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Sustainability of hydropower in California

See attached document

Additional submitted attachment is included below.

Sustainability of hydropower in California
Comments following on CEC Staff Workshop 05 March 2021
Submitted by G Mathias Kondolf, University of California Berkeley

Thank you for an informative workshop on an important topic. In my comments, I would like to put on the Commission's 'radar' the importance of understanding threats to the sustainability of hydropower (including from sedimentation), the potential for strategic planning to optimize hydropower in the context of both statewide energy planning and river conservation, and implications for hydropower's potential to support a Climate-Resilient Transition to a Clean Electric System.

Hydropower has an increasingly important role in the transition to renewables, especially as hydropower can provide dispatchable, non-fossil fuel electric power to the grid during times that solar and wind (non-hydro renewables, NHRs) cannot generate power. As the environmental and social impacts of chemical battery storage become better understood, there will be increasing demand for alternative ways of compensating for the intermittency of NHRs.

Hydropower is an important though relatively small component of the state's utility-scale electricity generation, and its potential varies from year to year depending on precipitation and availability of flow to drive turbines. In 2015, during the recent drought, hydropower contributed only about 7% of the state's net electricity generation, but with restoration of more 'normal' precipitation, the contribution increased to 19% in 2019. Thus, hydropower generation is very sensitive to changes in climate, and the more severe droughts anticipated in the future will undermine the contribution of hydropower to supporting NHRs.

Moreover, the long-term sustainability of California's reservoirs is threatened by accumulation of sediments, which displaces water storage capacity and can interfere with the operation of intakes and turbines long before visible loss of storage. With a drier, hotter climate, vegetation will shift to drier, more Mediterranean species, and fires will be more extensive and intense. Both of these factors that will likely increase erosion rates and sediment yield from watersheds draining to reservoirs, increasing the severity of the reservoir sedimentation problem. While there are techniques available to manage sediments sustainably that could apply to many reservoirs, these are rarely implemented (Kondolf et al 2014). Globally, reservoir storage capacity loss to sediment has outstripped new storage created by new dam construction for more than four decades, casting doubt on the long-term sustainability of reservoir storage (Annandale 2013). Especially in developed river basins, we cannot replace this lost storage by building new dams because most good dam sites are already taken, leaving remaining sites with unfavorable economics and high environmental and social impacts. A recent study of sedimentation in California reservoirs predicted that as of 2008, over 120 reservoirs in the state had capacities reduced to less than 25% of original capacity and almost 190 reservoirs had less than 50% of original capacity remaining (Minear and Kondolf 2009).

California has multiple hydropower projects ranging widely in scale and type, but all hydropower projects have some environmental and social impact on river systems, such as blocking fish migration, altering natural flow regimes, and interrupting sediment continuity to downstream reaches. Reducing and mitigating for these impacts create significant constraints on

hydropower generation. Unfortunately, to date there have been no comprehensive efforts to link environmental impacts on rivers with the potential contribution of hydropower to electricity generation at the state level. Indeed such analyses have been conspicuously absent globally, except for a recent study coupling national-level energy planning with strategic hydropower planning, using Myanmar as a case study because the country's energy system has yet to be fully developed and there remain strong synergies possible to preserve free-flowing rivers (Schmitt et al in press).

In conclusion, I encourage the Commission to consider the sustainability of hydropower's contribution to the state's energy portfolio in light of hydropower's critical role in a Climate-Resilient Transition to a Clean Electric System.

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