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Policy brief: making climate services impactful on hydropower reservoir optimization

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Challenges to efficiently manage water resources for hydropower production include changes and increased variability in climate drivers as well as the pressing needs for sharing the water stored in reservoirs with other water uses to mitigate existing and projected conflicts. In this context, hydropower reservoir operations might benefit from the information coming from a broad range of prediction time scales, from short-term to seasonal and decadal time horizons.
The increasing number of climate portals and services for the water sector has brought users of the hydropower sector to ask questions such as: Where is there still room for improvement in typical hydrometeorological forecasting and reservoir management systems designed for the hydropower sector? What do state-of-the-art climate services offer today that actually impacts the performance of hydropower operations? Where, within such systems, should we place our efforts today? What type of investment in the forecasting-reservoir management chain should be prioritized? Which is the dominant driver to inform hydropower dam operations: water availability or energy prices?
This brief explores how matching available climate services with local hydrological-energy contexts and needs can be crucial to improve the operation of hydropower systems and impact decision-making. It includes results from four study sites covering the broad EU hydro-climatological and socio-economic contexts: a set of typical mountainous catchments in France, a typical snow-dominated Alpine basin in Italy (the Lake Como), a typical south Mediterranean basin in Spain, with a large share of water for irrigated agriculture (the Jucar River basin), and a typical north European catchment in Sweden (the upper part of the Umeälven River), highly influenced by snowmelt runoff and volumes for planning the hydropower production for the current and next winter seasons.
Our main findings show that, when decisions are optimized based on future climate and energy prices, hydropower revenue associated with interannual reservoir storage can increase by 3% to 8%, when seasonal predictions from climate and hydrological models are used. Given the presence of multiple time dynamics in hydropower systems, strategic planning on the medium- (weekly) to long- (monthly to seasonal) term, which are mostly driven by climate and hydrology at the local scale, needs to be aligned with daily and sub-daily decisions, which are mostly driven by the energy market. This highlights how climate-oriented and market-oriented decisions have to cohabit in decision-making in hydropower reservoir operations.

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