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Efficient dynamic scarcity pricing in urban water supply

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Water pricing is a key instrument for water demand management. Despite the variety of existing strategies for urban water pricing, urban water rates are often far from reflecting the real value of the resource, which increases with water scarcity. Current water rates do not bring any incentive to reduce water use in water scarcity periods, since they do not send any signal to the users of water scarcity. In California, the recent drought has spurred the implementation of drought surcharges and penalties to reduce residential water use, although it is not a common practice yet.
In Europe, the EU Water Framework Directive calls for the implementation of new pricing policies that assure the contribution of water users to the recovery of the cost of water services (financial instrument) while providing adequate incentives for an efficient use of water (economic instrument). Not only financial costs should be recovered but also environmental and resource (opportunity) costs. A dynamic pricing policy is efficient if the prices charged correspond to the marginal economic value of water, which increases with water scarcity and is determined by the value of water for all alternative uses in the basin. Therefore, in the absence of efficient water markets, measuring the opportunity costs of scarce water can only be achieved through an integrated basin-wide hydroeconomic simulation approach.
The objective of this work is to design a dynamic water rate for urban water supply accounting for the seasonal marginal value of water in the basin, related to water scarcity. The dynamic pricing policy would send to the users a signal of the economic value of the resource when water is scarce, therefore promoting more efficient water use. The water rate is also designed to simultaneously meet the expected basic requirements for water tariffs: revenue sufficiency (cost recovery) and neutrality, equity and affordability, simplicity and efficiency. A dynamic increasing block rate (IBR) tariff is designed, including a variable charge related to the scarcity value of water in the basin. The new tariff would encourage water conservation, providing more incentives with great water scarcity. The approach is applied to the supply to the city of Valencia with water resources from the Jucar river basin, a drought-prone Mediterranean basin in Eastern Spain that constitutes a good case for testing this policy. Our results demonstrate the potential of integrating the marginal value of water in the urban water tariffs, with water savings reaching up to 30% during scarcity conditions with respect to the baseline urban water tariffs.