

**SACRAMENTO MUNICIPAL UTILITY DISTRICT'S
UPPER AMERICAN RIVER PROJECT
(FERC NO. 2101)**

**SUPPLEMENTAL
PRELIMINARY DRAFT
ENVIRONMENTAL ASSESSMENT**

SECTION 5.3.11 – AIR RESOURCES

Sacramento Municipal Utility District
Sacramento, California

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5.3.11 Air Resources

5.3.11.1 Environmental Effects of the Agency Alternative on Air Resources

To compensate for any hydroelectric energy and capacity lost due to reoperation of the UARP under the Agency Alternative, SMUD must obtain a substitute supply of electricity for SMUD's customers. The Agency Alternative includes no measures specifically addressing the effect a reduction in energy generation will have on air resources. Nonetheless, the following Agency Alternative measures will substantially reduce the overall energy generation and capacity of the UARP and will make infeasible the peak generation increases that would occur under the SMUD Proposed Action's Iowa Hill Pumped Storage Development (Iowa Hill):

- "Minimum Streamflows" (Agency Alternative, p. 21);
- "Pulse Flows" (Agency Alternative, p. 28);
- "Ramping Rates" (Agency Alternative, p. 30);
- "Reservoir Levels" (Agency Alternative, p. 87);
- "Recreation Streamflows" (Agency Alternative, p. 89).

The Agency Alternative does not discuss air quality or the effects that reducing UARP generation will have on air resources.

To determine the environmental effects of the Agency Alternative on air resources, SMUD compared the effects of the Agency Alternative on air quality within the Sacramento region and beyond against the baseline conditions and the Proposed Action. We considered the Agency Alternative to have a significant environmental effect if it: 1) obstructs implementation of an applicable air quality plan; 2) causes violation of an air quality standard; 3) contributes substantially to an existing or projected air quality violation; or 4) results in a cumulatively considerable net increase of any criteria pollutant for which the affected region is considered to be in nonattainment under an applicable federal or state ambient air quality standard.

As discussed below in more detail, the Agency Alternative has higher air emissions compared to both baseline conditions and the Proposed Action. These adverse effects consist of a cumulatively considerable net increase of criteria air pollutants in the Sacramento region, which is in nonattainment for criteria pollutants, and in other regions that are likely in nonattainment. The fact that some of the generating plants that will be called upon to produce peaking power have had their air emissions offset under state and local regulatory programs does not reduce the impact of the real increase in emissions that will occur under the Agency Alternative as compared with either the baseline or the Proposed Action.

5.3.11.2 Agency Alternative Increases Reliance Upon Fossil Fuel Energy Sources

The UARP is a key component of SMUD's energy portfolio, which emphasizes low-emissions and low-carbon generation. As described in the PDEA, SMUD generates, transmits, and distributes electric power to a 900-square-mile service area with 578,041 customers and peak demand of 2,957 megawatts. Operation of the existing UARP facilities causes negligible atmospheric emission of criteria pollutants or other hazardous material with the potential to affect air quality, and negligible carbon emissions. Under baseline conditions (current operations), the UARP generates an average of 1,835,000 MWh of emissions-free energy annually.

Both the Proposed Action and the Agency Alternative will increase the volume of water to be released or bypassed during the spring, decreasing the volume available to generate electricity. Under the Proposed Action, the UARP will generate an average of 1,794,000 MWh, a reduction of 41,000 MWh compared with baseline conditions. Under the Agency Alternative, the UARP will generate an average of 1,664,000 MWh, a reduction of 171,000 MWh compared with baseline conditions. The Agency Alternative reduces average annual UARP generation by more than four times the reduction under the Proposed Action. Nearly all the electricity that must be generated to substitute for these reductions will be produced in power plants operated by burning fossil fuels.¹

To compensate for the loss of electricity generation currently provided by the UARP under baseline conditions, SMUD must use or procure other sources of energy. The bulk of SMUD's energy not produced through the UARP is generated at five existing natural gas power plants with a combined total of 9 natural gas-fired combustion turbines. Power plants operated by fossil fuels emit criteria air pollutants, precursors to such pollutants, and carbon dioxide. Criteria air pollutants are nitrogen dioxide (NO₂)², sulfur dioxide (SO₂), carbon monoxide (CO), ozone, reactive organic gases (ROG), and particulate matter of less than 10 microns (PM₁₀) and of less than 2.5 microns (PM_{2.5}). NO_x and ROG are ozone precursors, while NO_x, ROG, and SO₂ are precursors to both PM₁₀ and PM_{2.5}.

