Chapter 18 – Power

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Chapter 18 Power

This chapter is based on the background information and technical analysis documented in Appendix U, *Power Technical Appendix*, which includes additional information on power conditions and technical analysis of the effects of each alternative.

18.1 Affected Environment

Most of the Central Valley Project (CVP) and State Water Project (SWP) dams have associated hydroelectric facilities. 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, and by other users. The study focuses on CVP and SWP hydroelectric generation facilities at CVP and SWP reservoirs, CVP and SWP energy use to move water, and transmission activities of the net generated electricity for other users throughout California. These CVP/SWP energy generation facilities are in the Trinity River and Central Valley regions. The movement of water with CVP and SWP energy primarily occurs in the Central Valley, San Francisco Bay Area, Central Coast, and Southern California regions, as defined in Appendix U.

18.1.1 Central Valley Project Power and Energy Resources

Power generated by the CVP is marketed and transmitted by the Western Area Power Administration (WAPA) Sierra Nevada Region. CVP facilities generally use around 25% to 30% of the power generated by the CVP. WAPA markets the remaining power under existing laws including the Reclamation Project Act, Hoover Power Plant Act, Energy Policy Act, and reporting policies under WAPA/Power Marketing Department Order, Department of Energy (DOE) Order RA6120-2. WAPA under the 2025 Power Marketing Program for the Sierra Nevada provides allocations to wholesale customers in northern and central California and portions of Nevada (Western Area Power Administration 2023). Five customers are listed as first preference in the Fiscal Year 2024 Rates. First preference power customers are Calaveras Public Power Agency, Chicken Rancheria, California Department of Corrections Sierra Conservation Center, Trinity Public Utilities District, and Tuolumne Public Power Agency (Western Area Power Administration 2024). Additional customers include Native American tribes, Bureau of Reclamation (Reclamation) customers, military agencies, cities, Bay Area Rapid Transit District (BART), rural electric cooperatives, public utilities and irrigation districts, and federal and state agencies (Western Area Power Administration 2020).

The CVP power facilities include 11 hydroelectric powerplants and have a total maximum generating capacity of 2,103 megawatts (MW), as shown in Table 18-1. Water releases as part of water operations determine the amount of power that will be produced at an individual plant. Hydrology can vary substantially from year to year, which then affects the hydropower production. The season of the release and the time of day affect the value of the power production. Typically, in an average water year, approximately 4,500 gigawatt-hours (GWh) of energy is produced (Bureau of Reclamation 2021). During power emergencies water may be released to provide power generation for a specific purpose. The power generated from CVP powerplants is prioritized to: (1) meet project use loads; (2) first preference power customers; (3)

sub balancing authority requirements; (4) ancillary services; and (5) base resource energy which is marketed to other preference customers.

Table 18-1. Central Valley Project Hydroelectric Powerplants

Facility	Installed Capacity (MW)
Trinity Powerplant	140
Lewiston Powerplant	0.3
Judge Francis Carr Powerplant	154
Shasta Powerplant	714
Spring Creek Powerplant	180
Keswick Powerplant	117
Folsom Powerplant	207
Nimbus Powerplant	13
New Melones Powerplant	380
O'Neill Pump-Generating Plant	14.4
San Luis Powerplant (CVP portion of the San Luis (William R. Gianelli) Pump-Generating Plant)	202
Total	**2,121.7**

Source: *Bureau of Reclamation 2021*.
MW = megawatt
CVP = Central Valley Project

WAPA Sierra Nevada together with the Balancing Area of Northern California joined California Independent System Operator's (CAISO) Western Energy Imbalance Market in March of 2021 (Western Area Power Administration 2021). Participants in the Western Energy Imbalance Market are able to purchase and sell power at a reduced cost in real-time and improve balancing supply and demand. The benefits to the CVP power facilities and other Western Energy Imbalance Market participants include the following (Western Energy Imbalance Market 2024).

