Smart Savings Water Conservation

Measures that Make ¢ents

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Executive Summary

Water planners across the western United States are faced with the continuous risk of drought, complications involved in seeking new water supply projects, the high cost of such projects, and fierce competition for decreasing supplies.

As a result, many utilities are changing their approach to water planning by utilizing demand management programs that can postpone or avoid large, costly development projects. Demand management programs have proven to be an effective way for water utilities to manage challenges and ensure their ability to provide for their customers.

A well-implemented demand management program can prolong existing water supplies for water utilities. To achieve optimal effectiveness, utilities need to implement a variety of conservation measures that target various areas of potential savings. Programs should target indoor and outdoor savings from residential customers as well as commercial, industrial, and institutional accounts.

This report provides water utility managers and the public with information that can be utilized to gauge the likely effectiveness of water conservation measures, including the diversity of water conservation measures available, the variety of programs to encourage customers to save water, the water savings that have been achieved, and utility program costs. Each conservation measure represented differs with respect to the number of participants, the water savings achieved, and the utility costs, but all reveal effective ways of reducing water demand.

We gathered information from various utilities across the western United States, in addition to Sydney, Australia, to highlight the cost per acre-feet (AF) of water saved throughout the life span of numerous conservation measures. Table 1 summarizes what we found.

The installation of low-water use devices offers a great potential for water savings at a low cost. A one-time investment will yield water savings for the lifetime of the device. We found that a residential high-efficiency clothes washer often saves over 111,500 lifetime gallons, or 8,500 gallons annually, per retrofit, and a commercial high-efficiency clothes washer can save over 491,400 lifetime gallons, or 37,800 gallons

Table 1. Effectiveness of Conservation Measures for Water Utilities

Utility	Conservation Measure and Program Type	Estimated Life Span (in years)	Utility Cost per Lifetime AF Saved
Austin Water Utility	Toilet retrofit	25	$75
Albuquerque Bernalillo County Water Utility Authority	Toilet rebates	25	$81
Jordan Valley Water Conservancy District	Residential ultra-low-flush toilet replacement	25	$168
Aurora Water	Toilet and clothes washer rebates	20.5	$232
Albuquerque Bernalillo County Water Utility Authority	Industrial, commercial, and institutional audit	10	$42
Santa Clara Valley Water District	Water-Efficient Technologies rebate program	5	$144
Colorado Springs Utilities	Increasing block rate structure	5	$190
Colorado Springs Utilities	Commercial landscape code	25	$5128
Southern Nevada Water Authority	Water Smart Landscapes rebates program	10	$575
Southern Nevada Water Authority	Pool cover rebates	3	$419
Sydney Water	Residential WaterFix program	20	$88
Irvine Ranch Water District	Residential and commercial conservation programs[1]	10	$577

[1]Irvine Ranch Water District's residential conservation program includes three conservation measures and the commercial conservation program includes six conservation measures. See Table 9 for the effectiveness of each individual measure.

annually, per washer. Installation of a single low-flow toilet can save 325,000 gallons over the lifetime of the toilet, or roughly 13,000 gallons per year.

An industrial, commercial, and institutional (ICI) water audit will assess how much water is being used and where opportunities lie for conservation. Upwards of 305,000 gallons per year can be saved from one ICI audit for a total of three million gallons over the lifetime of the retrofitted devices.

Conservation-oriented rate structures can also efficiently extend water supplies. Increasing block rate structures increase the unit price for water as consumption increases, thereby rewarding low-water use with lower monthly rates and encouraging conservation. An increasing block rate structure can reduce water use by 35 million gallons per year, or 175 million gallons over a five-year span.

There is also a strong economic benefit for water customers to utilize water conservation measures and incentives. Some entities will see millions of dollars saved as a result of large-scale fixture replacement programs. Table 2 provides examples of the effectiveness of conservation measures for large entities.

Table 2. Effectiveness of Conservation Measures for Customers

Customer	Conservation Measure	Estimated Life Span (in years)	Customer Savings Over Device Lifetime	Payback Period (in years)
Colorado State University	Water saving-devices on 42 autoclaves	10	$510,000	1.4
University of Washington	Toilet replacement	25	$11,900,000	1.21

Colorado State University saves 360,000 gallons per year per autoclave retrofit and over $1,400 in annual avoided water and sewer costs for each autoclave retrofit. Over the lifetime of each individual water-saving device, Colorado State University will save 3.6 million gallons and $14,000 in avoided costs.

The University of Washington undertook a large-scale toilet replacement program that saves over 27,000 gallons per toilet annually and over $300 per toilet in annual avoided water and sewer costs. Over the lifetime of each retrofitted toilet, the University of Washington will save 675,000 gallons per toilet and over $7,500 on avoided water and sewer costs per toilet.

Conservation is an effective way to extend water supplies. Although an increasing number of utilities are implementing demand management programs, our research found that more data is needed on the effectiveness of individual conservation measures. Many utilities do not track water savings, costs incurred, or level of penetration of their conservation measures. Tracking these elements is a crucial part of demand management programs. Without this data, the true effectiveness cannot be determined and optimal water savings may not be reached.

It is our hope that the information in this report will be used as guidance for customers implementing a conservation measure and utilities deciding to implement a demand management program. We also hope that utilities and customers that have done so will be encouraged to share their findings.

Introduction

Water scarcity has shaped the western United States since it was first settled. In the early years of western settlements, cities and towns formed along rivers and streams that provided an adequate year-round water supply. As settlements throughout the West continued to grow, a strain on water supplies began to impact the availability of water. In an effort to provide a consistent flow of water year-round, communities began to undertake large water development projects to meet increasing demands.

The tough competition to obtain new water resources for growing populations, coupled with the regulatory and legal complexities of developing new supplies, has caused a shift in how westerners utilize their water supply. Instead of pursuing difficult and financially straining supply projects, an increasing number of water utilities are using demand management as a tool to expand use of existing water resources.

Implementing Demand Management Programs

Effective demand management programs can reduce water consumption and improve quality of life. Implementing an effective demand management strategy requires leadership, political will, an understanding of demand-side efficiency technologies, commitment to a sustainable water supply, and the foresight to see the benefits of a strategic, innovative, and comprehensive policy.

Just as utilities diversify their supply portfolio, they must also diversify their demand management programs. Conservation measures and incentives should be prioritized based on the estimated effectiveness in each community. The best way to achieve desired water savings through conservation is to implement a variety of measures and incentives that target different areas of potential savings.

Types of measures and incentives that should be examined are:

- *A conservation-oriented rate structure,* such as an increasing block rate, in addition to monthly billing that gives customers the up-to-date information necessary to change use patterns, if necessary
- *Water use/water waste and landscape ordinances* to promote water savings
- *Residential rebates* that encourage water conservation:
  - » *Indoors:* Low-flow toilets (1.6 gallons per flush, or GPF), high-efficiency toilets (average of 1.28 GPF), low-flow faucets (1.5 gallons per minute, or GPM), low-flow showerheads (2.5 GPM), high-efficiency clothes washers, high-efficiency dish washers
  - » *Outdoors:* Evapotranspiration (ET) controllers, rain sensors, soil amendments, turf replacement, drip irrigation systems, irrigation system audits
- *Commercial rebates* that encourage water conservation:
  - » *Indoors:* Low-flow toilets, high-efficiency toilets, waterless urinals, high-efficiency washing machines, autoclave/ sterilizer condensate kits, car wash equipment, cooling tower conductivity control equipment, recirculating cooling systems
  - » *Outdoors:* ET controllers, rain sensors, soil amendments, turf replacement, drip irrigation systems, irrigation system audits
- *Water conservation education programs,* including informational websites, school programs, and marketing campaigns, in addition to Xeriscape™ demonstration gardens, classes, and resources

Goals/Targets

Setting precise goals for water use reduction is an essential tool of demand management programs. By setting a specific target for water use reduction to be met within an exact timeframe, utilities have a concrete objective to work towards. Tailoring a demand management program towards this objective will help utilities to achieve the greatest potential water savings.

Evaluation of Conservation Measures

Measures within demand management programs should be assessed regularly to allow the utility to gauge the effectiveness of measures. Water conservation technology is as dynamic as other technology fields, constantly improving savings potentials and reducing costs. Periodic information is valuable because it allows the utility to focus limited resources on the most effective measures to ensure that financial resources are being used efficiently.

To successfully evaluate conservation measures, utilities should track the water savings attributed to each measure, the number of participants, and the money spent on incentives and staff time during the duration. Measures that do not meet their desired effectiveness should be altered to increase success.

Effectiveness of Conservation Measures for Water Utilities

The following case studies highlight the effectiveness of various water conservation measures that have been implemented by water utilities. Each program is different from the others in terms of the program design, time period examined, water savings achieved, and cost of implementation. Each has reached a level of effectiveness that underscores the benefit of implementing such programs.

For each case study in this report, the water savings noted were achieved during a specific time period. Some cities attempted to gauge the exact amount of water saved through data collection before and after implementation of conservation measures; other cities estimated water savings using end-use studies and product water-use estimates.

Each case study notes the cost to the utility and/or customer to implement the measures. When possible, the costs are broken down into implementation costs, rebate incentive costs, and staff time costs to administer the programs. All costs are in nominal dollars. For utilities that did not have an estimate of the cost of staff time to administer conservation programs, Western Resource Advocates (WRA) calculated an estimate in an effort to better portray all of the costs typically involved in implementing conservation measures. This estimate was determined by averaging staff time costs per rebate or replacement for Jordan Valley Water Conservancy District ($11.86 per toilet replaced)[2], Aurora Water ($9.65 per rebate)[3], and Denver Water ($6 per rebate)[4]. The average of $9.17 was used to estimate the cost of staff time per rebate.

WRA used the program costs incurred by the utility and the cumulative water saved over the lifetime of the water-saving device to calculate the utility cost per AF of water saved as a result of these measures. Water savings include point of consumption and do not take into account the savings from increased leak detection and decreased evaporation.