The Sacramento region is designated as a "serious" ozone nonattainment area for the federal 8-hour ozone standard (69 Federal Register 23858 (April 30, 2004)). The federal ozone nonattainment area consists of all of Sacramento and Yolo counties and parts of Placer, El Dorado, Solano and Sutter counties. Ozone, a primary component of smog, is a harmful pollutant when present at ground level. It is formed in the presence of sunlight typically on hot summer days as the result of photochemical reactions involving ROG and NO_x. In addition, Sacramento County is designated nonattainment for the state ozone ambient air quality standards.

¹ SMUD's renewable portfolio standard states SMUD will acquire 20% of its annual energy supply from renewable sources. Practically speaking, the Agency Alternative will make it more difficult to achieve this goal and will substantially reduce SMUD's ability to enhance renewable energy production beyond 20%.

² Oxides of nitrogen (NO_x) are a precursor to ambient concentrations of nitrogen dioxide.

Sacramento County is also in nonattainment with state standards for PM₁₀ and PM_{2.5} (California Air Resources Board, Final Regulation Order, Area Designations for State Ambient Air Quality Standards (January 20, 2005)). Though both are associated with serious health effects and reduced visibility, finer particles (PM_{2.5}) are inhaled more deeply into the lungs and are more strongly associated with serious health effects than larger particles (PM₁₀).

Even with best available control technology installed, SMUD's gas-fired turbines emit NO_x, SO₂, ROG, PM₁₀ and PM_{2.5}. If the incremental generation required to make-up for the lost UARP energy product under the Proposed Action and Agency Alternative comes from these five plants, these emissions will contribute to ongoing exceedances of state and federal ozone standards in the Sacramento region. The Agency Alternative will increase NO_x and ROG emissions (ozone precursors) by more than four times the increase under the Proposed Action.

In addition, the increases in emissions of PM₁₀, PM_{2.5}, and precursors to these pollutants from operating SMUD's gas-fired turbines to substitute for hydroelectric power will contribute to existing violations of the state's annual average standards for these pollutants. (Although increased operations from SMUD's gas-fired turbines to substitute for the reduced availability of hydroelectric power will occur most often outside of the peak particulate season, year-round emissions of these pollutants contribute to the violations of the state annual average standards.)

Table 5.3.11-1 estimates the increase in emissions of ozone and particulate precursors associated with the Proposed Action and Agency Alternative, as compared with baseline conditions, assuming that all of the additional fossil generation is produced by the Cosumnes Power Plant, SMUD's cleanest and most efficient generating resource. Thus, these values represent the *minimum* increase in emissions that would be associated with these alternatives. To ensure consistency in comparing the cumulative emissions associated with the UARP under each alternative, the table does not include Iowa Hill. Although some emissions may be associated with pumping activities, those emissions are likely to occur during off-peak hours when ozone is relatively low and when the available energy tends to originate from low-emission sources; on balance, operation of Iowa Hill will typically reduce daily air emissions.

| Table 5.3.11-1. Increase in Ozone and PM₁₀/PM_{2.5} Emissions (Agency Alternative vs. SMUD Proposed Action). | | | |
|---|----------------------------|---|---------------------------|
| | Baseline Conditions | SMUD's Proposed Action (without Iowa Hill) | Agency Alternative |
| Annual Generation (MWh) | 1,835,000 | 1,794,000 | 1,664,000 |
| Increased Fossil Generation (MWh) | 0 | 41,000 | 171,000 |
| Increased Ozone Precursor Emissions (tons per year) ¹ | 0 | 1.4 | 5.7 |
| Increased PM ₁₀ /PM _{2.5} Precursor Emissions (tons per year) ² | 0 | 2.2 | 9.3 |
| Notes: | | | |
| ¹ Ozone precursors include NO _x and ROG. Maximum hourly NO _x and ROG emissions from each of the two Cosumnes units are 13.51 lbs/hr and 3.30 lbs/hr, respectively, for a total of 33.62 lbs/hr of ozone precursor emissions. ³ Based on the nominal plant output of 500 MW, ozone precursor emissions are 0.0672 lbs/MWh. | | | |
| ² PM ₁₀ /PM _{2.5} precursors include NO _x , ROG, SO _x and PM ₁₀ /PM _{2.5} . Maximum hourly emissions of these pollutants from each of the two Cosumnes units are 13.51, 3.30, 1.31 and 9.0 lbs/hr, respectively, for a total of 54.24 lbs/hr of PM ₁₀ /PM _{2.5} precursor emissions. ⁴ Based on the nominal plant output of 500 MW, PM ₁₀ /PM _{2.5} precursor emissions are 0.1085 lbs/MWh. | | | |

Moreover, the Agency Alternative will substantially increase the number of metric tons of carbon emissions produced to meet the energy demands in SMUD's service area. Under the Proposed Action, increased generation to replace the loss in hydroelectric capacity will result in an increase in 6,355 metric tons of carbon emissions. Under the Agency Alternative, increased generation to replace the loss in hydroelectric capacity will result in an increase in 26,505 metric tons of carbon emissions. On June 1, 2005, California Governor Arnold Schwarzenegger signed Executive Order # S-3-05, which established the target of reducing state greenhouse gas emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. The Agency Alternative will make achieving that target more difficult.

