UC RIVERSIDE UNIVERSITY OF CALIFORNIA | School of Public Policy

Promoting Supply Reliability through Demand Side Management

Ken Baerenklau

University of California – Riverside

School of Public Policy

Joint work with Professors Kurt Schwabe and Ariel Dinar of UC Riverside

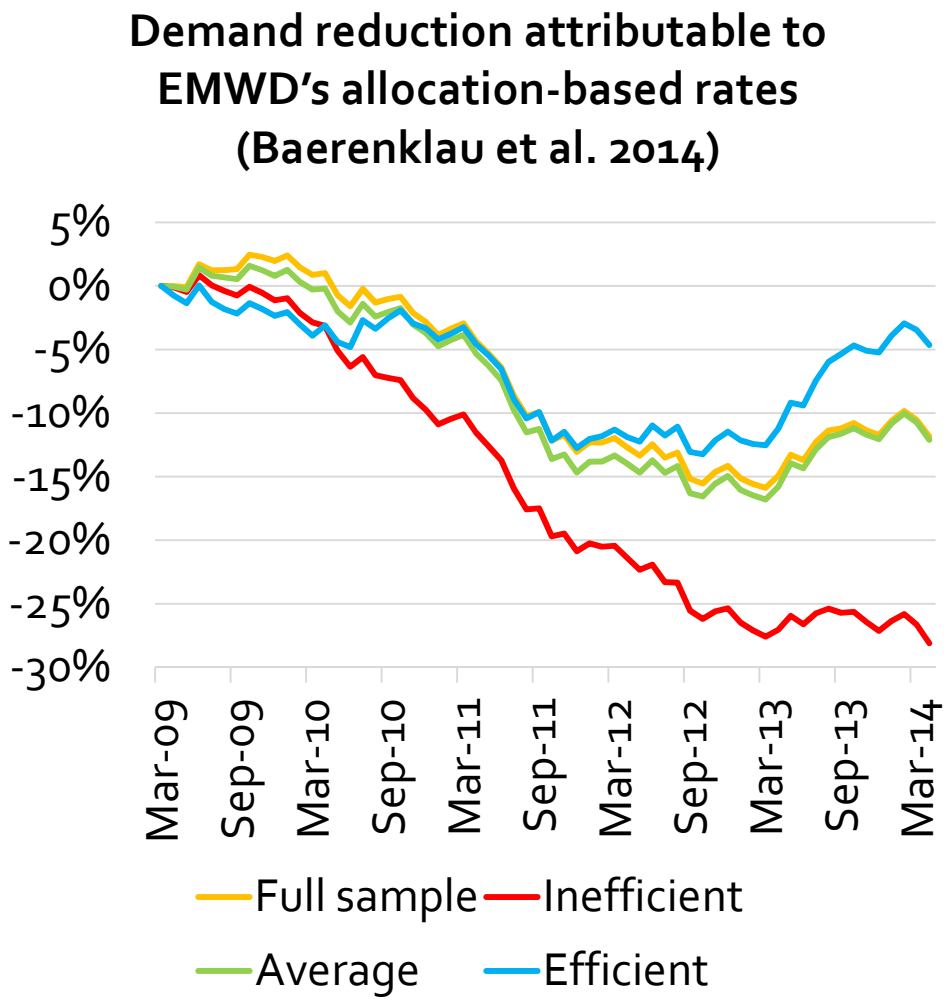
Six P's of demand side management

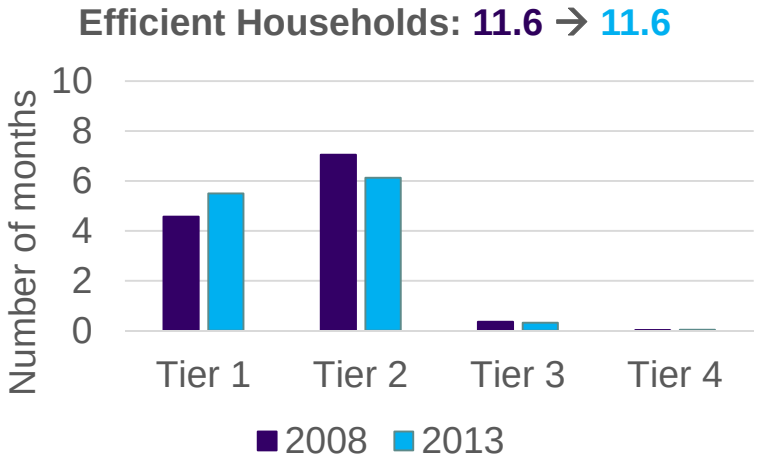
- Pricing: higher price → lower demand
- Programming: encourage use of conservation practices
- Pleading: voluntary requests for conservation
- Prohibiting: mandatory restrictions and other requirements
- Pressuring: social norm messaging and peer influence
- Plastering: education and information campaigns