[2]Paula Mohadjer, Jordan Valley Water Conservancy District, *Residential Ultra-Low-Flush Toilet Replacement Program*, July 2003. Based on 275 toilets replaced.

[3]Aurora Water document provided by Kevin Reidy of Aurora Water to Western Resource Advocates, *Toilet & Washing Machine Analysis 2002-2006*. Based on 7,209 toilet and washing machine rebates given.

[4]Phone conversation with Greg Fisher of Denver Water, November 6, 2007. Based on 6,800 rebates given for various Denver Water rebate programs, including staff overhead.

Austin, TX

The city of Austin conducted an analysis of its multifamily housing toilet retrofit program in 2001. To determine effectiveness, the city chose 45 multifamily complexes built prior to the 1991 efficient plumbing standards set forth in state statute to retrofit and compare metered water use before and after toilet replacement.[5] The complexes had a total of 2,902 apartments housing 5,893 residents with 3,463 toilets that were retrofitted with 1.6-GPF water-efficient toilets. Each unit that completed a toilet retrofit also installed one 2-GPM showerhead, a 1.5-GPM faucet aerator, and a 2.2-GPM kitchen aerator.[6]

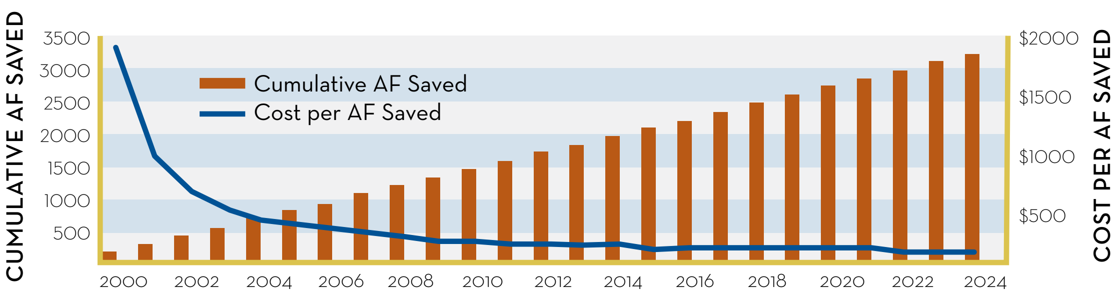
Water Savings

Indoor water use in all 45 complexes totaled 170.6 million gallons (524 AF) one year prior to the retrofits, an average of 79.3 gallons per capita per day (GPCD) for indoor use. After a complete retrofit with water-efficient toilets, showerheads, and faucet aerators, the indoor water use totaled 128.09 million gallons (393 AF) for all 45 multifamily complexes, averaging 59.6 GPCD for the post-retrofit year. Overall, indoor water use was reduced by an average of 19.7 GPCD, or 25% from the previous year. This is an annual water savings of 42.5 million gallons (131 AF), or almost 3.5 million gallons a month.

Cost

The toilet retrofit program cost the city of Austin roughly $60 per replaced toilet, in addition to $2.39 for the cost of one showerhead and two aerators for each apartment.[7] At a total cost of $62.39 for each participating unit, the cost of all retrofitted devices during this study was approximately $214,716.[8] The value of staff time associated with the retrofits is estimated to be approximately $31,756, for an estimated total $246,472 spent by Austin for this toilet retrofit program analysis.[9]

Figure 1. Cost per Cumulative AF Saved due to Austin's Multifamily Housing Toilet Retrofit Program



Conclusion

Assuming a 25-year life span of the toilets, Austin's toilet retrofit program will cost the utility $75 per lifetime AF of water saved and will save over 1 billion cumulative gallons (3,275 AF).[10]

At the time of this study in 2001, the city determined that there were approximately 51,000 apartment units in Austin that were built before 1991 with roughly 72,000 toilets. An estimated 8,000 of these toilets had already been replaced with water-efficient toilets (including those in this study), leaving 64,000 to be replaced.

By 2007, the city of Austin replaced an additional 13,253 toilets in multifamily properties, 19,357 single-family toilets, and 3,709 commercial toilets.[5] As a result, an additional estimated 445.7 million gallons are saved each year.

In addition to the effectiveness for the water utility, Austin's toilet retrofit program is also extremely effective for participants. The showerheads and faucet aerators were free, and the toilets were either free or customers received a rebate of $60 towards the purchase of a toilet. Austin estimates $245,000 is collectively saved each year in water and wastewater charges by those who took part in the retrofit program in the year 2000.[12]

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[5] Texas Water Saving Performance Standards for Plumbing Fixtures Act of 1991.

[6] Jessica E. Woods, Ximena Poch, and H.W. Hoffman, *Documenting Significant Water Savings in Apartments in Austin, Texas* (Denver: American Water Works Association, 2001).

[7] Each customer had a choice to receive a free toilet for retrofit or a toilet rebate. The toilets that Austin purchased under contract for its free toilet program cost $60 each and the rebate that Austin gave for toilets purchased by the customers was also $60 each.

[8] Personal correspondence with Dan Strub of Austin Water, October 19, 2007.

[9] Staff time estimated by WRA.

[10] Amy Vickers, *Handbook of Water Use and Conservation* (Amherst, MA: WaterPlow Press, 2001) 43. Based on a 25 year life span of toilets.

[11] Personal correspondence with Dan Strub of Austin Water, October 24, 2007.

[12] City of Austin Water Conservation, "Apartment Water Savings Average 25 Percent," *ICI Water Conservation Newsletter 2* (February 2001) 1, http://cityofaustin.org/watercon/downloads/ici0201.pdf.

Albuquerque Bernalillo County Water Utility Authority Toilet Rebate Program

Albuquerque, NM

The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) completed an analysis of water savings resulting from low-flow toilet rebates issued from 1995 to 2002. Water savings were calculated for participants by comparing water use from the city's utility billing database one year prior to the rebate and one year after.[13]

At the time, the water utility offered a residential toilet rebate of $125 for the first rebate, $75 for the second rebate, and $50 for the third rebate. Nonresidential customers were offered a $90 rebate for each low-flow toilet installed.[14]

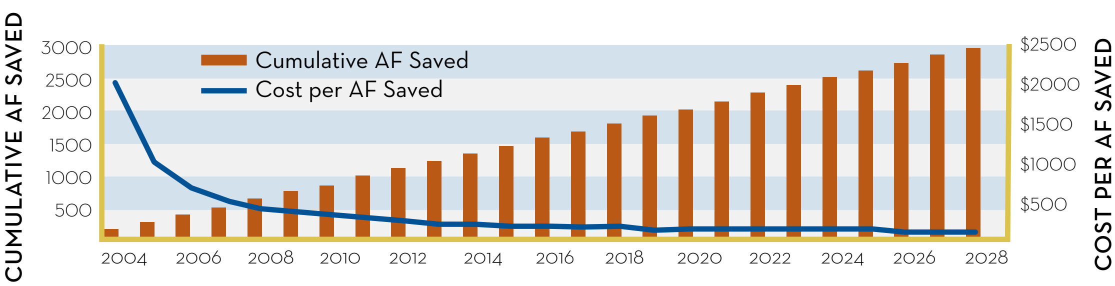
Water Savings

All 27,500 toilet rebates yielded a total water savings of over 371 million gallons (1,139 AF) during the first year following the installation of the low-flow toilets.[15] This is an annual savings from each toilet of approximately 13,475 gallons.

Cost

Albuquerque issued roughly 27,500 toilet rebates to customers from 1995 to 2002 for a total rebate cost of $2,056,835.[16] An additional estimated $252,175 was spent on staff time to administer ABCWUA's toilet rebate program from 1995 to 2002, for a grand total of $2,309,010 spent on rebates and staff time for the toilet rebate program during this period.[17]

Figure 2. Cost per Cumulative AF Saved due to ABCWUA's Toilet Rebate Program



Conclusion

Each toilet retrofitted will save 336,875 gallons throughout its lifetime. Assuming a 25-year life span of the toilets, the utility program cost per lifetime AF saved is $81.[18] In contrast, the San Juan-Chama drinking water project, which is expected to be completed in 2008, will divert water from the Rio Grande River at a total expected project cost of $350 million and $14 million per year in operation and maintenance costs.[19, 20] The project will bring the Albuquerque metropolitan area 48,200 AF of water per year, for a total annualized cost of $790 per AF.[21, 22]

[13] CH2MHill, "City of Albuquerque Rebate Program Review," draft technical memorandum, September 22, 2004.

[14] Christy Smith, CH2M Hill, "City of Albuquerque Water Conservation Rebate Program Savings Analysis," 2004.

[15] Ibid.

[16] Ibid.

[17] Staff time estimated by WRA.

[18] Amy Vickers, *Handbook of Water Use and Conservation* (Amherst, MA: WaterPlow Press, 2001) 43.

[19] Albuquerque Bernalillo County Water Utility Authority, "San-Juan Chama Drinking Water Project," http://www.sjcdrinkingwater.org/newsletters/jan06.htm (accessed September 14, 2007).

[20] Albuquerque Bernalillo County Water Utility Authority, "Water Resources: Strategy Overview," http://www.abcwua.org/waterresources/strategyoverview.html (accessed November 14, 2007).

[21] Albuquerque Bernalillo County Water Utility Authority, San-Juan Chama Drinking Water Project, http://www.sjcdrinkingwater.org/newsletters/jan06.htm (accessed September 14, 2007).

[22] Assuming a 30-year time horizon and 5.5% interest rate.