³ Final Decision, California Energy Commission. Cosumnes Power Plant (01-AFC-19). September 2003. pp. 27-28.

⁴ *Id.*

| Table 5.3.11-2. Increase in Carbon Emissions (Agency Alternative vs. SMUD Proposed Action). | | | |
|---|----------------------------|---|--|
| | Baseline Conditions | SMUD's Proposed Action (without Iowa Hill) | Agency Alternative |
| Annual UARP Generation | 1,835,000 | 1,794,000 | 1,664,000 |
| Carbon Emissions That Would Result if Fossil Fuel Power Facilities Generated Energy to Replace Incremental Loss from Baseline Conditions ⁵ | 0 | 6,355 increase in metric tons of carbon emissions | 26,505 increase in metric tons of carbon emissions |

5.3.11.3 Agency Alternative Increases Reliance Upon Fossil Fuel Energy Sources During the Peak Summer Smog Season.

In addition to reducing average annual UARP generation by increasing spring bypasses and reservoir release rates, the Agency Alternative includes a reservoir level restriction that will decrease generation during the hotter summer months (July, August, September) in SMUD's service area, when demand is at its peak and ozone-related air quality is at its worst. UARP generation will instead be shifted to the (generally) cooler month of October. The surface level restrictions at Slab Creek Reservoir also make it infeasible to operate Iowa Hill, which would play a substantial role in meeting peak energy demands by generating up to 400 MW when demand is highest. The Agency Alternative will have a greater impact on air quality compared to baseline conditions or to the Proposed Action because both baseline conditions and the Proposed Action provide greater generation of emissions-free hydroelectric energy to meet peak energy demands during the summer, when ozone air quality is at its worst. By requiring substitute energy to be generated at that time, primarily through the operation of power plants run on natural gas, the Agency Alternative will contribute substantially to existing violations of state and federal ozone standards.

One of the UARP's most critical roles in regional energy production is as a clean, reliable source for meeting peak energy demands. Generating peaking energy quickly is particularly important for SMUD because weather patterns are similar throughout SMUD's service area, and thus unexpected weather changes can rapidly lead to high surges in energy demand. Unlike with other utilities whose broad customer base covers a wide range of geographic and climatic locations, SMUD's customer base is centralized around the Sacramento Valley, where the weather is generally uniform (e.g., during summer months, hot temperatures prevail throughout the entire SMUD territory).

The fact that peak load periods reflect temperature changes in the Sacramento region does not mean that planned load curves can fully anticipate actual demand. The service area is subject to

⁵ 278,070 metric tons of carbon emissions equals 1,794,000 MWh/yr x 155 kg of carbon/MWh x 0.001 metric tons/kg. The value of kg of carbon/MWh for a regional carbon intensity factor of a California gas-fired facility was derived from the Oak Ridge Competitive Electricity Dispatch computer model.

an unpredictable weather phenomenon known as the Sacramento-San Joaquin River Delta breeze, which can decrease the actual temperature significantly compared with the previous day's temperature forecast. Because of the Delta breeze, SMUD consistently experiences a summer month load swing up to a magnitude of plus/minus 500 to 600 MW from the previous day to real time. SMUD's plan to install substantial new wind turbines in this area to meet a portion of its renewable energy goals will exaggerate this effect since an unexpected Delta breeze both lowers load and increases wind generation. The opposite occurs when an expected breeze does not materialize. These unpredictable swings in potential daily load and capacity represent 20% to 25% of SMUD's summer peak load to which SMUD must respond using available capacity resources. This effect will be exacerbated given the projected 2% annual load growth in SMUD's current service area over the next decade and beyond.

The Agency Alternative's required minimum water surface levels for July, August and September at Loon Lake, Union Valley and Ice House reservoirs will prohibit the release of available stored water to generate peaking energy when demand is highest. As a consequence, the Agency Alternative will reduce SMUD's ability to use the full non-emissive hydroelectric generation capacity of the UARP in the event of a summer heating event or other strenuous system condition that continues over an extended period. In response to an information request from FERC, SMUD performed a sensitivity analysis that demonstrated this impact on generation capacity is substantial. For example, during July and August 1996 SMUD required full use of UARP Project Dependable Capacity (PDC) to meet system load due to an extended summer period of high loads. The analysis revealed that, for this period, the Agency Alternative would have restricted SMUD's ability to use its UARP PDC by up to 470 MW (SMUD, Response to the Federal Energy Regulatory Commission's December 20, 2005 Request for Clarification and Additional Information (March 20, 2006).

