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The economic-engineering of smart-meter-enabled dynamic water pricing

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The introduction of smart metering is set to revolutionize in many ways how water utilities conduct their business and interact with customers. Among those is the possibility of changing water prices during the day or seasonally. This work presents the engineering and economic implications of dynamic pricing implemented at two distinct timescales, 1) a seasonal scarcity tariff aimed at reducing consumption during drier period or droughts, and 2) time-of-day tariffs aimed at reducing peak-hour water use. Sophisticated dynamic pricing schemes are hard to understand for many users, and this reduces their social acceptability because it gives the impression that they help the water utility charge more for water. Therefore, we focus on simple pricing mechanisms, and estimating their short- and long-term benefits for communication with regulators and consumers.

Seasonal scarcity tariffs are designed by adjusting prices such that the increased expenditure is commensurate with economic gains in other uses such as the environment and recreation. These tariffs could promote efficient use of limited supplies during relatively dry periods. In the long term, consistently reducing water consumption when it is scarce delays the need to invest in new sources of supply meant only for dry periods (e.g. desalination) which can bring down supply costs in the long-term. Reducing peak-hour use through time-of-day tariffs in the short run decreases peak-hour energy consumption and delays maintenance by reducing the likelihood of pipe burst. In the long run it delays capacity expansion of the distribution network. We develop and demonstrate a simple economic model of water supply to a generic city to demonstrate these concepts. This simple model is applied to London's water supply to better understand the scale of potential price changes and savings given London's environmental flow demands.