Jordan Valley Water Conservancy District Residential Ultra-Low-Flush Toilet Replacement Program

West Jordan, UT

In an effort to determine the effectiveness of its ultra-low-flush toilet (ULFT) replacement program, the Jordan Valley Water Conservancy District (JVWCD) completed a study that replaced 275 high-volume residential toilets (3.7 to 7 GPF) with 3 different models of ULFTs.[23] The water savings were determined by metering the water use per flush of each old toilet before replacement and each new ULFT after replacement, installing flush counting devices on 15% of the ULFT for monitoring, and comparing indoor water use records before and after the retrofit. Each household that took part in the study averaged 2.96 persons.[24]

Water Savings

Prior to replacement, the older toilets used an average of 4.16 GPF, ranging from 2.1 to 6.7 GPF. The new ULFT's water use range depended on the model: the Niagaras averaged 1.69 GPF, the Gerbers averaged 1.8 GPF, and the Caroma dual-flush toilets averaged 1.68 GPF for the large-volume flush and 0.88 GPF for the small-volume flush.

The study determined a savings of 42 gallons per household per day, or approximately 15,511 gallons per household per year, for a total annual savings of 4.3 million gallons (13.1 AF), achieved by replacing 275 old residential toilets with new ULFTs.

Figure 3. Flush Counter in a Caroma Dual-Flush Toilet[25]

Table 3. Total Cost of Jordan Valley Water Conservancy District's Toilet Replacement Program

	Cost
Toilet installation	$25,127
Purchase of 275 ULFTs	$25,046
Toilet-flush measuring equipment	$3,130
Mailing expenses	$1,207
Legal advertising	$2,728
Participant's cost of $20 per ULFT	($5,500)
JVWCD's staff time	$3,262
Total:	**$55,000**

This is an average cost of $200 per ULFT; however, JVWCD expects the effectiveness of toilet replacements in the future to increase since the expenditures of this toilet replacement program include costs that are specific to this project that will not be incurred by future retrofits, such as water metering equipment and installation of toilets. Without these expenses, the average cost per ULFT replaced as part of JVWCD's toilet replacement program will be approximately $97. Figure 4 shows the cost per cumulative AF saved with the costs specific to this project.

Cost

The Jordan Valley Conservancy District paid all costs associated with this toilet replacement program, except for a one-time $20 fee charged to the study participants. The costs incurred by the Jordan Valley Water Conservancy District for this toilet replacement program include:

This is an average cost of $200 per ULFT; however, JVWCD expects the effectiveness of toilet replacements in the future to increase since the expenditures of this toilet replacement program include costs that are specific to this project that will not be incurred by future retrofits, such as water metering equipment and installation

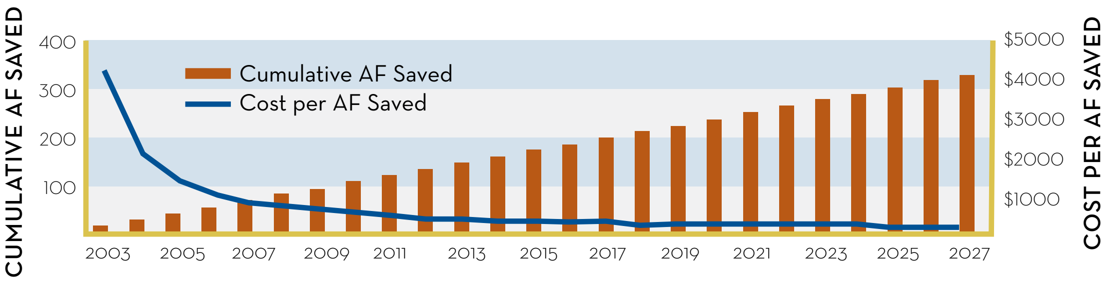
[23] JVWCD defines an ultra-low-flow toilet as one using 1.6 GPF or less.

[24] Paula Mohadjer, Jordan Valley Water Conservancy District, "Residential Ultra-Low-Flush Toilet Replacement Program," July 2003.

[25] Ibid.

of toilets. Without these expenses, the average cost per ULFT replaced as part of JVWCD's toilet replacement program will be approximately $97. Figure 4 shows the cost per cumulative AF saved with the costs specific to this project.

Figure 4. Cost per Cumulative AF Saved due to Jordan Valley Water Conservancy District's Toilet Replacement Program



Conclusion

Assuming a 25-year life span of the retrofitted toilets,[26] the 275 ULFT toilets will cumulatively save 341 AF at a utility program cost of $168 per lifetime AF saved.[27] This includes costs specific to this project that will not be incurred in future programs, such as toilet installation and water metering. Each toilet will save over 404,000 gallons during its life span. JVWCD will also avoid $14,230 in treatment costs due to the 341 AF saved.[28]

In comparison, the proposed Bear River Development Project is estimated to cost approximately $70 million for the construction of the facilities needed to divert flows from the Bear River to Willard Bay and roughly $350 million for the treatment facilities and distribution system to deliver roughly 75,000 AF water from Willard Bay for JVWCD and Weber Basin Water Conservancy District. Developing Bear River water will cost $5,600 per AF.[29]

[26]Amy Vickers, *Handbook of Water Use and Conservation* (Amherst, MA: WaterPlow Press, 2001) 43.

[27]JVWCD calculates $313 per AF, assuming a 20-year life span of the new ULFT, a water savings of 42 gallons per day, and 4% interest.

[28]Jordan Valley Water Conservancy District, *2006-2007 Summary of Operations*, page 26, http://www.jvwcd.org/Display.aspx?fid=5289&fname=Summary_06-07.pdf. Based on the average treatment cost per AF of $41.73.

[29]Utah Rivers Council, *Alternatives to Developing Bear River Water*, August 2006, page 31, http://www.utahrivers.org/images/stories/docs-pdfs/bearriver/alternativesanalysis_sep06.PDF. This is the cost to develop Bear River water, not the cost of the water on an annual basis.

Aurora Water Toilet and Clothes Washer Rebate Program

Aurora, CO

Aurora Water's low-flow toilet rebate program and high-efficiency clothes washer rebate program gave a total of 7,209 rebates from 2002 to 2006. The costs associated with each program are tracked as one; therefore, the costs are examined together below.

Toilets

Aurora Water currently offers single-family residential customers a $100 credit for the purchase of a low-flow toilet that uses 1.6 GPF and a $150 credit for a high-efficiency toilet that uses 1.28 GPF. Apartment property owners/managers and large commercial properties can receive a rebate of the cost of a new low-flow toilet up to $100 per toilet with a maximum rebate of $10,000 per property.[30]

Washing Machines

Aurora Water customers are currently eligible for a $125 rebate when they purchase a high-efficiency clothes washer.[31]

Water Savings

From 2002 to 2006, 418 AF were cumulatively saved from toilet rebates and 82 AF were cumulatively saved from washing machine rebates, for a cumulative total of 500 AF during that time. On average, each retrofit saves 8,461 gallons each year.[32]

Cost

Aurora issued 4,521 toilet rebates and 2,688 washing machine rebates from 2002-2006. The city spent approximately $819,316 on rebate incentives for both programs, in addition to $69,540 on salaries related to the toilet and clothes washer programs, for a total of $888,856. The average cost to the utility per toilet and washing machine replaced was $123.[33]

Table 4. Total Number of Rebates and Total AF Saved due to Aurora Water's Toilet and Clothes Washer Rebate Program, 2002-2006

	Number of Toilet Rebates	AF Saved	Number of Washer Rebates	AF Saved	Total AF Saved
2002-2003	1,258	44.46	539	7.85	52.31
2004	1,483	50.17	343	4.99	55.16
2005	1,037	34.91	681	9.6	44.51
2006	743	20.14	1,125	16.38	36.52

Table 5. Toilet and Clothes Washer Rebate Program Costs

	Incentives Total	Salaries Total	Total Expended
2002-2003	$231,373	$19,320	$250,693
2004	$184,689	$18,300	$202,989
2005	$172,689	$11,720	$184,409
2006	$230,565	$20,200	$250,765

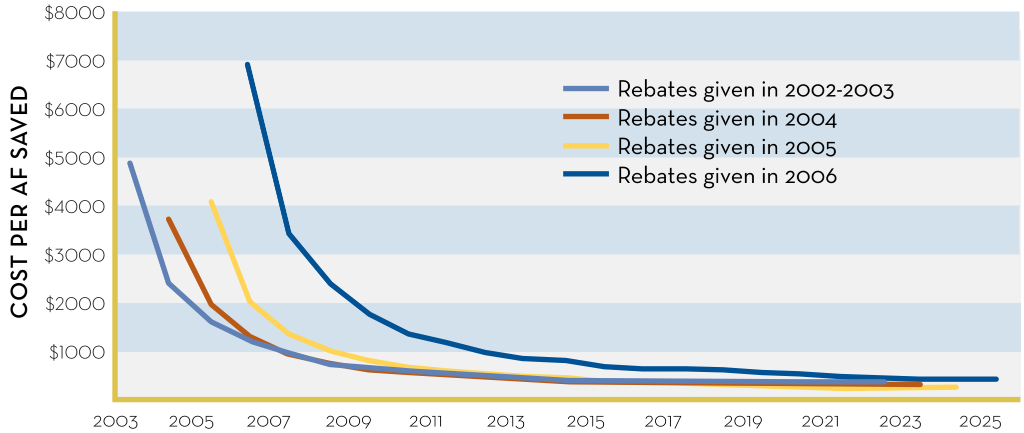
[30]Aurora Water, "Rebates," http://www.auroragov.org/AuroraGov/Departments/AuroraWater/Rebates/index.htm (accessed September 14, 2007).

[31]Ibid.

[32]Aurora Water document provided by Kevin Reidy of Aurora Water to Western Resource Advocates, *Toilet & Washing Machine Analysis 2002-2006.*

[33]Aurora Water document provided by Kevin Reidy of Aurora Water to Western Resource Advocates, *Toilet & Washing Machine Analysis 2002-2006.*

Figure 5. Cost per Cumulative AF Saved due to Aurora Water's Toilet and Clothes Washer Rebate Program, 2002-2006



Conclusion

Assuming a life of 25 years for toilets and 13 years for washers,[34] the weighted lifetime of the program measures is 20.5 years.[35] The utility program cost per lifetime AF saved is $232 per AF, and the lifetime savings for each rebate is 173,451 gallons (0.53 AF).