The Agency Alternative also limits SMUD's ability to generate emissions-free peaking energy by making Iowa Hill infeasible. As discussed in the PDEA, construction of Iowa Hill would benefit air quality by facilitating SMUD's future use of 400 MW of clean energy. At Iowa Hill, water will be pumped to the upper reservoir during off-peak hours, at a time when cleaner sources overall can be used for energy generation. The stored water will be used to generate a slightly smaller amount of energy to meet unexpected peak demand, which will be primarily met through powerhouses run on fossil fuels. Iowa Hill's pumped storage thus provides SMUD a high level of operational flexibility and reliability. The presence of Iowa Hill in SMUD's portfolio could assist SMUD in developing clean, albeit intermittent, future sources of power.

There are no comparable low-emissions energy sources that SMUD can use to substitute for peaking energy losses due to the reservoir elevation restraints and the loss of Iowa Hill. Hydroelectricity is particularly suited to meeting peak-load demand, because water can be released from long-term storage or else stored during off-peak hours. Generally speaking, other energy sources that produce little or no emissions are not suited to meeting unexpected peak energy demands. Wind turbines, as suggested above, operate only when pressure systems are producing wind. Similarly, solar power cannot be ramped up to conform with demand for it is limited by immediately available sunshine. And although solar energy production is at its

highest during the peak summer hours, peak solar energy is generated earlier in the day than peak demand for energy because the solar peak precedes the temperature peak.

Gas turbine plants, by contrast, can be used to supply peak energy because they can be started rapidly during periods of high demand. SMUD maintains 3 natural gas-fired turbines that can be operated to meet peak energy demands; the peaking capacity of these turbines is approximately 160 MW, compared with the 400 MW peaking energy capacity of Iowa Hill and with the 470 MW of UARP PDC available under baseline conditions and the Proposed Action. On their own, SMUD's existing turbines cannot satisfy the peak demand shortfall created by the Agency Alternative.

To substitute for the rest of the UARP PDC and Iowa Hill peaking energy that will be lost or made infeasible under the Agency Alternative (~710 MW), SMUD will have to make purchases from the statewide net system power (i.e., energy available for purchase, not onsite use). The California Energy Commission has determined that approximately 72% of the net system power in California is derived from burning of fossil fuels—38.5% coal and 33.5% natural gas (California Energy Commission, CEC-300-2006-009-F, *Net System Power: A Small Share of California's Power Mix in 2005*, April 2006).

The source of energy purchased from the statewide net system cannot be isolated, though the vast majority of the energy is produced in California. Of California's 58 counties, the vast majority of those with fossil generating plants are nonattainment areas for the state and federal air quality standards for ozone, PM₁₀, and PM_{2.5}. Thus, it is reasonably likely that the increased emissions from power plants that will provide the bulk of the substitute energy purchased from the system will occur in areas that are in nonattainment for one or more of these standards. Although it might be argued that some, or all, of the increase in emissions from these generating plants may have been mitigated through an emission reduction credit (or offset) program, this is not necessarily the case. The marginal generating units in California, particularly during peak generating periods in summer months, are older, less efficient, fossil-fired units. Non-fossil units (such as nuclear, wind, geothermal, and hydroelectric) are typically dispatched before fossil-fired units, and more efficient fossil units are dispatched before less efficient units. Many of the older, less efficient units were built before the advent of emission offset requirements and, as a result, their emissions are not, in fact, mitigated through a regional offset program. Furthermore, these units invariably result in the production of higher rates of emissions for each megawatt hour of electricity produced as compared with SMUD's efficient Cosumnes Power Plant, which was used above to estimate the minimum increase in emissions associated with the Proposed Action and the Agency Alternative. Some of the smaller peaking units, which, together, may produce sufficient peaking capacity to displace the lost UARP and Iowa Hill peak power generation, were similarly not subject to emission offset requirements, either because they predated the offset program, or because their size results in emissions below the offset trigger levels. Finally, even if the units used to produce the lost UARP and Iowa Hill peak power generation comes from power plants whose emissions were offset, the fact remains that emissions of ozone precursors will increase substantially during the peak ozone season under the Agency Alternative as compared with either baseline conditions or the Proposed Action.