6.16 Climate Change

6.16 Climate Change

The proposed UNFFR Project and alternatives put forth in this environmental impact report (EIR) would result in varying levels in greenhouse gas (GHG) emissions. The California Environmental Quality Act (CEQA) and the State CEQA Guidelines require a lead agency to consider GHG emissions from a proposed project in determining whether the project has the potential to cause significant impacts.

This section provides an overview of climate change and describes the relationship of the Upper North Fork Feather River Hydroelectric Project (UNFFR Project) to the energy grid in California, estimates the GHG emissions resulting from the operation of the UNFFR Project under a new Federal Energy Regulatory Commission (FERC) license, and assesses whether the GHG emissions from the UNFFR Project or either alternative would cause a significant impact on the environment. The information presented in this section is based on a GHG analysis report (Appendix J). The analysis focuses on the indirect effects of the GHG emissions that would be generated by a non-hydroelectric energy source to offset the reduction in UNFFR Project energy generation. The estimated power loss associated with the Proposed UNFFR Project and alternatives, including the No Project Alternative (discussed in Chapter 8 – Alternatives Development) are discussed below.

Comparison of Power Loss

The Proposed UNFFR Project, No Project Alternative, and each alternative discussed in this EIR would result in different amounts of estimated total power loss (in gigawatt-hour per year (GWh/YR). The estimated power losses are compared in Table 6-16-1.

The total estimated power loss was originally calculated using the base flows required by the 2004 Settlement Agreement. Since the total water required for minimum instream flow releases will not change under either Alternative 1 or Alternative 2, it can be assumed that the total power loss will be very similar. Additional flows in excess of the minimum instream flows are required only under Alternative 1, consisting of the 250 cubic feet per second (cfs) release from Canyon dam.

With the flow modifications and changes in operations under Alternative 1, the total estimated power loss would be 85.87 GWh/YR (equivalent to $1x10^6$ kilowatt hours [kWh]). This power loss is attributable to the reduction in flows through Butt Valley reservoir and the Caribou powerhouses as a result of increased releases through Canyon dam as well as the power loss anticipated as a result of the increased minimum flows outlined in the 2004 Settlement Agreement.

Under Alternative 2 and the Proposed UNFFR Project, the total estimated power loss would be 47.94 GWh/YR, which is attributable to the increased minimum instream flows in the Seneca and Belden reaches.

The power loss estimated for the No Project Alternative, discussed in Chapter 8 – Alternatives Development, assumes loss of all power generation associated with retirement of the UNFFR Project.

Table 6-16-1. Summary Comparison of Estimated Power Losses

Alternative	Total Power Loss (GWh/YR)
Alternative 1 (Alternative 3 in Level 3 Report)	85.87[a]
Prattville intake thermal curtain	0
Canyon dam low level outlet release up to 250 cubic feet per second	37.93
Butt Valley reservoir thermal curtain	0
Alternative 2 (Alternative 4a in Level 3 Report)	47.94
Prattville intake thermal curtain	0
Butt Valley reservoir thermal curtain	0
Proposed UNFFR Project	47.94
No Project Alternative	1,171.9

[a] Total power loss includes an anticipated 47.94 GWh/YR power loss associated with implementation of the new minimum instream flows.

6.16.1 Environmental Setting

Climate Change Overview

Evidence of climate change has been observed throughout the world as atmospheric conditions and seasonal temperatures and patterns change. Global climate change could have widespread consequences that would affect the availability of important resources in California and elsewhere, including water and energy. Human activities that emit carbon dioxide (CO_2) and other heat-trapping gasses, such as methane (CH_4), nitrous oxide (N_2O), and fluorinated gases, to the atmosphere contribute to the changing climate. These gasses are collectively referred to as GHGs. The potential for global warming is correlated to the residence time of the compound in the atmosphere and its ability to warm the planet, measured in CO_2 equivalent (CO_2e) metric tonnes.

Examples of human activities that contribute to GHG emissions include burning of fossil fuels, clearing of forests, and land development. Electricity generation using fossil fuels primarily produces CO_2 emissions, with other GHG emissions tending to be smaller and more easily

controlled. Coal and petroleum coke-fired energy generation facilities emit larger quantities of GHG emissions than other sources, such as gas, nuclear, biomass, and geothermal facilities. Hydroelectric generation facilities tend to generate the smallest quantity of GHG emissions when compared to those mentioned above.