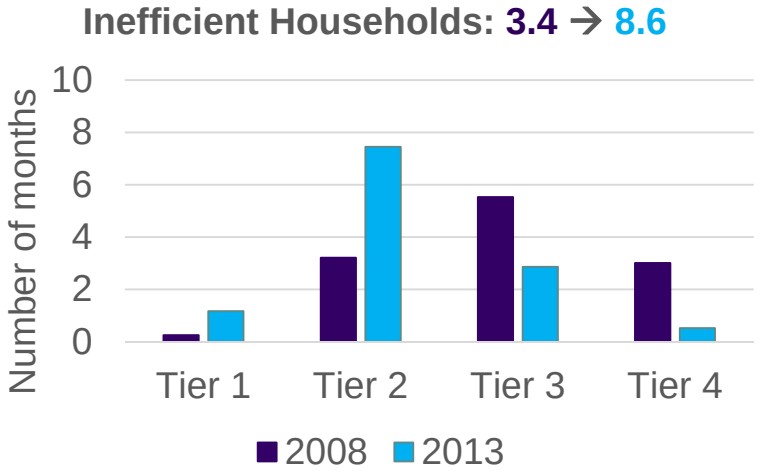
Pricing: an effective tool

- There is ample evidence that customers respond to price changes and that pricing is a cost-effective means of achieving conservation goals.
- Price elasticity of water demand (a measure of price responsiveness) in the residential sector tends to be around -0.4 to -0.6 but it depends on local conditions
- If customers are metered then pursuing conservation through pricing does not create any additional monitoring challenges.

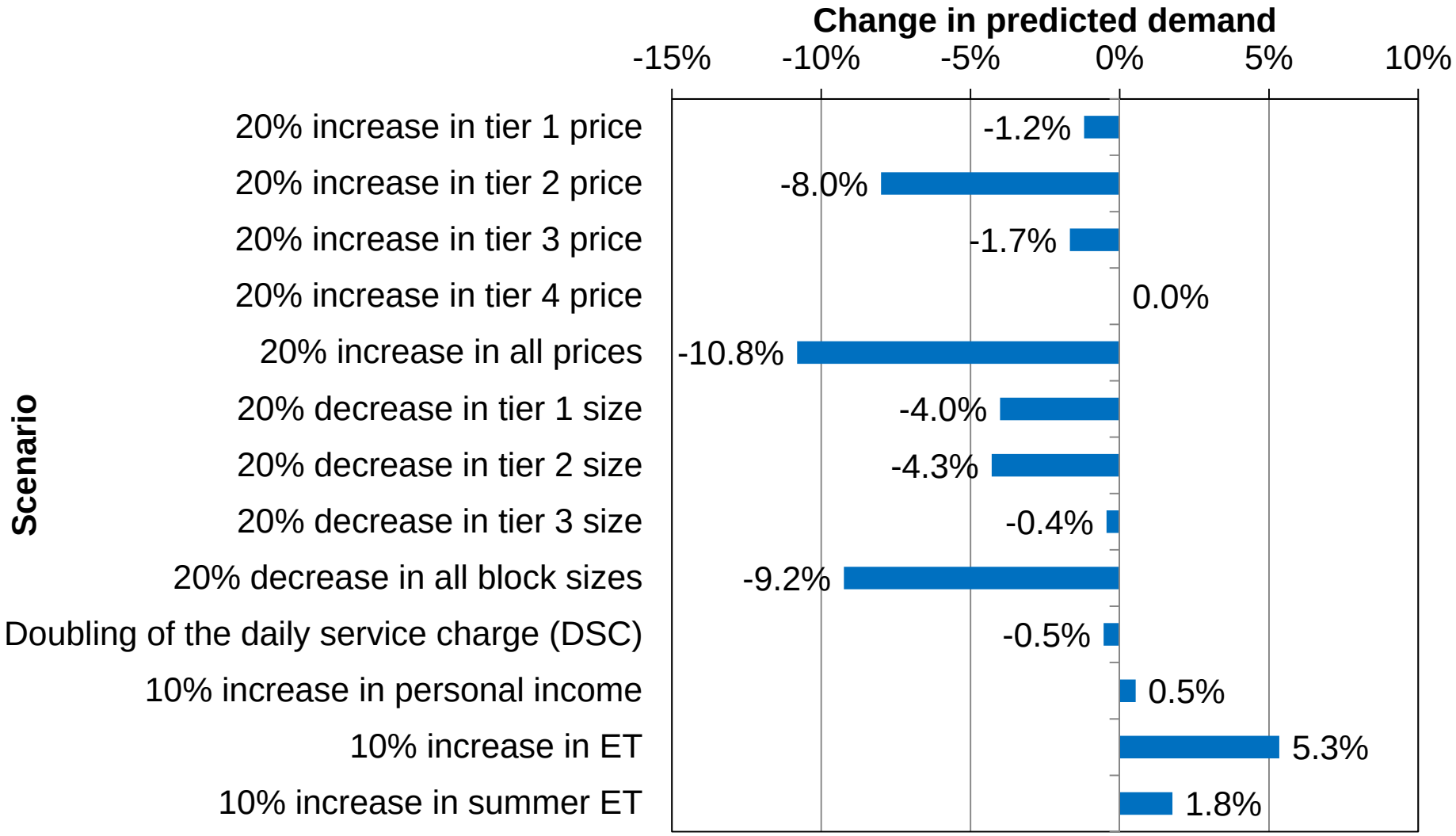
UCR study of Eastern's allocation-based rates