- Costs are reduced with more efficient transmission through the regional transmission system and the need to carry reserve utilities is reduced
- Carbon emissions are reduced with more efficient use and integration of renewable energy
- Increased operational visibility among other electricity grids enhances reliability and improves transmission line congestion management

18.1.2 State Water Project Power and Energy Resources

The SWP also generates hydroelectricity along the California Aqueduct at energy recovery plants (California Department of Water Resources 2022). Power generated by the SWP is transmitted by PG&E, Southern California Edison, and CAISO through other facilities (California Department of Water Resources 2022). The SWP also markets energy in excess of the SWP demands to a utility and members of the WSPP, formerly known as the Western Systems Power Pool.

The SWP power facilities are operated primarily to provide power for the SWP facilities (California Department of Water Resources 2022). Table 18-2 summarizes the SWP power facilities and capacities. The SWP has power contracts with electric utilities and the CAISO that function as exchange agreements with utility companies for transmission and power sales and purchases. Each year, the SWP must purchase additional power to meet pumping requirements.

Table 18-2. State Water Project Hydroelectric Powerplants

Facility	Installed Capacity (MW)
Hyatt Pumping-Generating Plant (Oroville)	645
Thermalito Diversion Dam Powerplant (Oroville)	3
Thermalito Pumping-Generating Plant (Oroville)	114
San Luis (William R. Gianelli) Pumping-Generating Plant (SWP share)	225
Alamo Powerplant	17
Mojave Siphon Powerplant	30
Devil Canyon Powerplant	276
Warne Powerplant	74
Total	**1,384**

Source: *California Department of Water Resources 2017*.
MW = megawatt
SWP = State Water Project

18.1.3 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 PG&E and Southern California Edison; municipal agencies, such as the 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 are included in the subsequent list (California Energy Commission 2023).

- PG&E
    - Helms Pumped Storage (1,212 MW capacity) in Fresno County
    - Pit System (579 MW) in Shasta County

    - Upper North Fork Feather River System (351 MW) in Plumas County
- Sacramento Municipal Utility District American River Project System (708 MW) in El Dorado County
- City and County of San Francisco Hetch Hetchy Power System (286 MW) in Tuolumne County
- Southern California Edison
    - Big Creek System and Eastwood Pump Storage (590 MW) in Fresno and Madera counties
    - Mammoth Pool Project (187 MW) in Fresno and Madera counties
- Turlock Irrigation District and Modesto Irrigation District Don Pedro Project (203 MW) in Tuolumne County
- Yuba Water Agency Yuba River Development Project (364 MW) in Yuba County

18.2 Effects of the Alternatives

The impact analysis considers changes in surface power generation related to changes in CVP and SWP operation under the alternatives as compared with the No Action Alternative.

The No Action Alternative is based on 2040 conditions. Changes that would occur over that time frame without implementation of the action alternatives are not analyzed in this chapter. However, the changes to power generation that are assumed to occur by 2040 under the No Action Alternative are summarized in this section.

The No Action Alternative is based on 2040 conditions. The changes to power that are assumed to occur by 2040 under the No Action Alternative conditions would be different than existing conditions because of the following factors:

- Climate change and sea-level rise
- General plan development throughout California, including increased water demands in portions of the Sacramento Valley

Under the No Action Alternative, Reclamation would continue with the current operation of the Central Valley Project (CVP), as described in the 2020 Record of Decision and subject to the 2019 Biological Opinions. The 2020 Record of Decision for the CVP and the 2020 Incidental Take Permit for the State Water Project represent current management direction or intensity pursuant to 43 Code of Federal Regulations Section 46.30.

Although the No Action Alternative included habitat restoration projects at a programmatic level, the 2020 ROD did not provide environmental coverage for these projects, and all of the habitat projects considered under the No Action required or will require additional environmental documentation. Thus, ground disturbance for habitat restoration projects did not materialize as a

result of implementing the No Action Alternative. For the purpose of the analysis, these habitat restoration projects are considered independent projects that will be considered under cumulative effects.

The No Action Alternative is expected to result in potential changes to power generation at CVP and SWP facilities and energy used to pump water resulting in changes to net generation of CVP and SWP power. These changes were described and considered in the 2020 Record of Decision.