GHG Programs

To address climate change impacts, the United States has developed regulations and programs to expand research and identify actions to reduce GHG emissions. The United States Environmental Protection Agency (USEPA) has proposed a Prevention of Significant Deterioration program and New Source Review rule changes to regulate GHGs. In December 2009, USEPA declared that GHG emissions threaten the public health and welfare of the American people (the endangerment finding), resulting in a new federal rule (40 C.F.R. § 98), effective December 29, 2009, that requires reporting of GHGs for certain GHG-emitting facilities.

California has demonstrated its intent to address global climate change through research, adaptation, and GHG inventory reductions. The California Legislature enacted the California Global Warming Solutions Act of 2006 (Assembly Bill [AB] 32 [Statutes 2006, Chapter 488, Nunez], Health and Safety Code Section 38500 et seq.) to implement standards that will reduce GHG emissions to 1990 levels. In the act, the Legislature found that "[g]lobal warming poses a serious threat to the economic well-being, public health, natural resources, and the environment of California," which is consistent with the USEPA's endangerment finding.

Energy Generation in California and Future Scenarios

The California electric power grid (managed by the California Independent System Operator (CAISO)) is supplied by a large, interconnected system that receives electricity from basic energy production and ancillary services. Ancillary services are used to provide the generation capability to meet loads that vary throughout the day. Because of the integrated electricity system, the contributions of energy resources are constantly changing to adapt to the load demands. The most reliable and economically feasible resources are used to meet the demand, with alternate sources available as needed. Some facilities are operated to provide both basic energy production and ancillary services, whereas others serve only one purpose. Additional details on how the CAISO operates can be found in Appendix J.

Pacific Gas and Electric Company (PG&E) operates facilities that provide both basic energy production and ancillary services, as demand requires and as PG&E is able to contribute to the energy markets. Its hydroelectric resources and facilities in northern California provide up to 75 percent of the ancillary services in the area (specifically spinning reserves, see Appendix J for information). Hydropower facilities are especially well suited to provide ancillary services because of their quick start-up capability and proven reliability.

The California Energy Commission (CEC) has evaluated the future of the energy industry in California in relation to the State's goals for reducing GHG emissions. The CEC envisions changes in the long-term role of fossil-fueled power plants in California's electricity system. Gas-fired power plants will likely play a larger role because they offer a highly renewable, low-GHG system (California Energy Commission 2009a). Net GHG emissions from the integrated electric system are expected to decline as new gas-fired power plants are developed (California Energy Commission 2009b). In addition, as contracts for coal-fired facilities expire (pursuant to Public Utilities Code sections 8340-8341), use of new and existing facilities will replace the lost energy and capacity. Some energy will come from renewable sources, and some will come

from new and existing natural gas-fired facilities. New generation resources are expected to emit significantly less GHG than the coal and petroleum coke-fired generation facilities. The analysis by the CEC of potential future outcomes is the basis of the methodology used to assess reasonably expected bounding cases for changes in GHG emissions related to the UNFFR Project.

North Fork Feather River Generation Resources

Behind the McCloud-Pit Hydroelectric Project, the North Fork Feather River system upstream of Lake Oroville accounts for the second largest portion of PG&E's hydroelectric generation, with 729.3 megawatts (MW) rated capacity (California Public Utilities Commission 2000). The UNFFR Project capacity is 362.3 MW or about half of this capacity. The North Fork Feather River system has both large inflows and very large amounts of storage, which provide for the ability to control levels of generation and water releases on both a daily and seasonal basis. Besides permitting winter-spring runoff to be stored for use in the summer, the considerable storage provided by Lake Almanor and other PG&E reservoirs can be used to coordinate generation with high electricity load periods on an hourly and daily basis. During off-peak hours when market prices for electricity are low, flows through powerhouses are typically reduced, usually to minimum levels, to preserve water for release during high-load periods. Butt Valley, Caribou No. 1, and Caribou No. 2 powerhouses rarely operate at sustained rated generating capacity (maximum flows) because they are used to provide ancillary services[1].

The UNFFR Project provides flexible, dispatchable, and fast ramping power and serves as an important supporting resource for the intermittent renewable generation needed to achieve PG&E's renewable portfolio standard (RPS) and GHG emission goal. The UNFFR Project operations contribute to the CAISO by:

- providing flexible, dispatchable power necessary to integrate some of the increasing generation from intermittent renewable sources, such as wind and solar generation;
- displacing some less efficient gas-fired facilities that are required to provide electricity reliability in PG&E's service territory;
- partially replacing out-of-state coal electricity generation that must be phased out in conformance with the State's new Emissions Performance Standard; and
- providing other services, including integration of renewable energy, local generation displacement, ancillary services, grid system and emergency support, and general energy support.

