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Hydroelectricity, sustainability, and the role of probabilistic inflow forecasting

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Hydroelectricity is one of the oldest energy options known to mankind. While public perceptions of hydroelectricity have had their ups and downs, there is growing consensus that it offers one of the most sustainable options to energy reliability, as well as one of the most cost-effective one. This talk focusses on the factors leading to loss of efficiency due to uncertainty in energy demands and reservoir inflows. The talk formulates the need for probabilistic forecasts of demand and inflow, and presents the obstacles in formulating such forecasts due to the complexities of the climate system. A case is made for the use of ensemble forecasts, in this case formulated using statistical alternatives assuming global sea surface temperatures as a key source of information content. A newly formulated approach for identifying nonlinear dependence between variables (termed as the Partial information - Partial Weight, or PI-PW approach, see Sharma and Mehrotra (2014) for details), and subsequent use of these variables to formulate a probabilistic forecasting model is then presented, a key feature of this model being the lack of any major assumption in the nature of dependence (or variables) being modelled. The talk concludes with a list of challenges that still need overcoming, in ensuring hydroelectricity continues to be considered as a key sustainable energy alternative as we head into times of growing disparity between energy resource and consumption.

Reference:
Sharma, A., and R. Mehrotra (2014), An information theoretic alternative to model a natural system using observational information alone, Water Resources Research, 49, doi:10.1002/2013WR013845.