[34]Amy Vickers, *Handbook of Water Use and Conservation* (Amherst, MA: WaterPlow Press, 2001) 125. The lifetime of a toilet is expected to be between 25 and 50 years, while washing machines typically have a life span of 13 years.

[35]The weighted lifetime of the program measures was determined given that 63% of the rebates were for toilets with an estimated 25-year life span, and 37% of the rebates were for washing machines with an estimated 13-year life span.

Irvine, CA

To educate community members and promote the water conservation benefits of synthetic turf, the Irvine Ranch Water District (IRWD) partnered with four local municipalities to install synthetic turf in multiple locations across Orange County. The site chosen by the city of Irvine was 2,168 square feet; by Lake Forest, 1,746 square feet; by Newport Beach, 1,323 square feet; and by Tustin 2,600 square feet.[36]

Water Savings

For each synthetic turf installation site, three years of annual water use was averaged and then divided by the square footage of the area to determine the water use per square foot for one year before turf replacement.

Replacing 7,837 square feet of high-water-use grass with synthetic turf saves a total of 149,917 gallons (0.46 AF) per year. Each individual site achieves a cumulative acre-feet of water savings at a different rate: the Irvine site in 8 years, Lake Forest in 16 years, Tustin in 7 years, and Newport Beach in 10 years.

Table 6. Estimated Annual Water Savings for Turf Replacement Project

City	Synthetic Turf Area (sq. ft.)	Water Use per Square Foot per Year *(gallons)*	Estimated Annual Water Savings from Synthetic Turf *(gallons)*	Estimated Annual Water Savings from Synthetic Turf *(AF)*
Irvine	2,168	19.5	42,564	0.131
Lake Forest	1,746	12	20,904	0.064
Tustin	2,600	20.2	53,372	0.164
Newport Beach	1,323	24.7	33,077	0.102
Total	**7,837**		**149,917**	**0.461**

Figure 6. Transformation of City of Irvine Site

Before Synthetic Turf Installation

Synthetic Turf Rolled Out After Removal of Turfgrass

Site After Synthetic Turf Installation

Cost

Each of the cities involved in the turf replacement study agreed to contribute $1 per square foot towards the purchase and installation of the synthetic turf. IRWD contributed the rest of the installation costs, approximately $27,510 total.

The price of each installation includes the removal of old vegetation, capping the existing irrigation system, weed suppression, and laying the turf with infill to keep the blades upright (if needed). If synthetic turf were installed in the first place, replacement costs would be avoided.

[36]Irvine Ranch Water District, *Central Orange County Turf Replacement Project: Quarterly/Final Project Status Report for Irvine Ranch Water District and the Cities of Irvine, Lake Forest, Newport Beach and Tustin*, May 19, 2006.

Table 7. Synthetic Turf Installation Costs for Turf Replacement Project

City	Square Footage	Cost	Unit Price
Irvine	2,168	$12,683.00	$5.85
Lake Forest	1,746	$6,475.70	$3.71
Newport Beach	1,323	$6,246.22	$4.72
Tustin	2,600	$9,945.33	$3.83
	Totals	**$35,350.25**	**$4.51**

Conclusion

The cost per acre-foot of water saved as a result of the Central Orange County Turf Replacement Project varies with each site. The participating cities each had different types of synthetic turf, different filling requirements, and different drainage requirements.

Expenditures at both the Irvine and Newport Beach turf replacement sites totaled $0.30 per gallon of water saved, the Lake Forest site cost $0.31 per gallon, and the Tustin turf replacement totaled only $0.12 per gallon.

The benefits from the installation of artificial turf go beyond water savings. Each city will also see savings resulting from the end of mowing, irrigation system maintenance, weed and pest control, and fertilization. In addition, with no irrigation on the synthetic turf area and no need for harsh chemicals to kill pests, insects, and weeds, the hazardous runoff is also decreased.

Albuquerque Bernalillo County Water Utility Authority Industrial, Commercial, and Institutional Water Audit

Albuquerque, NM

The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) offers free water audits to industrial, commercial, and institutional (ICI) water customers. These audits identify opportunities for increasing water efficiency and implementing water conservation measures. ABCWUA sends an engineer to each ICI facility that has its request for an audit approved. The engineer assesses water use associated with cooling, processing, and irrigation, as well as potential changes to equipment, processes, and fixtures that could yield water savings.

The ABCWUA engineer also provides a water balance sheet that breaks down current water use at the site, potential water savings if the suggested conservation measures are implemented, an estimated cost of implementation, and the payback time if the conservation measures are utilized to each audit participator.

ABCWUA conducted an analysis to determine the effectiveness of its free ICI water audit program from 1999 to 2003.[38]

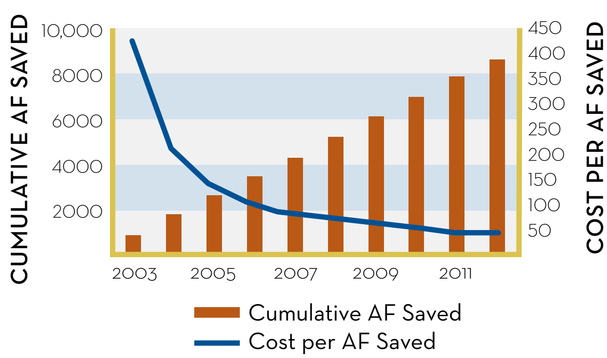
Water Savings

The ICI water audit program cumulatively saved 867 AF from 1999 to 2003.

Cost

ABCWUA spent approximately $360,000 on ICI water audits from 1999-2003. This includes a field visit by an ABCWUA engineer to evaluate onsite water use, a water use analysis conducted by the engineer to determine opportunities for water conservation, an audit report for each participant that summarizes the field visit results, and an audit follow-up by the engineer to assist with implementation of water conservation measures.

Figure 7. Cost per Cumulative AF Saved due to Albuquerque Bernalillo County Water Utility Authority's ICI Audit Program 1999-2003



Conclusion

Assuming the installed water-saving equipment has a life span of 10 years, the utility program cost over the device life span is $42 per cumulative AF saved. In comparison, the ABCWUA spends $6,000 on average to purchase an acre-foot of water and an average of $600 annually to lease an AF of water.[38]

[37]Christy L. Smith, *ICI Conservation Program Analysis – Effectiveness of ICI Audits* (Denver: American Water Works Association, 2006), http://www.awwa.org/waterwiser/references/pdfs/CII_INDOOR_Smith_C_ICI_Conservation_Program_Analysis.pdf.

[38]Christy L. Smith, *ICI Conservation Program Analysis – Effectiveness of ICI Audits* (Denver: American Water Works Association, 2006), http://www.awwa.org/waterwiser/references/pdfs/CII_INDOOR_Smith_C_ICI_Conservation_Program_Analysis.pdf.

Irvine, CA

The Irvine Ranch Water District (IRWD) offers various water conservation rebates through its residential and commercial rebate programs. Residential customers are eligible for a $250 rebate for high-efficiency clothes washers (18-25 gallons per load), a $180 rebate for high-efficiency toilets (1.28 GPF) and dual-flush toilets (0.8 GPF to 1.6 GPF), and $25 for ultra-low-flow toilets (1.6 GPF or less).[39]

IRWD's commercial rebate program offers a $1,000 rebate for cooling tower conductivity controllers that maintain cooling system efficiency and a $500 rebate for high-efficiency commercial clothes washers. IRWD also offers a $170 rebate for dual-flush toilets, a $120 rebate for high-efficiency toilets, $90 for ULF toilets, and $115 for waterless urinals.[40]

Water Savings

In the two-year period from July 1, 2005 to June 30, 2007, the IRWD distributed a total of 1,464 rebates under its commercial rebate program and 4,017 rebates under its residential rebate program. All of these rebates combined save a total 55.4 million gallons (170 AF) per year, or an estimated 645 million gallons (1,980 AF) over the lifetime of the devices. For this analysis, IRWD estimated the life span of the cooling tower conductivity controller to be five years, the commercial clothes washer to be eight years, the residential clothes washer to be 14 years, and the toilets and urinals to be 10 years.[41]

Table 8. Commercial and Residential Rebate Program Water Savings Summary, July 1, 2005 to June 30, 2007

Commercial Devices	Number of Devices Rebated	Annual Water Savings (AF)	Device Lifetime (years)	Total Lifetime Water Savings (AF)
Cooling tower conductivity controllers	11	4.93	5	24.63
Commercial clothes washers	24	2.78	8	22.30
Commercial dual-flush toilets	0	0.00	10	0.00
Waterless urinals	31	2.29	10	22.94
Commercial high-efficiency toilets	1057	53.91	10	539.07
Commercial ULF toilets	341	14.32	10	143.22
Total	**1,464**	**78.23**		**752.16**
Residential Devices				
Residential clothes washers	2940	76.44	14	1,076.62
Residential high-eff./dual-flush toilets	406	6.5	10	64.87
Residential ULF toilets	671	8.73	10	85.34
Total	**4,017**	**91.67**		**1,226.83**

Cost

During the two-year period from July 1, 2005 through June 30, 2007, IRWD spent $174,664 on rebate incentives for commercial devices and $759,549 on rebates for residential devices, for a total of $931,213. Cost of staff time is estimated to be $13,425 for commercial device rebates and $36,836 for residential device rebates, for a total of $50,260 spent on staff time to administer the rebate programs during this time.[42] Rebate incentives and staff time together cost a total of $981,474.[43]

[39]Irvine Ranch Water District, "Conservation Rebates," http://www.irwd.com/Conservation/rebates.php?a=res (accessed November 6, 2007). IRWD defines an ultra-low flow toilet as one using 1.6 GPF or less.

