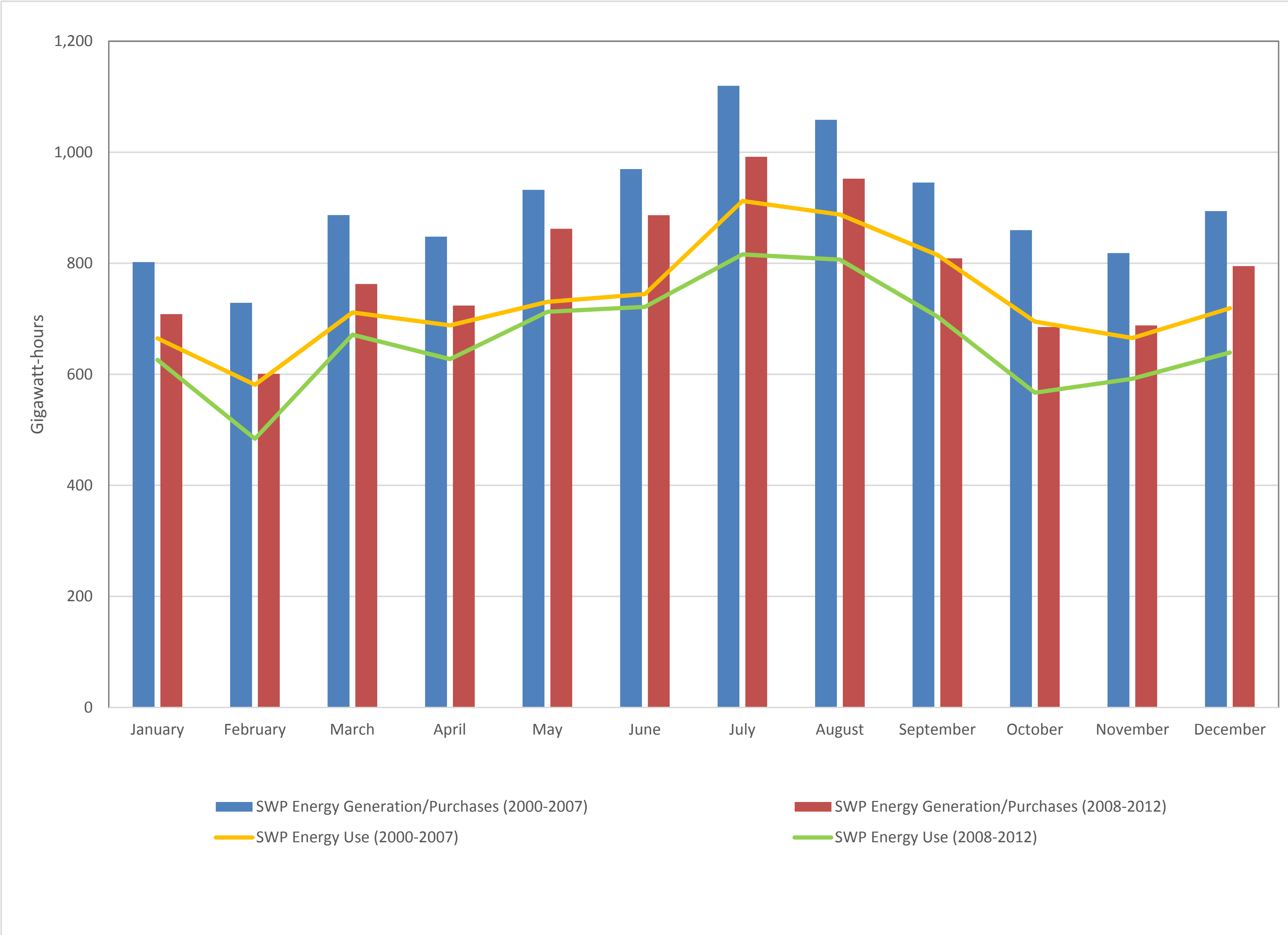

Figure 8.3 State Water Project Energy Generation and Energy Use

Sources: DWR 2002, 2004a, 2004b, 2005, 2006, 2007, 2008, 2012a, 2012b, 2013