UCR study of Eastern's allocation-based rates



Pricing is not without inherent drawbacks

- Increased costs are particularly challenging for disadvantaged households and local businesses
- Higher prices hurt customer perceptions and strain customer relationships

Solution: Couple pricing with conservation rebate programs

- Rebate programs make it easier for customers to reduce water use and exposure to high water bills
- Conservation programs are an important complement to pricing

Conservation programs have unpredictable results

Observation: Savings are highly variable and usually less than expected

Examples: Low flow showerheads, low-flush toilets, front load washers,… (Mayer et al. 1998; Olmstead & Stavins 2007; Schwabe et al. 2014)

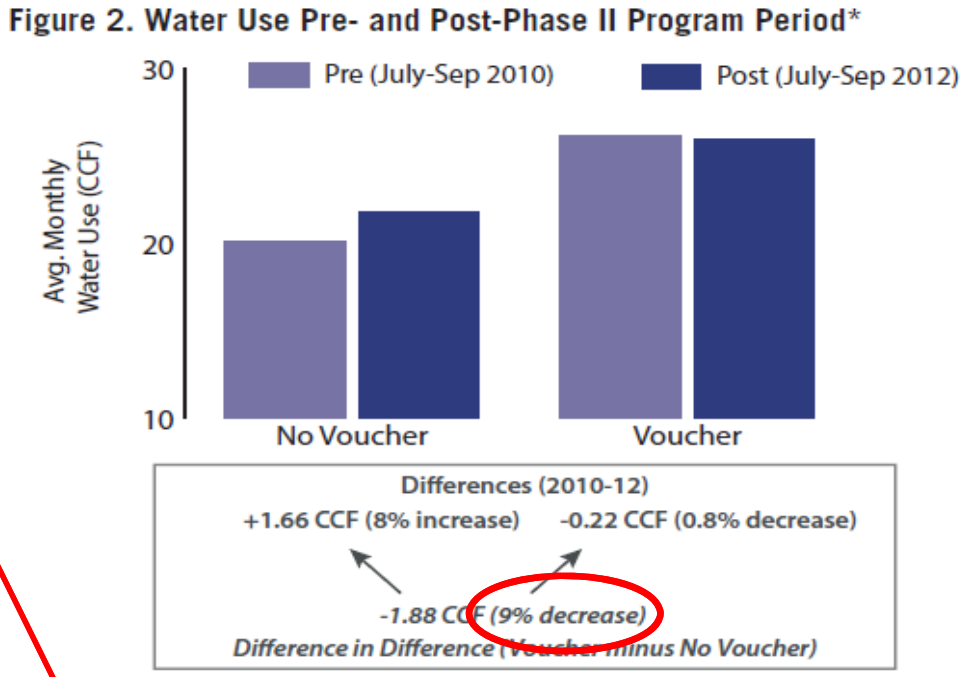
Reasons:

- Behavioral response to incentives is hard to predict
- Engineering calculations typically do not consider behavior

Consequences:

- Rebates fail to produce high participation rates
- Customers do not use technologies as anticipated
- Cost per unit of water saved is higher than expected