18.2.1 Potential Changes in Central Valley Project Net Generation

Each of the action alternatives would result in a change in annual average net power generation. Alternative 1 would increase the annual energy use of the CVP 12% for the long-term average and 15% for dry and critically dry years. Alternative 2 would slightly decrease (up to 2%) annual long-term average energy use or increase (1%) annual long-term average energy use; and slightly decrease annual average energy use (2% to 3%) for dry and critically dry years. Under Alternative 3 there would be decreases (39% long-term average, 31% dry and critically dry years) in annual average energy use compared with the No Action Alternative. Alternative 4 would slightly increase average energy use for the annual long-term average (3%), and for dry and critically dry years (less than 1%).

The CalSim 3 modeling output indicates that each of the action alternatives would slightly increase annual generation of CVP power. The increase in energy generation is due to increases in reservoir storage and elevation resulting in higher generation for each unit of water released. The changes in energy use are due to changes in the volume of exports through CVP pumping facilities. The increase in annual generation (1% long-term average, 3% dry and critically dry years) would be much less than increases of annual energy use (12% long-term average, 15% dry and critically dry years) under Alternative 1, resulting in slight reductions in annual net generation (4% long-term average, 2% dry and critically dry years). Under Alternative 2, there would be no change in annual generation for both the long-term average and dry and critically dry years, resulting in slight increases (1% to 2%) or no change in annual net generation for all phases of Alternative 2 compared with the No Action Alternative. Under Alternative 3, there would be no change in annual long-term generation and a slight increase (2%) in annual generation for dry and critically dry years, resulting in substantial increases (21% long-term average, 16% dry and critically dry years) in annual net generation because of the greater decreases in annual energy use. Under Alternative 4, there would be no change in the long-term average in annual generation and a slight increase (1%) in annual generation for dry and critically dry years, resulting in a slight decrease (1%) in annual net generation for the long-term average and a slight increase (1%) in net generation for dry and critically dry years.

Figure 18-1 shows the comparison of long-term average annual CVP energy use, generation, and net generation for the No Action Alternative and the action alternatives.