[40]Irvine Ranch Water District, "Commercial/Industrial/Institutional (CII) Rebates," http://www.irwd.com/Conservation/rebates.php?a=com (accessed November 6, 2007).

[41]Fiona Sanchez of IRWD, "Presentation to San Francisco P.U.C. Sustainable Water Supply Briefing," September 28, 2006, and IRWD conservation data received from Tim Schaadt of IRWD, October 25, 2007.

[42]Staff time estimated by WRA.

[43]Fiona Sanchez of IRWD, "Presentation to San Francisco P.U.C. Sustainable Water Supply Briefing," September 28, 2006, and IRWD conservation data received from Tim Schaadt of IRWD, October 25, 2007.

IRWD's rebate incentives are in addition to the commercial rebate program, "Save Water, Save a Buck," which is run by a vendor for Metropolitan Water District of Southern California (Metropolitan), a wholesaler that provides water to the Municipal Water District of Orange County (MWDOC), which in turn provides water to IRWD. On the residential side, MWDOC runs the rebate program for any agency in Orange County that wishes to participate. IRWD participates in both of these programs and

The Irvine Ranch Water District (IRWD) offers various water conservation rebates through its residential and commercial rebate programs. Residential customers are eligible for a $250 rebate for high-efficiency clothes washers (18-25 gallons per load), a $180 rebate for high-efficiency toilets (1.28 GPF) and dual-flush toilets (0.8 GPF to 1.6 GPF), and $25 for ultra-low-flow toilets (1.6 GPF or less).

IRWD's commercial rebate program offers a $1,000 rebate for cooling tower conductivity controllers that maintain cooling system efficiency and a $500 rebate for high-efficiency commercial clothes washers. IRWD also offers a $170 rebate for dual-flush toilets, a $120 rebate for high-efficiency toilets, $90 for ULF toilets, and $115 for waterless urinals.

Water Savings

In the two-year period from July 1, 2005 to June 30, 2007, the IRWD distributed a total of 1,464 rebates under its commercial rebate program and 4,017 rebates under its residential rebate program. All of these rebates combined save a total 55.4 million gallons (170 AF) per year, or an estimated 645 million gallons (1,980 AF) over the lifetime of the devices. For this analysis, IRWD estimated the life span of the cooling tower conductivity controller to be five years, the commercial clothes washer to be eight years, the residential clothes washer to be 14 years, and the toilets and urinals to be 10 years.

Cost

During the two-year period from July 1, 2005 through June 30, 2007, IRWD spent $174,664 on rebate incentives for commercial devices and $759,549 on rebates for residential devices, for a total of $931,213. Cost of staff time is estimated to be $13,425 for commercial device rebates and $36,836 for residential device rebates, for a total of $50,260 spent on staff time to administer the rebate programs during this time. Rebate incentives and staff time together cost a total of $981,474.

IRWD's rebate incentives are in addition to the commercial rebate program, "Save

Table 9. Commercial and Residential Rebate Program Cost Summary, July 1, 2005 to June 30, 2007

Commercial Devices	Number of Devices Rebated	Incentives Paid per Device	Total Incentives Paid	Estimated Cost of Staff Time
Cooling tower conductivity controllers	11	$1,000	$3,664	$101
Commercial clothes washers	24	$500	$12,000	$220
Commercial dual-flush toilets	0	$170	$0	$0
Waterless urinals	31	$115	$0*	$284
Commercial high-efficiency toilets	1,057	$120	$126,840	$9,693
Commercial ULF toilets	341	$90	$29,160	$3,127
Total	**1,464**		**$171,664**	**$13,425**
Residential Devices				
Residential clothes washers	2940	$250	$710,100	$26,960
Residential high-eff./dual-flush toilets	406	$180	$33,800	$3,723
Residential ULF toilets	671	$25	$15,649	$6,153
Total	**4,017**		**$759,549**	**$36,836**

**The wholesaler rebate from Metropolitan is greater than the cost of device; therefore, IRWD does not offer an additional incentive.*

Water, Save a Buck," which is run by a vendor for Metropolitan Water District of Southern California (Metropolitan), a wholesaler that provides water to the Municipal Water District of Orange County (MWDOC), which in turn provides water to IRWD. On the residential side, MWDOC runs the rebate program for any agency in Orange County that wishes to participate. IRWD participates in both of these programs and adds additional incentives on select devices.

Figure 8. Cost per Cumulative AF Saved due to Irvine Ranch Water District's Commercial and Residential Rebates Given, July 1, 2005 to June 30, 2007

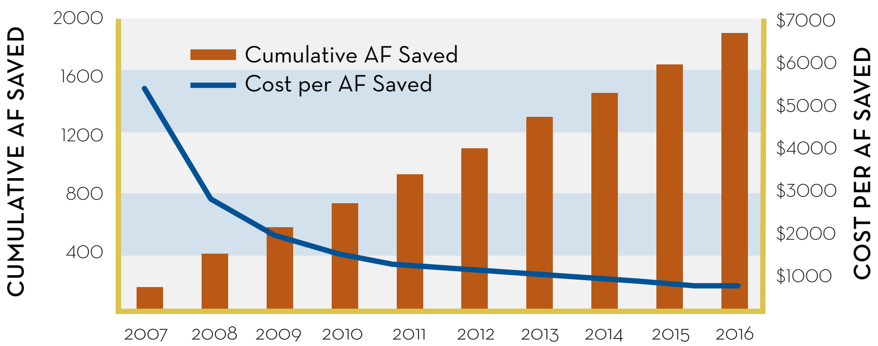


Table 10. Utility Cost per Lifetime AF Saved for Individual Measures

Devices Rebated from July 1, 2005 to June 30, 2007	Number of Devices Rebated	Device Life Span (years)	Total Lifetime Water Savings (AF)	Utility Cost per Lifetime AF Saved
Cooling tower controllers	11	5	24.63	$153
Commercial clothes washers	24	8	22.30	$548
Commercial dual-flush toilets	0	10	0.00	$0
Waterless urinals	31	10	22.94	$12
Commercial high-efficiency toilets	1,057	10	539.07	$253
Commercial ULF toilets	341	10	143.22	$225
Residential clothes washers	2,940	14	1,076.62	$685
Residential high-eff./dual-flush toilets	406	10	64.87	$578
Residential ULF toilets	671	10	85.34	$255

Conclusion

Assuming a 10-year life span of IRWD's commercial and residential conservation programs, the utility program cost is $577 per cumulative AF saved over the lifetime of the conservation programs.

The cost per AF saved during the life span of each individual conservation measure ranges from $153 per AF saved from cooling tower conductivity controller rebates (five-year expected life span) to $685 per AF saved from residential clothes washer rebates (14-year expected life span). Most experts assume at least twice the life span estimated by IRWD for toilets and urinals, resulting in even greater water savings and effectiveness.

In addition to the effectiveness for the water utility, installing these water-saving devices in homes or commercial properties is also effective for water customers. For example, high-efficiency clothes washers can save 6,000 gallons or more per year compared to older models.[44]

[44]Irvine Ranch Water District, "Conservation Rebates," http://www.irwd.com/Conservation/rebates.php?a=res (accessed November 6, 2007).

Santa Clara Valley Water District Water-Efficient Technologies Rebate Program

San Jose, CA

The Santa Clara Valley Water District's Water-Efficient Technologies (WET) program offers rebates to commercial, industrial, and institutional water customers for process, technology, and equipment retrofits that reduce business water usage. Instead of the rebate being based on the cost of the water-saving technology, the water district offers $4.00 per hundred cubic feet (CCF) of water saved annually, with a minimum annual water savings requirement of 100 CCF (74,800 gallons), or $400. The maximum rebate is $50,000 or 50% of project costs, whichever is less.[45]

The city of San Jose started the WET program in 1990 and the Santa Clara Valley Water District (SCVWD) began 50% cost-sharing in 1997. At the time, the program was available only to businesses located within the San Jose/Santa Clara Water Pollution Control Plant Tributary Zone; however, this was expanded to include the entire Santa Clara County in 2001.[46]

The SCVWD has funded $777,163 for 69 WET projects to date, saving approximately 1.759 billion gallons (5,398 AF) over the lifetime of the projects (assuming a five-year life span).[47] Including an estimated $633 spent on staff time to administer rebates, the total cost to the utility is $144 per AF of water saved over the lifetime.

Details on specific projects are below.

Recirculating Cooling System

Once-through cooling systems use water only once as it passes through a condenser to absorb heat and then discharge the water. In contrast, a recirculating cooling system recycles water, thereby reducing water needs. In an effort to use water more efficiently, a Santa Clara County school took advantage of SCVWD's Water-Efficient Technologies rebate program to convert a once-through cooling system to a recirculating system that reuses water to cool the building.[48]

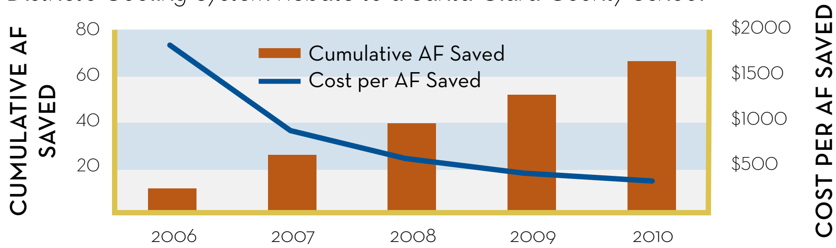
Water Savings

This project saves 4.3 million gallons (13 AF) of water per year.

Cost

The cooling system conversion project cost a total of $315,587. Through the WET rebate program, the school received a rebate of $22,996, reducing the cost to the school to $292,591.

Figure 9. *Cost per Cumulative AF Saved due to Santa Clara Valley Water District's Cooling System Rebate to a Santa Clara County School*



[45] Jeannine Larabee, *Implementation and Analysis of an Innovative Water Efficient Technologies Rebate Program*, (Denver: American Water Works Association, February 6, 2006), http://www.awwa.org/waterwiser/references/pdfs/PLAN_PROG_Larabee_J_Implementation_and_Analysis.pdf.