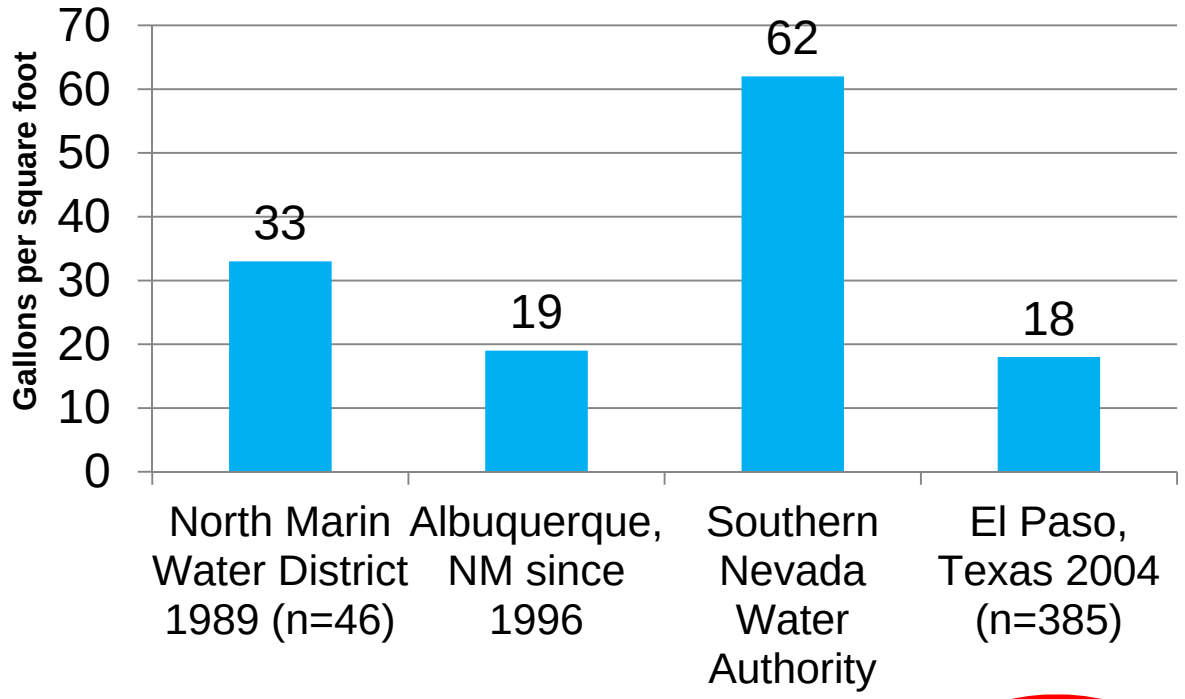
UCR study of high-efficiency sprinkler nozzle program (study funded by Metropolitan)



1/3 of potential efficiency when installed

Recent study of turf removal programs

Estimated Water Savings and Costs
(Addink 2014)



Cost/AF:	***$512***	***$718***	***$532***	***$1834***

Did not require irrigation improvements

Pleading and Prohibiting

- Voluntary requests have relatively small effects
  - Atlanta case study (Ferraro et al. 2011; Bernedo et al. 2014)
    - Technical advice suggesting ways to reduce water use: no reduction
    - Technical advice with a request signed by the GM: 2.7% reduction
  - EMWD study: uniform rates
    - Requests for short-term voluntary conservation have a 5% effect in the month issued
- Mandatory restrictions can be very effective *if enforced!*
  - Enforcement is costly
  - Behavior is slippery
  - Restrictions are inefficient and thus costly to households
    - Estimated cost of 2-day-per-week irrigation restrictions relative to a price-based approach: ~25% of a household's average water bill (Mansur and Olmstead 2007).

Pressuring and Plastering

- Pressuring (i.e. social norm messaging) is relatively new
  - Atlanta case study (Ferraro et al. 2011; Bernedo et al. 2014)
    - Technical advice, GM letter, social norm comparison: 4.8% reduction
  - EBMUD case study (Mitchell and Chestnutt 2013)
    - WaterSmart Home Water Reports: 5.6% reduction
- Plastering (i.e. information and education)
  - Billing frequency: no detectable effect (Olmstead and Stavins 2007)
  - Conservation messaging (Janmaat 2012, *working paper*)
    - Message source variety increases conservation effort
    - Knowledge of water issues *does not!*

Main messages

- A demand-side management strategy should be built around a robust rate structure
- Conservation programs work well as complements to a rate structure
- Try to avoid mandatory restrictions
- Messaging may function more like advertising than education; and peer pressure appears to be cheap but effective
- Understanding your customers, targeting your policies, and continually evaluating your strategies will improve effectiveness.

Thank you!