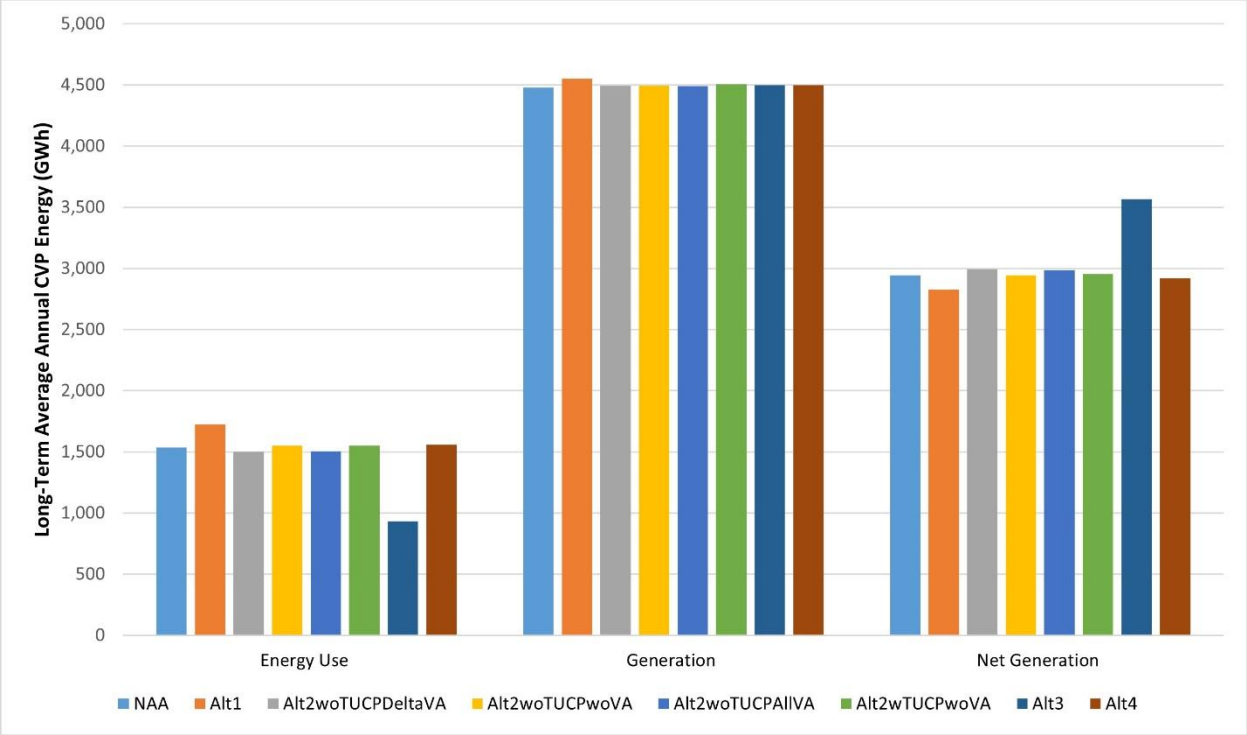

Figure 18-1. Comparison of Simulated Long-Term Average Annual CVP Energy Use, Generation and Net Generation

Each of the action alternatives would result in a change in long-term average CVP net generation on a monthly basis. Reductions in monthly net generation would not require the procurement of additional generation energy because generation would be positive in all months under all of the alternatives. Monthly reductions (greater than 5%) in long-term average net generation for the action alternatives compared with the No Action Alternative would be greatest in January through March and September through October under Alternative 1 and in September under Alternative 4. In other months, Alternatives 1 through 4 would not have reductions in long-term average net generation greater than 5%, with several months having an increase in net generation, with the greatest monthly increases under Alternative 3. Figure 18-2 shows a comparison of long-term monthly average net generation for the No Action Alternative and the action alternatives, as well as changes between the action alternatives and the No Action Alternative.