[1] Belden powerhouse was not evaluated because no operational changes are foreseen at that facility.

6.16.2 Environmental Impacts and Mitigation Measures

Methodology

Section 15064.4 of the CEQA Guidelines directs that:

(a) A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of GHG emissions resulting from a project. A lead agency shall have discretion to determine, in the context of a particular project, whether to:

(1) Use a model or methodology to quantify GHG emissions resulting from a project, and which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; and/or

(2) Rely on a qualitative analysis or performance based standards.

(b) A lead agency should consider the following factors, among others, when assessing the significance of impacts from GHG emissions on the environment:

(1) The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.

(2) Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.

(3) The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of GHG emissions. If there is substantial evidence that the possible effects of a particular project are still cumulatively considerable notwithstanding compliance with the adopted regulations or requirements, an EIR must be prepared for the project.

The information presented in this section is summarized from a technical report (Appendix J) that evaluates the effects of the Proposed UNFFR Project and each alternative on power loss and the resulting increase in indirect GHG emissions generated by a replacement non-hydroelectric energy source. Detailed methodology for the analysis is provided in Appendix J. In summary, a three-step process was used to conduct the analysis to assess the anticipated changes in UNFFR Project hydropower generation under different operations and flow regimes, anticipating the resources that would be used to offset any losses to meet future electricity demand, and calculating the estimated indirect GHG emissions related to the alternatives discussed in this EIR.

- Step one required preparation of a spreadsheet that initially converted monthly energy changes into hourly operational changes; this provided a model that represents a typical

week of hourly operations for the summer period for three water-year types (Dry, Above Normal, and Below Normal).

- Step two involved preparation of an estimate of short-term and long-term incremental energy system resource additions using the year 2020 that was used to delineate the type of generation resources, distributed generation, and demand-side management in order to characterize resources necessary to replace reduced generation of the UNFFR Project.

- The third step was to use the information developed to estimate the changes in incremental generation resources based on the changes to baseline conditions under various hydrologic conditions.

The type of replacement energy resource was an important assumption to estimate GHG emissions because different energy resources generate different levels of GHG emissions. To estimate the amount of GHG emissions resulting from the change in UNFFR Project hydropower generation considered in this EIR, several replacement energy resource scenarios were used in this analysis. Incremental CO_2 rates from the scenarios were multiplied by the estimated difference in hourly MW generation to determine the approximate CO_2e in tonnes for the Proposed UNFFR Project and each alternative.

Future energy generation and customer-side resources in California are expected to change to reflect the State's goals for reducing GHG emissions, but the mix of those resources is unknown. To address this uncertainty, a range of scenarios was selected to reflect reasonably expected bounding cases. The CEC examined several future scenarios or plans to meet State goals in its *Integrated Energy Resource Plan* (resource plan) (California Energy Commission 2007).

The three scenarios that best represent the range of reasonably expected bounding cases are:

- Case 1B which reflects pre-AB 32 "business as usual" with significant continuing reliance on fossil fuels and achieving the current 20 percent RPS by 2020.

- A second scenario using the Case 1B resource plan but including a carbon fee or allowance price set at $100 per tonne of CO_2 emitted to reflect a potential outcome of meeting AB 32 goals or a national cap and trade program. This fee or price would be levied on the carbon content of the fuel, with coal having a much larger carbon "footprint" than natural gas.

- Case 4 which reflects the highest investment in renewables, achieving a 33 percent RPS by 2020.

The CEC scenarios assume that the future resource plan will be implemented and only operations will change. Two additional scenarios were created to reflect more fundamental changes in the resource plan than represented in the CEC scenarios (e.g., how the mix of resources might change). These two scenarios include a 20 percent RPS or 33 percent renewable energy standard (RES), which requires most (20 percent scenario) or all (33 percent scenario) new resources to be zero-emitting renewables except when a new combustion turbine-driven thermal power plant is required to provide peak capacity and ancillary services. Together, the incremental changes in emissions in these five scenarios represent potential

future conditions for purposes of evaluating the contribution of the Proposed UNFFR Project and each alternative to GHG emissions.