[46] Ibid.

[47] Santa Clara Valley Water District, *Water Use Efficiency Program Annual Report, Fiscal Year 2005-2006*, page 14, http://www.valleywater.org/media/pdf/WUE_AR_2005-2006_web.pdf.

[48] Jeannine Larabee, *Implementation and Analysis of an Innovative Water Efficient Technologies Rebate Program*, (Denver: American Water Works Association, February 6, 2006), http://www.awwa.org/waterwiser/references/pdfs/PLAN_PROG_Larabee_J_Implementation_and_Analysis.pdf.

Conclusion

Assuming a five-year life span of the once-through cooling system in the school, this project will cumulatively save 65 AF. Given that the Santa Clara Valley Water District paid a rebate of $22,996 to the school for the cooling system conversion, the program cost to the water utility is $354 per cumulative AF saved during the device lifetime.

Electrodialysis Reversal System

A Silicon Valley semiconductor manufacturing firm installed an electrodialysis reversal system that treats reverse osmosis reject water for use in air scrubbers and cooling towers. Electrodialysis reversal is a process that separates out ions and other charged particles from water and other fluids. The process pushes these particles through membranes made up of ion exchange material, which creates a separate concentrated stream that is rid of impurities.[49] This water, in return, can be reused in cooling towers and air scrubbers.[50]

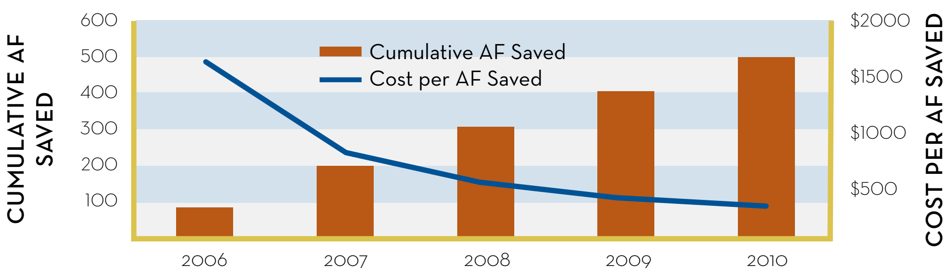
Water Savings

This entire project saves 34,123,012 gallons (105 AF) per year.

Cost

The total cost of $1,674,746 includes five separate projects in four buildings in the manufacturing firm. The company received a rebate of $169,592 for all five projects, bringing the company's total cost to $1,505,154.

Figure 10. Cost per Cumulative AF Saved due to Santa Clara Valley Water District's Electrodialysis Reversal System Rebate to a Semiconductor Manufacturing Firm



Conclusion

Assuming a five-year life span of the electrodialysis reversal system, this project will save 525 AF at a utility cost of $323 per cumulative AF saved.

[49]General Electric, "GE Water & Process Technologies: Electrodialysis Reversal (EDR)," http://www.gewater.com/products/equipment/ed_edr_edi/edr.jsp.

[50]Ibid.

Colorado Springs Utilities Residential Increasing Block Rate Structure

Colorado Springs, CO

Colorado Springs Utilities (CSU) adopted an increasing block rate structure in 2002 that promotes water conservation through price signals on customers' water bills. In addition to the pricing thresholds, customers are billed on a monthly basis so they are kept up to date on their water usage and can change their habits accordingly if their monthly bill is high.

All residential customers are charged a $5.70 fixed monthly service charge, in addition to the consumption rates listed below.[51]

Monthly Water Use (in gallons)	Rate per 1,000 Gallons
Up to 7,480	$2.15
7,480 to 18,700	$3.72
Over 18,700	$5.62

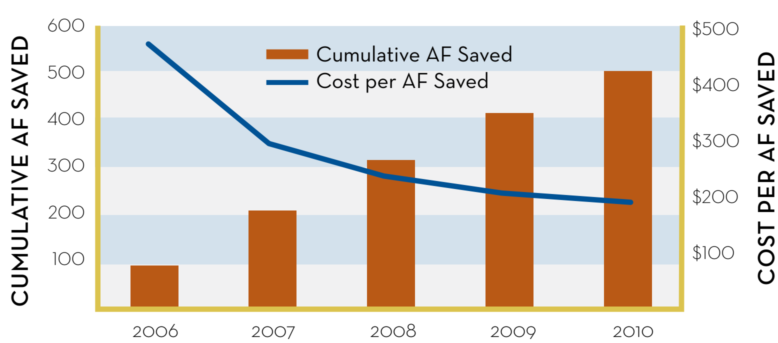
Water Savings

CSU's conservation-oriented rate structure has cumulatively saved 750 AF (244.4 million gallons) of water from 2001 through 2007; this is approximately 2,100 gallons per residential customer since the implementation.[52] Due to the difficulty involved in confirming actual water savings related to the implementation of water rate structures, the savings attributed to the increasing block rate was derived using a method set forth in William Maddaus's Evaluation of Water Conservation Programs (Maddaus Water Management 2003).[53]

Cost

Colorado Springs Utilities estimates that approximately $127,800 was spent from 2001 through 2007 to develop and implement the block rate structure.[54] Costs incurred are for staff time only and include roughly $18,500 spent on initial development of the rate structure, $18,500 to restructure, and $12,950 annually to analyze the rate structure to ensure revenue neutrality and conservation goals are met.[55] Due to the many changes that CSU made to the structure, the implementation of this increasing block rate structure required more staff time than if the utility had automatically implemented an increasing block rate structure without the multiple changes — and thus higher costs.

Figure 11. Cost per Cumulative AF Saved due to Residential Increasing Block Rate Structure of Colorado Springs Utilities



Conclusion

Colorado Springs Utilities cumulatively spent $127,800 on its residential increasing block rate structure to save 750 AF. Assuming a five-year period during which CSU's rate structure stands as is, or results only in further conservation, the utility program cost for CSU's residential increasing block rate structure will be $190 per cumulative AF saved.

[51]Colorado Springs Utilities, "Residential Rate Sheet," January 1, 2008. http://www.csu.org/customer/rates/rate_residential/1488.pdf (accessed January 18, 2008).

[52]Personal correspondence with Scott Winter of CSU, November 28, 2007.

[53]The method for estimating water savings is expressed as: water savings, GPD = number of accounts targeted x market penetration (%) x total program water savings. Determined using actual consumption and actual single-family residential accounts; actual savings not confirmed; customer cost assumption from DSS model.

[54]Personal correspondence with Scott Winter of CSU, November 28, 2007.

[55]Personal correspondence with Scott Winter of CSU, November 30, 2007.

Colorado Springs Utilities Commercial Landscape Code and Policy

Colorado Springs, CO

The city of Colorado Springs adopted a commercial landscape code and policy that promotes water efficiency and the use of Xeriscape design. In addition to slope standards, soil amendments, and water-efficient irrigation requirements, the policy requires that high-water-use turf may not cover more than 50% of the irrigable acreage of commercial properties.[56]

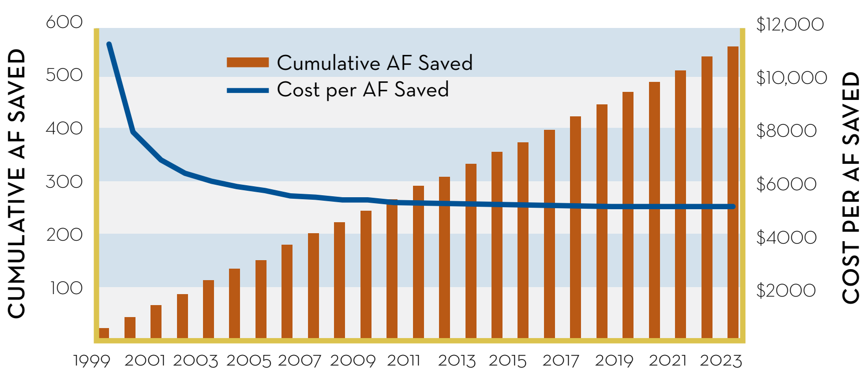
Water Savings

Water savings as a result of Colorado Springs' Commercial Landscape Code and Policy total an estimated 205 AF (66.8 million gallons) of water from 1999 to 2007. Roughly 1,650 customers have been subject to the new code, saving 40,500 gallons each.[57] Due to the difficulty involved in confirming actual water savings related to the implementation of policies and codes, the savings attributed to the Commercial Landscape Code was derived using a method set forth in William Maddaus's Evaluation of Water Conservation Programs (Maddaus Water Management 2003).[58]

Cost

Colorado Springs Utilities cumulatively spent $1.1 million on development and implementation of the Commercial Landscape Code and Policy from 1999 through 2007. Of this $1.1 million, approximately $148,000 was spent on development of the code, and $111,000 is spent annually.[59] These costs include labor for development and implementation, administration, and enforcement.[60]

Figure 12. Cost per Cumulative AF Saved due to Colorado Springs' Commercial Landscape Code and Policy, 1999–2024



Conclusion

The Commercial Landscape Code and Policy saves roughly 22.8 AF per year; it cost $148,000 to develop and costs $111,000 annually to operate. Assuming a 25-year period during which the code remains as is, or results only in further conservation, 570 AF will be saved cumulatively, and the utility program cost will be $5,128 per cumulative AF saved.

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[56] City of Colorado Springs, *Colorado Springs Landscape Code and Policy Manual*. http://www.springsgov.com/Page.asp?NavID=4068

[57] Personal correspondence with Scott Winter of CSU, November 28, 2007.

[58] The method for estimating water savings is expressed as: water savings, GPD = number of accounts targeted x market penetration (%) x total program water savings. Determined using actual consumption and actual single-family residential accounts; actual savings not confirmed; customer cost assumption from DSS model.

[59] Personal correspondence with Scott Winter of CSU, November 30, 2007.