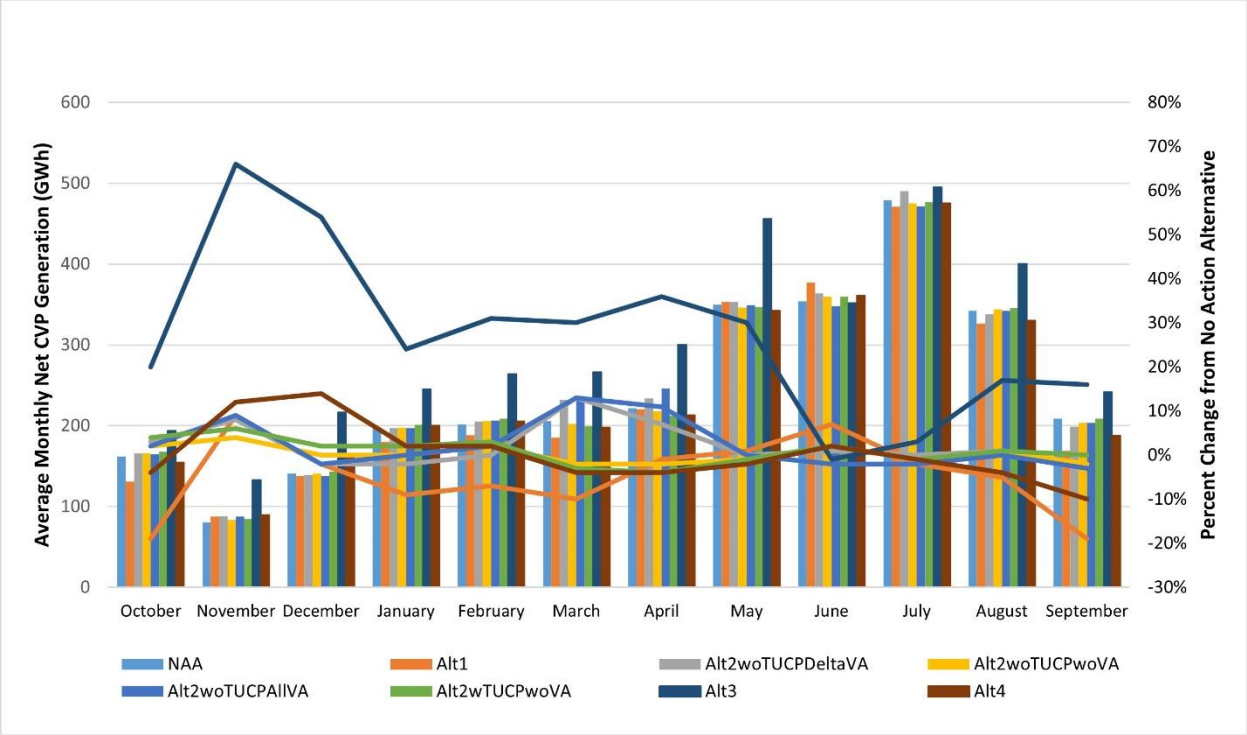

Figure 18-2. Comparison of Stimulated Long-Term Monthly CVP Net Generation and Percent Change in Net Generation from the No Action Alternative

Due to the limitations and uncertainty in the CalSim 3 monthly model and other analytical tools, monthly incremental differences of less than 5% between action alternatives and the No Action Alternative are considered to be similar.

There may be inherent overestimation bias for monthly power generation release in the CalSim modeling output. As the monthly power generation releases are different across the alternatives, there may be differences in overestimation bias between the alternatives. In CalSim, the power generation releases are assumed constant through each month. However, there can be significant releases during flood and temperature control operations within the month. The assumption of monthly averaged releases in CalSim may result in unaccounted for power bypass from flood and temperature control in the model which in turn may result in bias in power generation release outputs.

Due to the comparative manner that the output data is used, the overestimation bias may be considered to not be a concern. However, to evaluate the alternatives, the gross differences in outputs between the alternatives may not be able to be used on their own because there are differences in bias of CalSim modeled power generation release between alternatives. These differences could be attributed to differences in elevations of the CVP reservoirs between alternatives (along with other criteria), which in turn could lead to varying amounts of bypass from flood and water temperature control being unaccounted for in each of the alternatives, and therefore could result in varying amounts of bias between the alternatives with respect to generation.

18.2.2 Potential Changes in State Water Project Net Generation

Alternative 1 would increase the annual energy use of the SWP 25% for the long-term average and 47% for dry and critically dry years compared with the No Action Alternative. Alternative 2 phases would slightly increase (2% to 3%) annual long-term average energy use; and slightly increase annual energy use (1% to 2%) or slightly decrease (1%) in dry and critically dry years. Under Alternative 3 there would be substantial decreases (47% long-term average, 49% dry and critically dry years) in annual average energy use compared with the No Action Alternative. Alternative 4 would slightly increase average energy use for the annual long-term average (6%), and for dry and critically dry years (11%).

Each of the action alternatives would increase or decrease annual generation of SWP power. Under Alternative 1 for the long-term average and dry and critically dry years, the increase in annual generation (10% and 43%, respectively) would be less than increases of annual energy use (25% and 47%, respectively), resulting in reductions in annual net generation (42% long-term average, 72% dry and critically dry years). Under Alternative 2, phases there would be slight increases or decreases in annual generation (<1% to 1%) for both year types, resulting in slight decreases (3% to 6%) or a slight increase (1%) in annual net generation for Alternative 2 phases compared with the No Action Alternative. Under Alternative 3, there would be a decrease (19%) for annual long-term average generation, and a decrease (13%) in annual generation for dry and critically dry years, resulting in substantial increases (77% long-term average, 88% dry and critically dry years) in annual net generation compared with the No Action Alternative because of the greater decreases in annual energy use. Under Alternative 4, there would be a slight increase (2%) in annual generation for the long-term average and a 6% increase in dry and critically dry years in annual generation, resulting in a decrease (10%) in annual net generation for the long-term average and a decrease (16%) in net generation for dry and critically dry years. Figure 18-3 shows long-term average annual SWP energy use, generation, and net generation for the No Action Alternative and the action alternatives.