Thresholds of Significance

Impacts on climate change would be significant if the Proposed UNFFR Project, Alternative 1, or Alternative 2 would:

- contribute substantially to GHG emissions through increased fuel or energy consumption or emission of GHGs; or
- conflict with the adopted statewide 2020 GHG emissions limit or the plans, programs, and regulations adopted to implement the Global Warming Solutions Act of 2006.

Impacts and Mitigation Measures

This section discusses the anticipated impacts of the Proposed UNFFR Project and each alternative and identifies mitigation measures for significant impacts. Table 6.16-2 compares the final level of significance for each impact, with incorporation of mitigation measures if appropriate.

Table 6.16-2. Summary of Climate Change (CC) Impacts

IMPACT	PROPOSED UNFFR PROJECT	ALTERNATIVE 1	ALTERNATIVE 2
Impact CC-1: Implementation of the UNFFR Project could indirectly increase GHG emissions and conflict with policies adopted to reduce GHG emissions.	Less than significant	Less than significant	Less than significant

Impact CC-1: Implementation of the UNFFR Project could indirectly increase GHG emissions and conflict with policies adopted to reduce GHG emissions.

Proposed UNFFR Project and Alternatives 1 and 2

Construction

Construction activities relevant to GHG emissions under the Proposed UNFFR Project and each alternative are also discussed in Section 6.14, Air Quality, specifically under Impacts Air Quality (AQ)-1 and AQ-2. Construction activities would generate GHG emissions from diesel-powered construction equipment, diesel-powered generators, and diesel and gasoline-powered vehicles, including trucks and worker personal vehicles. GHGs emitted from the combustion of fuel associated with this equipment would consist mainly of CO_2, with small amounts of CH_4 and N_2O. All construction activities would occur for a relatively short time period (see Chapter 3, PG&E's Upper North Fork Feather River Project, for the construction schedule). Additionally, construction activities related to recreational improvements would be spread out over the term of the new FERC license. Therefore, impacts of the construction activities related to GHG emissions are considered **less than significant**.

Operation

The Proposed UNFFR Project and Alternatives 1 and 2 would entail flow modifications associated with releases to the Seneca and Belden reaches as described in the 2004 Settlement Agreement (Appendix A) and Chapter 4, Project Alternatives, of this EIR for four water year types: Wet, Normal, Dry, and Critically Dry. In addition, minimum flow releases to the Seneca Reach would be increased to 250 cfs from mid-June to mid-September under Alternative 1. Increased releases from Canyon dam would require decreased releases through the Prattville intake during these months on an annual basis. These flow modifications would also reduce the ability of the Butt Valley and Caribou powerhouses to generate electricity, resulting in an overall reduction in the UNFFR Project's electricity generation during the season when peak power is necessary to respond to increased use. While changes in operations would not directly increase GHG emissions, the operational changes could induce compensating changes elsewhere in the interconnected energy grid. The compensating changes could cause indirect increases in GHG emissions from other power plants that rely on fossil fuels.

Any operation of thermal curtains at the Prattville and Caribou intakes under either Alternatives 1 or 2 would not affect flows through the Butt Valley and Caribou powerhouses; there would be no reduction in electricity generation or a change in GHG emissions.

With the proposed minimum flow modifications to the Seneca and Belden reaches under either the Proposed UNFFR Project or the alternatives (excluding the 250 cfs under Alternative 1), the UNFFR Project would be able to continue providing ancillary services if operational changes are implemented that continue to allow water to be stored and released at a critical time in response to load demand and needs. The relatively small changes in hydropower generation induced as a result of either alternative under all water conditions would not largely affect the ancillary services. Although the base flows vary between the Proposed UNFFR Project and either alternative in terms of timing (month, water year) and flow rate (cfs), the minimum flows for the Seneca and Belden reaches described in Tables 4-1 and 4-2 were selected for the alternatives to ensure that they were neutral in terms of changes to the water budget and energy budget compared to the UNFFR Project.

If other short-term (days, weeks, months) sources of electricity generation are needed to replace the lost UNFFR Project generation in order to continue meeting the California load demands, existing or already-committed new resources available in the CAISO would be used, depending on future conditions and the ability to use existing resources. The GHG effects of using other sources would vary, depending on future conditions and the specific resources used (Table 6.16-2). This impact analysis recognizes the two valuable attributes of the generating assets—the ability to shape energy production into the highest demand and value periods and to rapidly respond to changes in demand and provide ready reserves. Typically, alternate resources used to replace lost services in the CAISO come from higher emitting fossil-fueled plants, such as older natural-gas fired steam turbines and less efficient combustible turbine facilities.

