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SEMINAR

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Meeting Room *ETH Hönggerberg, HIL G 36.1*
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Dynamic management of hydropower-irrigation systems

Abstract:
As the competition for water is likely to increase in the near future due to socioeconomic development and population growth, water resources managers will face hard choices when allocating water between competing users. Because water is a vital resource used in multiple sectors, including the environment, the allocation is inherently a political and social process, which is likely to become increasingly scrutinized as the competition grows between the different sectors. Since markets are usually absent or ineffective, the allocation of water between competing demands is achieved administratively taking into account key objectives such as economic efficiency, equity and maintaining the ecological integrity. When crop irrigation is involved, water is usually allocated by a system of annual rights to use a fixed, static, volume of water. In a fully-allocated basin, moving from a static to a dynamic allocation process, whereby the policies are regularly updated according to the hydrologic status of the river basin, is the first step towards the development of river basin management strategies that increase the productivity of water. More specifically, in a multipurpose multireservoir system, continuously adjusting release and withdrawal decisions based on the latest hydrologic information will increase the benefits derived from the system. However, the extent to which such an adjustment can be achieved results from complex spatial and temporal

interactions between the physical characteristics of the water resources system (storage, natural flows), the economic and social consequences of rationing and the impacts on natural ecosystems. The complexity of the decision-making process, which requires the continuous evaluation of numerous trade-offs, calls for the use of integrated hydrologic-economic models. This paper compares static and dynamic management approaches for a cascade of hydropower-irrigation reservoirs using stochastic dual dynamic programming (SDDP) formulations. For the static approach, the multiobjective (irrigation-hydropower) optimization problem is solved using the constraint method, i.e. net benefits from hydropower generation are maximized and irrigation water withdrawals are additional constraints. In the dynamic approach, the SDDP model seeks to maximize the net benefits of both hydropower and irrigation crop production. A cascade of 8 reservoirs in the Turkish and Syrian parts of the Euphrates river basin is used as a case study.