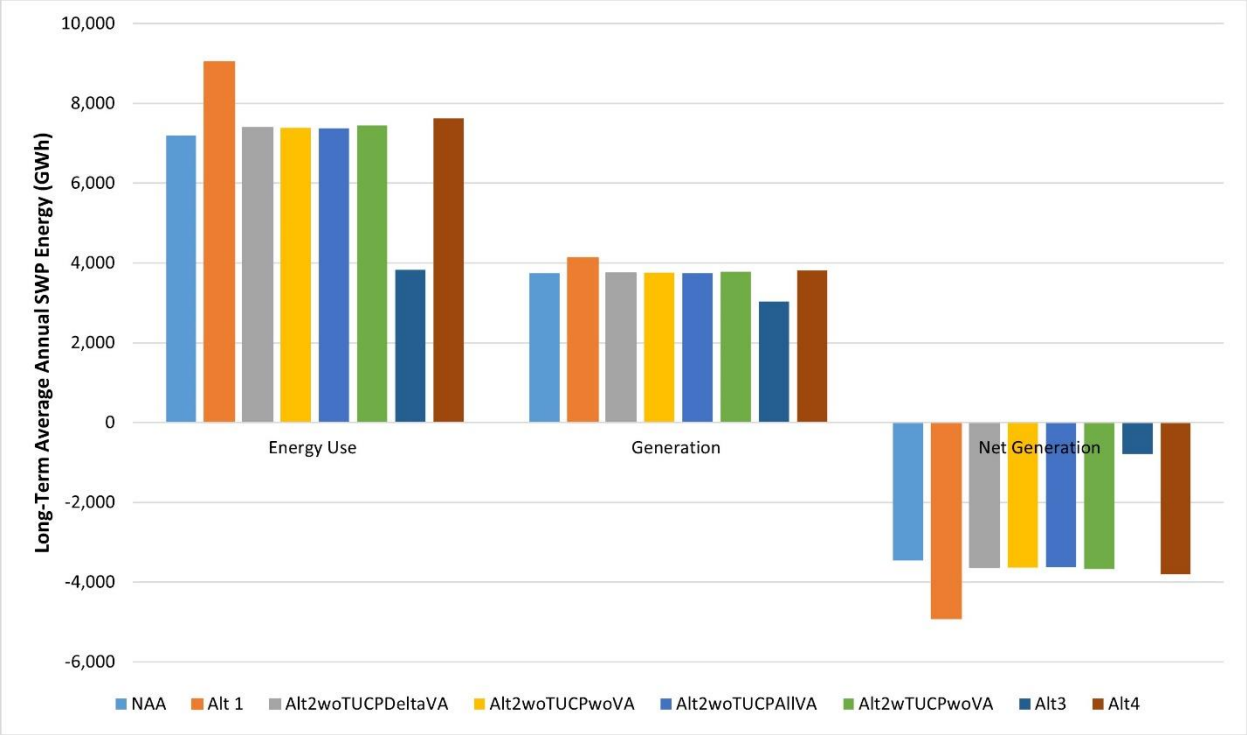

Figure 18-3. Comparison of Stimulated Long-Term Average Annual SWP Energy Use, Generation, and Net Generation

Each of the action alternatives would result in a change in long-term average SWP net generation on a monthly basis. All alternatives would have negative net generation in all months except for Alternative 3 where January through May would have positive net generation. Negative net generation would require the procurement of additional generation elsewhere within the California energy system. Monthly reductions (greater than 5%) in long-term average net generation for the action alternatives compared with the No Action Alternative would occur in all months and be greatest in January through March and July (over a 50% reduction) under Alternative 1. Alternative 2 phases would vary in the months with the greatest reduction in annual long-term net generation. However, some months would not have reductions greater than 5%. Under Alternative 3, monthly long-term net generation would increase in all months compared with the No Action Alternative. Under Alternative 4, the greatest decreases in monthly long-term net generation would occur in February, April, May, and July compared with the No Action Alternative. Figure 18-4 shows long-term average monthly net generation for the No Action Alternative and the action alternatives, as well as changes between the action alternatives and the No Action Alternative.

