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TECHNICAL REPORT

# Estimating the Value of Water-Use Efficiency in the Intermountain West

David G. Groves, James Griffin, Sara Hajiamiri

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1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665
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# Summary

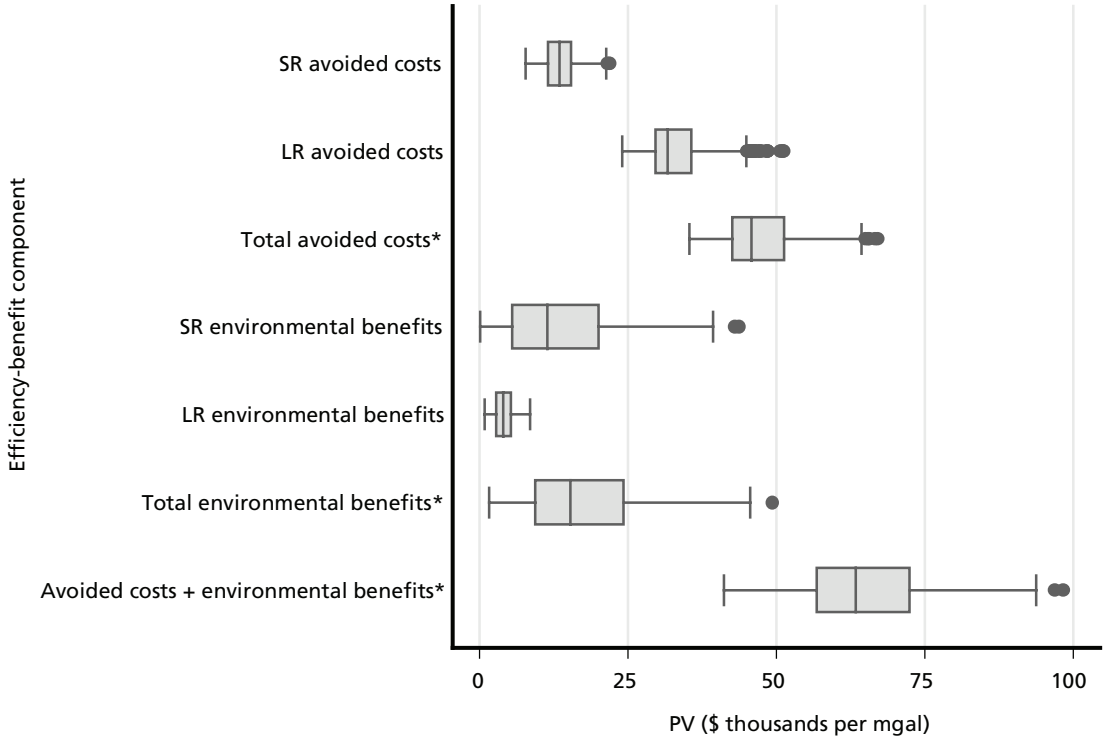
Increasing water-use efficiency is an important management strategy for western water agencies. Evaluating the cost effectiveness of water-efficiency programs relative to supply-enhancement measures can be difficult, however, because not all the benefits of improved efficiency are easily quantified. Tangible, future benefits, such as avoided costs, not only depend on the details of complex management systems, but can also be strongly influenced by future uncertainties that are difficult to characterize. Other nontangible benefits, such as supply reliability and avoided environmental impacts, are difficult to quantify due to a lack of standardized methodologies; poor data availability; and multiple, competing values over outcomes. Without good estimates of efficiency-program cost effectiveness, it may be difficult to identify appropriate efficiency programs for implementation.

This report utilizes two recently released tools by the California Urban Water Conservation Council—the avoided-cost model (AC model) and the environmental-benefit model (EB model)—to estimate the benefits of water use–efficiency programs in the Denver Water service area. The AC model is customized to reflect the short-run (SR) and long-run (LR) incremental benefits of water-use reduction on Denver Water's three water-collection systems—the South Platte River, the Roberts Tunnel system, and the Moffat system. We then use the methodological approach developed for the EB model to estimate the benefits of water-use efficiency to the environmental and recreational services. Specifically, we evaluate benefits to riparian and wetland habitat, air quality, recreational river fishing, and recreational river rafting. Together, the estimated avoided costs and environmental benefits comprise a more complete representation of the value of efficiency than water agencies often use, by comparing efficiency to other water supply–enhancing options.

The methodologies employed require significant simplifications of the water systems under evaluation and the use of uncertain estimates of the causal effects of water-use reduction and environmental and recreational benefits. To accommodate the significant uncertainties that result, we opt not to develop a single "best-guess" or likeliest estimate of the value of efficiency. Instead, we take an exploratory modeling approach and evaluate the models under a wide range of plausible assumptions. The results are ranges of possible efficiency benefits. We demonstrate that, even with a wide range of results, the true value of efficiency is significantly larger than one would estimate if only considering SR avoided costs.

Our principal findings are summarized by Figure S.1, which shows ranges of efficiency valuation results as more benefits are accounted for. Each box-and-stem result in the figure represents the present value (PV) of 1 million gallons of efficiency savings per year. The results are derived from 1,000 runs of the models under a wide range of assumptions.

**Figure S.1**
**Present Value of Short-Run, Long-Run, and Total Avoided Costs; Short-Run, Long-Run, and Total Environmental and Recreational Benefits; and the Sum of the Total Avoided Costs and the Total Environmental and Recreational Benefits**




NOTE: Asterisks indicate summation estimates. Each box represents the results of 1,000 model runs and shows the lower quartile (left edge), upper quartile (right edge), and median (inner line) of the results. The dots and stems depict the remaining range of the results.

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For example, considering only the SR avoided costs to Denver Water due to efficiency suggests savings of between $8,000 per mgal and $13,000 per mgal (top box). Adding the LR avoided costs increases the estimate to between $25,000 per mgal and $50,000 per mgal (third box from the top). The value of environmental and recreational benefits adds up to another $50,000 per mgal of benefit (sixth box from the top). After including all avoided costs and environmental and recreational benefits, the estimates suggest a range of marginal benefits between about $41,000 per mgal and just about $100,000 per mgal (bottom box). Although the range of this estimate is quite large, the lower bound of the range ($41,000 per mgal) is about double that of the upper range of the SR avoided costs ($22,000 per mgal). This suggests that, if an agency were to consider only the SR avoided costs, they could be undervaluing efficiency by 50 percent or more. These benefits are even larger if the efficiency induced by a specific program occurs primarily during the summer months—when demand is greatest.

We next compared these efficiency valuations to the economic characteristics of a set of efficiency programs proposed by Denver Water to help meet its 10-year conservation goals. We find that evaluating only the SR avoided costs leads to the conclusion that many water-efficiency projects that are already a part of Denver Water's 10-year conservation plan are not cost-effective. When LR avoided costs and efficiency and recreational benefits are estimated

and added to the marginal-benefit calculation, an additional five programs are cost-effective. All but two Denver Water programs were estimated to be cost-effective using this efficiency valuation. Finally, we find that it is critical to consider the timing of projected water savings from efficiency programs. Water savings from programs that concentrate savings during summer months, when water is scarcer, should be valued more highly than savings from programs that lead to more uniform water savings throughout the year.