For the three scenarios considered for this analysis, with respect to the Proposed UNFFR Project and the alternatives, the mix of generation and customer-side resources would likely be unchanged under the CEC scenarios (Cases 1B and 4), whereas the mix of new generating resources would likely change under the 20 percent RPS and 33 percent RES scenarios described in Appendix J. The potential annual increase in GHG emissions in 2020 (future conditions) under each scenario is presented in Table 6.16-3. The resulting energy loss from

flow modifications identified in the 2004 Settlement Agreement for the Proposed UNFFR Project would result in an indirect increase in GHG emissions of between approximately 0 and 332 tonnes of CO_2e per year. Under Alternative 1, modifications to the flow schedules for the Seneca and Belden reaches coupled with 250 cfs releases through Canyon dam from mid-June to mid-September would result in an indirect increase in GHG emissions of between approximately 0 and 1,454 tonnes of CO_2e per year. GHG emissions under Alternative 2 resulting from the modifications to instream flow schedules for the Seneca and Belden reaches would be between approximately 0 and 332 tonnes of CO_2e per year, which is similar to the Proposed UNFFR Project.

Table 6.16-3. Potential Annual Change in GHG Emissions for Power Scenarios (2020)

	CASE 1B	CASE 1B with $100/$CO_2e$ tonne	Case 4	20% RPS Case	33% RES Case
Proposed UNFFR Project (2004 Settlement Agreement measures)	261	280	332	68	0
Alternative 1 (2004 Settlement Agreement measures, thermal curtains, Canyon dam 250 cfs)	1,120	1,165	1,454	265	0
Alternative 2 (2004 Settlement Agreement measures, thermal curtains)	261	280	332	68	0

Note: Emissions in tonnes CO_2e per year. Supporting information provided in Appendix J.

The estimates above for both alternatives were developed using the minimum flows put forth in the 2004 Settlement Agreement. As shown in Table 6.16-4, on average, there is minimal variation between the flows in the 2004 Settlement Agreement and alternative flows for the Seneca and Belden reaches without the 250 cfs releases from Canyon dam (Alternative 1).

Table 6.16-4. Comparison of Average[1] Flows in the 2004 Settlement Agreement with Average Flows under Alternative 1[2] and Alternative 2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Seneca Reach												
Settlement Agreement	86	94	113	119	119	116	85	73	60	60	60	74
Alternative Flows	85	90	100	105	114	114	101	95	60	60	60	74
Belden Reach												
Settlement Agreement	130	138	175	209	210	175	140	116	114	104	109	111
Alternative Flows	131	138	190	209	210	188	138	140	140	128	128	128

[1]Flows are monthly averages of all water year types. Flows are in cfs, rounded.
[2]Excludes 250 cfs releases to Seneca reach from mid-June to mid-September.

In 2010, the BAAQMD adopted air quality guidance that included quantitative thresholds of significance and recommended best management practices (BMPs) and mitigation measures

for GHG emissions, among other pollutants. Projects categorized as stationary sources have a threshold of 10,000 tonnes of CO_2e per year. The 2010 BAAQMD thresholds were successfully challenged in court because they were not evaluated under CEQA prior to adoption. The court did not determine whether the thresholds were valid on the merits, but found that the adoption of the thresholds was a project under CEQA. Although the UNFFR Project lies outside the jurisdictional boundaries of the BAAQMD, these thresholds were considered appropriate due to the fact that no other standards were readily available.

The annual total amount of GHG emissions in the State of California was reported to be about 448 million tonnes of gross CO_2e in 2011[2] (California Air Resources Board 2013). Under the various scenarios, the increase in GHG emissions would be minor under the Proposed UNFFR Project and both alternatives relative to the total annual amount in California, even under a bounding-case scenario (Case 4). In addition, the replacement sources would be required to comply with CARB programs and mandatory reporting requirements to achieve state-wide goals for GHG emissions. Other future requirements mandating compliance with AB 32 or other laws, such as a cap and trade program proposed by CARB, will also likely be effective by 2020, and future sources will need to comply with these as well. Based on the estimated GHG emissions and the need to comply with federal and state programs, impacts associated with GHG emissions would be **less than significant**.

[2] California Greenhouse Gas Inventory for 2000-2011— by Category as Defined in the 2008 Scoping Plan (CARB).