[60] Personal correspondence with Scott Winter of CSU, November 28, 2007.

Las Vegas, NV

Landscape conversion provides a great opportunity for water conservation in the Las Vegas Valley. Based on a study by Southern Nevada Water Authority (SNWA), residents apply a yearly average of 73.0 gallons per square foot (117.2 inches) of water to turfgrass, compared to 17.2 gallons per square foot (27.6 inches) to xeric landscape areas.[61] This is 55.8 gallons per square foot that could be saved each year after the conversion of high-water-use turf to climate-appropriate plants and groundcover, a 74% decrease.

Water savings in the Las Vegas Valley from landscape rebates is largely due to high evapotranspiration (ET) rates from extreme summer temperatures and a very dry climate. As the rate at which plants lose water increases, more water is needed for plants to survive, thereby increasing the water demand across the Las Vegas Valley. The ET rate for Las Vegas Valley is approximately 74.8 inches per year.[62]

The Southern Nevada Water Authority's Water Smart Landscapes rebate program is designed to promote the conversion of seldom-used lawn areas into climate-appropriate, drought-tolerant landscaping. As a condition of SNWA's Water Smart Landscapes rebate program, participants are required to sustain the landscape conversion for at least 10 years. Within this 10-year period, the only way that landscape can be converted back to turf is by a change of ownership of the property.[63] This condition allows for at least a 10-year life span of the water smart landscapes.

SNWA finds that although new property owners are not obliged to follow the agreement if they purchase property that has received a Water Smart Landscapes rebate, new owners usually leave the landscape as is when purchased. In the rare instance that the landscape is converted upon change of ownership, typically only a portion of the xeric plants are affected.[64]

Since implementation of SNWA's Water Smart Landscapes rebate program in 2000, over 96 million square feet have been converted on 5,380 residential and commercial properties.[65]

Water Savings

The landscape conversion rebate program has cumulatively saved 18 billion gallons (55,327 AF) of water from 2000 through the end of November 2007. This savings equates to an average of 199,008 gallons (0.61 AF) saved per rebate participant per year. Each square foot of lawn replaced saves roughly 55.8 gallons annually.

Table 11. Water Savings Summary from Water Smart Landscapes Rebate Program

Year	Number of Rebates Given	Square Feet Converted	Annual Water Savings (in gallons)	Cumulative Water Savings[66] (in gallons)
2000	262	666,919	37,214,080	37,214,080
2001	490	2,300,887	128,389,495	202,817,655
2002	602	3,496,496	195,104,477	563,525,707
2003	2,379	11,866,960	662,176,368	1,586,410,127
2004	8,618	34,067,670	1,900,975,986	4,510,270,533
2005	5,735	15,386,836	858,585,449	8,292,716,388
2006	3,466	10,710,460	597,643,668	12,672,805,911
2007*	5,380	17,555,597	979,602,296	18,028,229,480
To Date	**26,932**	**96,051,825**		**18,028,229,480**

** 2007 figures are through November 30, 2007*

[61] Kent A. Sovocool, Southern Nevada Water Authority, *Xeriscape Conversion Study Final Report*, 2005, http://www.snwa.com/assets/pdf/xeri_study_final.pdf.

[62] ET rate provided to Western Resource Advocates as part of the 2006 Water Retailer Survey by Southern Nevada Water Authority, 2006.

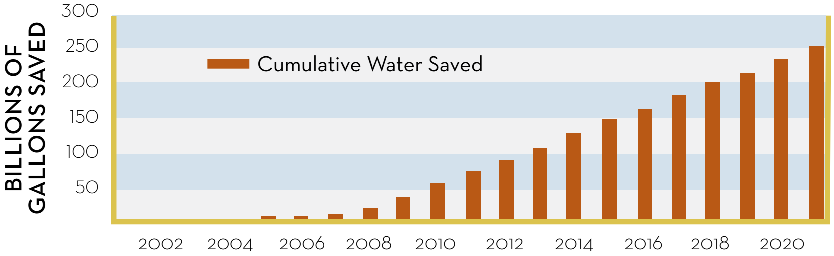
[63] Southern Nevada Water Authority, "Program Conditions – Water Smart Landscapes," http://www.snwa.com/html/cons_wsl_conditions.html (accessed November 7, 2007).

[64] Personal correspondence with Kent Sovocool of SNWA, November 13, 2007.

[65] SNWA cost-efficiency information obtained from Doug Bennett, conservation manager at SNWA, May 18, 2007, and from Kent Sovocool, senior conservation research analyst at SNWA, November 18 and December 19, 2007.

[66] Cumulative water savings were determined by adding the continual water savings year after year post-implementation.

Figure 13. Cumulative Water Saved due to Southern Nevada Water Authority's Water Smart Landscapes Rebates Given from January 2000 to November 30, 2007



Cost

From the program's inception in 2000 through the end of November 2007, SNWA spent roughly $89 million on incentives for landscape rebates. SNWA spent an estimated $19.4 million on staff time to administer the landscape rebates during this time, for a total cost of $108.4 million.[67] SNWA's incentive cost per square foot of lawn replaced has increased over time, as the rebate amount gradually climbed from $0.55 per square foot in 2000 to $2.00 per square foot, in order to maintain a consistent number of rebate participants. This "phase-in" strategy allows the utility to spend the least amount of money on rebates while achieving maximum water savings and reaching the desired number of customers.[68]

Figure 14. Cost per Cumulative AF Saved due to Southern Nevada Water Authority's Water Smart Landscapes Rebates, January 2000 to November 30, 2007

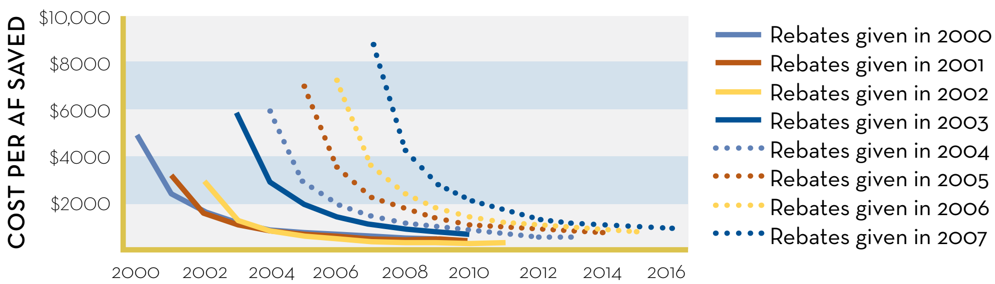


Table 12. Cost Summary of Water Smart Landscapes Rebate Program

Year	Number of Rebates Given	Square Feet Converted	Incentive Paid	Estimated Cost of Staff Time[69]
2000	262	666,919	$368,830	$188,902
2001	490	2,300,887	$894,314	$353,290
2002	602	3,496,496	$1,358,253	$434,042
2003	2,379	11,866,960	$10,284,527	$1,715,259
2004	8,618	34,067,670	$28,669,569	$6,213,578
2005	5,735	15,386,836	$14,236,924	$4,134,935
2006	3,466	10,710,460	$10,964,885	$2,500,000
2007*	5,380	17,555,597	$22,424,656	$3,878,980
To Date	**26,932**	**96,051,825**	**$89,201,958**	**$19,418,986**

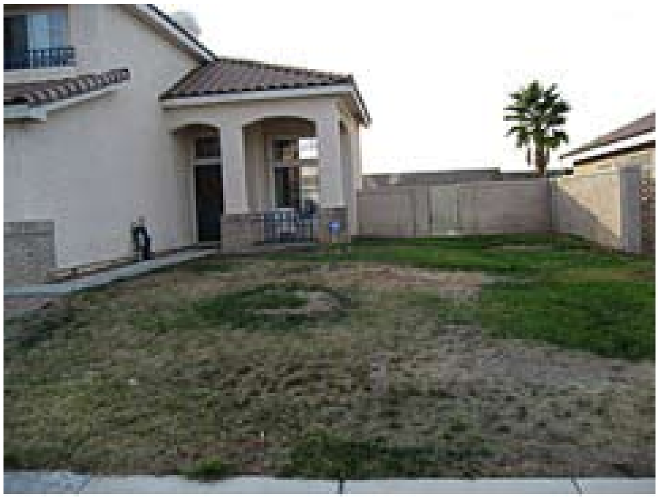
** 2007 figures are through November 30, 2007*

[67]SNWA does not have the actual cost of staff time for this program; however, it estimates that between $2 and $3 million dollars were spent in 2006 alone. Based on that estimate range, WRA estimates $2.5 million was spent on staff time for 3,466 rebates in 2006, for an estimated $721 spent on staff time per rebate. This estimated $721 per rebate is used to estimate the cost of staff time in the other years.

[68]Phase-in rebate programs start by offering smaller rebates and gradually increase the amount of the rebate to provide a stronger incentive for customers. A phase-in approach, along with yearly evaluations, allow a utility to maximize savings while minimizing cost.

[69]SNWA does not have the actual cost of staff time for this program; however they estimate that between $2 and $3 million dollars were spent in 2006 alone. Based on that estimate range, WRA estimates $2.5 million was spent on staff time for 3,466 rebates in 2006, for an estimated $721 spent on staff time per rebate. This estimated $721 per rebate is used to estimate the cost of staff time in the other years.

Figure 15. Sample Lawn Transformation Under Southern Nevada Water Authority's Water Smart Landscapes Rebate Program[70]



Before Landscape Replacement

After Landscape Replacement

Conclusion

Assuming a 10-year life span of water smart landscapes, the landscape conversion rebates cost SNWA an average of $575 per AF saved over the lifetime of the landscape. Although participants are required to sustain the landscape conversion for 10 years as a condition of SNWA's Water Smart Landscapes rebate program, SNWA finds that landscapes are rarely converted after that time period. Therefore, the effectiveness for the utility will most likely increase.