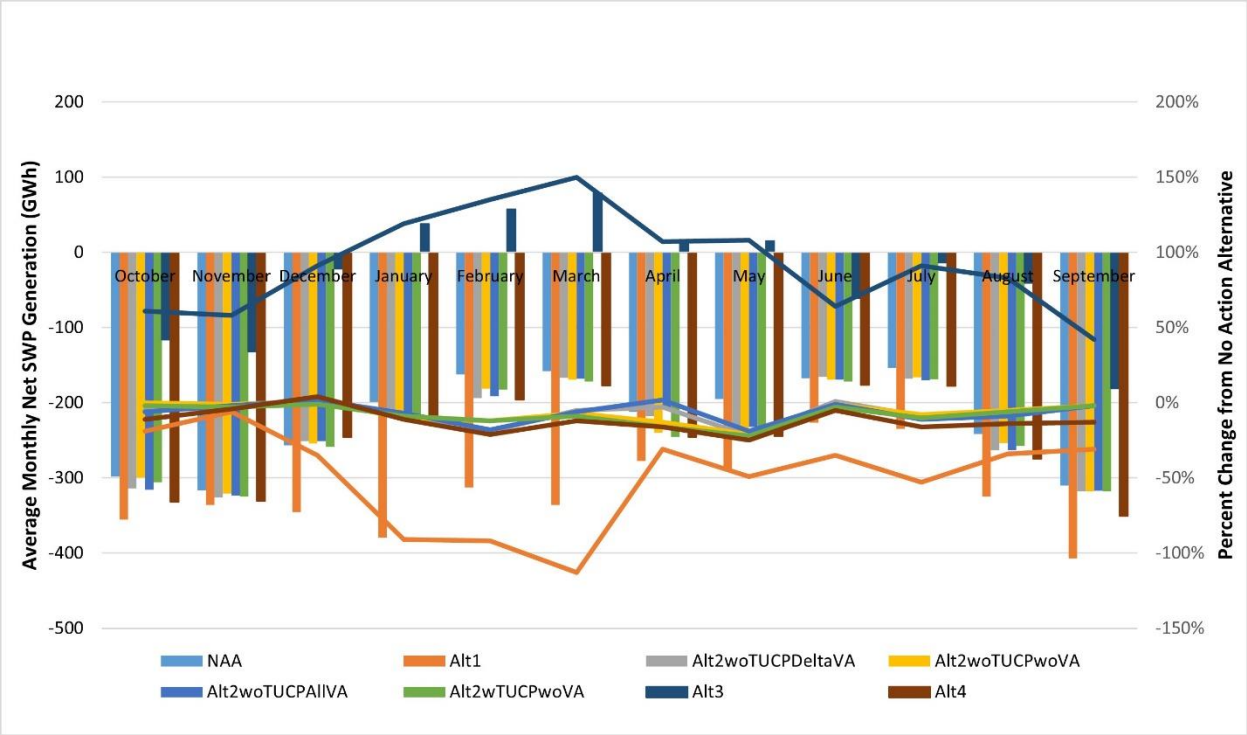

Figure 18-4. Comparison of Stimulated Long-Term Monthly SWP Net Generation and Percent Change in Net Generation from the No Action Alternative

18.3 Mitigation Measures

No avoidance and minimization measures or mitigation measures have been identified for power.

18.4 Cumulative Impacts

The No Action Alternative would continue with the current operation of the CVP and may result in changes to Central Valley Project and State Water Project net generation. The action alternatives will result in changes in long-term average CVP and SWP net generation rates. The magnitude of the changes is dependent on alternative and water year type. Given the changes in long-term average CVP and SWP net generation rates, the No Action Alternative and action alternatives may contribute to cumulative impacts for power resources as described in Appendix U and Appendix Y, *Cumulative Impacts Technical Appendix*.