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Do Residential Water Demand Side Management Policies Measure Up? An Analysis of Eight California Water Agencies[1]

Mary E. Renwick and Richard D. Green[2]

Water Resources Center, University of Minnesota, St. Paul, Minnesota 55108-6040

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To assess the potential of price and alternative demand side management (DSM) policies as an urban water resource management tool, an econometric model of residential demand is formulated and estimated. This econometric model incorporates alternative DSM policy instruments (such as water allocations, use restrictions, public education) and increasing block pricing schedules. The analysis relies on cross-sectional monthly time-series data for eight water agencies in California representing 24% of the state's population (7.1 million people). Results suggest that both price and alternative DSM policies were effective in reducing demand. However, the magnitude of the reduction in demand varied among policy instruments.

I. INTRODUCTION

Increased reliance on demand side management (DSM) policies as an urban water resource management tool has stimulated significant discussion among economists, water utility managers, and policymakers. While economists generally advocate residential water prices that reflect marginal costs as a means of reducing demand during periods of limited water supply availability, others argue that residential demand is price inelastic and thus price is a relatively ineffective DSM policy. This argument rests on both economic theory and empirical evidence that indicate residential water demand is expected to be relatively price inelastic.[3, 4] Yet, the argument that residential consumers do not respond to higher prices because demand is price inelastic is seriously flawed for at least two

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[2] Department of Agricultural and Resource Economics at University of California Davis. Comments can be directed to Mary E. Renwick, Water Resources Center, University of Minnesota, 146 Class Room Office Bldg., 1994 Buford Avenue, St. Paul, MN 55108-6040, or e-mail: renwi001@tc.umn.edu.

[3] Economic theory suggests that residential water demand should be price inelastic for three reasons: (1) there exist no close substitutes for water in most of its uses; (2) the amount of money spent on water is generally a relatively small share of the typical U.S. household budget; and (3) water is frequently demanded jointly with some other complementary good, as for bathing (Bach, 1980).

[4] Previous empirical studies indicating an own-price elasticity in absolute value of less than 1 include [1, 3, 7, 13, 16, 17].

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reasons.[5] In addition, some advocates of non-price policy have argued that "the use of price as an allocation mechanism is constrained by the fact that water is generally regarded as a basic necessity, even a right, not an economic good" [2].

The problem facing water utility managers and policy makers is a lack of adequate information to determine the potential performance of price and alternative non-price DSM policies in their communities. While water utility managers frequently adopt a combination of price and alternative DSM policy instruments, particularly during periods of limited supply availability, most previous economic analyses of residential water demand have ignored the effect of alternative DSM policies.[6] Alternative "non-price" DSM policy instruments—those that do not affect the price of water—include public education campaigns, rationing, water use restrictions, and subsidies for adoption of more water-efficient technologies. Failure to account for the influence of non-price DSM policies on demand when both price and non-price policies have been implemented may result in an overestimate of the price responsiveness of water demand.

To assess the potential of price and alternative DSM policy instruments to reduce demand, an econometric model of residential demand for water is formulated and estimated using a two-step estimation framework. This econometric model explicitly incorporates alternative non-price DSM policies, endogenous block pricing schedules, and a harmonic model to separately capture the effects of seasonality and climatic variability on demand, improving upon earlier specifications [10, 11, 13]. The analysis relies on agency-level cross-sectional monthly time-series data over an 8-year period for eight urban communities in California, representing 7.1 million people.

II. DSM POLICIES IN URBAN CALIFORNIA

To assess the relative performance of price and alternative DSM policies to reduce aggregate demand, this research takes advantage of experience with residential DSM programs implemented in California during the 1989–1996 period. This period includes California's statewide drought, which persisted with varying degrees of intensity between 1985 and 1992, allowing examination of both price and alternative non-price policy instruments. Data collection efforts were conducted in eight urban water agency service areas covering 24% of California's population (7.1 million people). The eight agencies include the San Francisco Water District (SFWD), Marin Municipal Water District (MMWD), Contra Costa Water Agency (CCWA), East Bay Municipal Utility District (EBMUD), City of San Bernardino (SBERN), City of Santa Barbara (SBARB), Los Angeles Department of Water and Power (LADWP), and City of San Diego (SDIEGO). These areas were selected for a number of reasons, including varied hydrological conditions, geographical dispersion, and experience under different DSM policy regimes.

[5]First, since a market demand curve for most functional forms will be inelastic in some price ranges and elastic in others, reference to a demand curve as either inelastic or elastic must be made in relation to a specific range of prices. Second, some policymakers have erroneously equated price inelasticity with no price responsiveness. The description of residential demand as price inelastic is a technical definition; it simply means that a 1% increase in price results in a less than 1% decrease in consumption. In other words, consumers respond to higher prices, but at a rate less than proportionate to the price increase.

[6]Exceptions include [16, 17].