SNWA's Water Smart Landscapes rebate program is cost-effective for SNWA. The conservation program enables SNWA to avoid or defer the need to obtain additional water supplies through other means. For every 10 million square feet of high-water-use turf replaced with drought-tolerant landscaping, we estimate that SNWA would net $35.8 million.[71]

[70] Southern Nevada Water Authority, "Water Smart Landscapes Rebate: Photo Gallery," http://www.snwa.com/html/cons_wsl.html.

[71] The net benefit is calculated as the present value of the avoided construction, operating, and maintenance costs of a portion of the Virgin River Surface Diversion Project corresponding to the water saved by the conservation program, minus the present value of the rebates and staff costs associated with installing the drought-tolerant landscaping. In making this calculation, we assumed 2007 rebate levels and staff costs, a 30-year time horizon, costs for the Virgin River Surface Diversion Project escalated to 2007 dollars, and a 5.5% discount rate. We also assumed that 1% of the converted landscape would be reconverted to turf each year. See Southern Nevada Water Authority, "IWP Cost Development," Exhibit 517, In the Matter of Applications 54003 through 54021, Nevada State Engineering Ruling No. 5726 (April 16, 2007), http://water.nv.gov/hearings/spring%20valley%20hearings/SNWA/517.pdf (accessed December 5, 2007).

Las Vegas, NV

Pool covers provide a great opportunity for water conservation in the Las Vegas Valley. Situated in the middle of the Mojave Desert, the valley has hot, dry summers and very mild winters. The area typically receives 4.13 inches of rain per year and the temperature frequently reaches above 100 degrees (F).[72] Pool covers protect pool water from the desert conditions and reduce water lost to evaporation by 90%.[73]

The pool cover rebate program offered by Southern Nevada Water Authority (SNWA) encourages pool owners to purchase a pool cover to greatly reduce water loss from evaporation. SNWA rebates 50% of the cost, up to $50, for the purchase of a non-permanent pool cover and 50% of the cost, up to $200, for the purchase of a permanent pool cover. The rebate is only redeemable once every three years per residential property.[74] As of mid-December 2007, SNWA gave a total of 11,156 pool cover rebates.[75]

Figure 16. Pool Covers Greatly Reduce Water Loss[76]

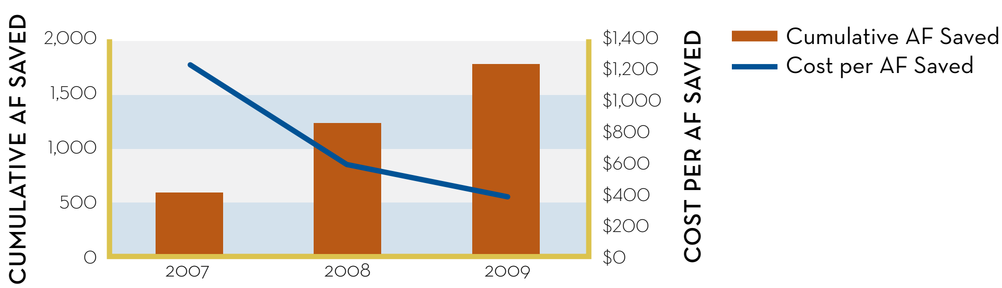
Water Savings

From 2005 through mid-December 2007, approximately 6,407,500 square feet of pool cover have been rebated through the pool cover rebate program.[77] SNWA estimates that covering a pool saves 30 gallons of water per square foot of water surface every year. Thus, pool cover rebates given from 2005 through mid-December 2007 achieve an approximate saving of 192.2 million gallons (590 AF) each year in the Las Vegas Valley.

Cost

To date, SNWA spent $640,750 on pool cover rebates. SNWA's incentive costs average approximately $0.10 per square foot of pool cover. Staff time to administer the pool cover rebates cost SNWA an estimated $101,200 over the lifetime of the program, for a total cost of $741,950.[78]

Figure 17. Cost per Cumulative AF Saved due to Southern Nevada Water Authority's Pool Cover Rebates Given from 2005 to 2007



Conclusion

The pool covers rebated through SNWA's rebate program from 2005 to mid-December 2007 will cumulatively save 1,770 AF of water. SNWA's pool cover rebate program costs the utility $419 per cumulative AF saved during the estimated 36-month life span of the cover.

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[72]Las Vegas Convention and Visitors Authority, "Las Vegas Weather," http://www.visitlasvegas.com/vegas/stay/planning-information/weather.jsp.

[73]Southern Nevada Water Authority, "Pool and Spa Tips," http://www.snwa.com/html/cons_tips_pool.html.

[74]Southern Nevada Water Authority, "Pool Cover Rebate Coupon," http://www.snwa.com/html/cons_coupons_pool.html (accessed June 6, 2007).

[75]SNWA cost-efficiency information obtained from Doug Bennett, conservation manager at SNWA, May 18, 2007 and Kent Sovocool, senior conservation research analyst at SNWA, November 18, 2007 and December 19, 2007.

[76]Picture proved by Lisa Riess of Southern Nevada Water Authority, January 4, 2008.

[77]Southern Nevada Water Authority document provided to WRA by Kent Sovocool, "Pool Cover Rebate Cost Benefit Estimates," 2007. Given that SNWA has spent $640,750 to date on pool cover rebates and SNWA estimates incentive costs to average a subsidy of approximately $0.10 per square foot, WRA calculates 6,407,500 square feet of pool cover have been rebated.

[78]Staff time estimated by WRA.

Effectiveness for Customers

In addition to the effectiveness of water conservation programs for utilities, there is a strong economic benefit for water customers to take advantage of rebates and retrofit incentives. Customers will see reduced water, sewer, and energy costs. The up-front cost paid by customers for water-saving devices is quickly earned back by avoided costs, making these incentives extremely efficient for participants.

For example, residential customers who install a high-efficiency clothes washer can save over 8,500 gallons annually. A single-family residential customer in Austin, paying $2.43 per 1,000 gallons, would save $270 over the lifetime of one high-efficiency washing machine.[79]

Commercial customers can save 37,800 gallons annually per high-efficiency clothes washer. A laundromat serviced by Irvine Ranch Water District with 20 high-efficiency washing machines will save 756,000 gallons annually and $1,000 per year in avoided water costs, based on IRWD's commercial rate of $0.98 per 748 gallons.[80] Over the lifetime of the washing machines, 9.8 million gallons will be saved and the laundromat will save $13,000 in avoided water costs.

Replacing a toilet that uses 3.5 GPF or higher with a low-flow toilet (1.6 GPF) can save over 13,000 gallons per year. A residential household in Albuquerque would save $35 annually on its water bill as a result of retrofitting two old toilets with low-flow toilets and $875 over the life span of the two toilets.[81]

Entities that implement large-scale fixture replacement programs can save millions of dollars in avoided water and sewer costs. The following are two in-depth examples of the effectiveness of large-scale retrofits for large entities.

[79] Austin Water Utility, "Current Water Services Rates – Retail Customers, Effective 11/1/07," http://www.ci.austin.tx.us/water/rateswr07.htm (accessed January 9, 2008). The unit charge of $2.43 per 1,000 gallons is based on monthly consumption of 2,000 to 9,000 gallons. Single-family residential customers that consume more than 9,000 gallons per month will have greater avoided costs.

[80] Irvine Ranch Water District, "Commercial/Industrial/Public Authority/Landscape Irrigation and Multi-Family Residential Customers Rates," http://www.irwd.com/AboutIRWD/rates_commercial.php (accessed January 9, 2008).

[81] Albuquerque Bernalillo County Water Utility Authority, "Customer Services: Water Rates," http://www.abcwua.org/customerservices/rates.html (accessed January 9, 2008).

Fort Collins, CO

Colorado State University (Colorado State) has many laboratories and health facilities across campus that use steam autoclaves to sterilize equipment. Typically, autoclaves sterilize objects by injecting steam into a chamber. When the steam comes into contact with the equipment, it condenses to water, also known as condensate. The condensate is then sent to the drain, but it is too hot to send to the drain without dilution, so the condensate is first cooled down using continuously running cold water, resulting in a constant stream of water (3.8 gallons per minute) being sent down the drain.[82]

Figure 18. Autoclave Retrofitted with Water-Saving Kit[84]

Engineers at Colorado State analyzed campus water use and determined that laboratory buildings and the veterinary teaching hospital were the largest water users on campus, requiring more water than all the lavatories on campus combined.[83] In an effort to reduce autoclave water use throughout campus, Colorado State installed 42 water-saving kits on the steam sterilizers that monitor the temperature and only inject cold water when needed, saving large volumes of water.

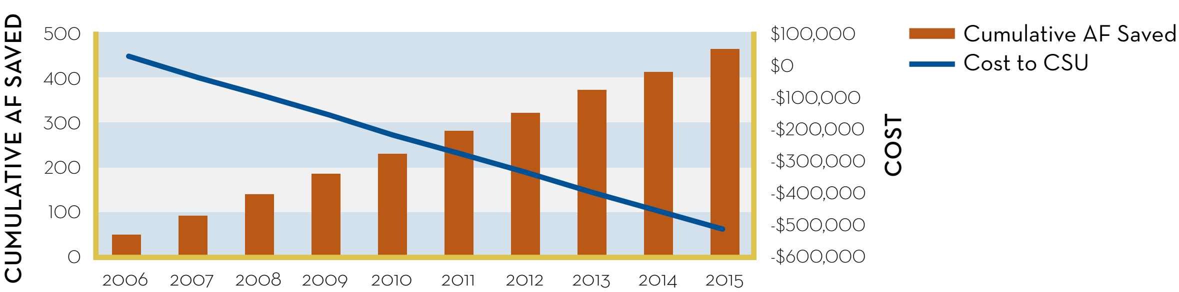
Water Savings

The 42 autoclave water-saving kits save over 15 million gallons (46 AF) of water per year.[85] Each kit individually saves almost 360,000 gallons (1.1 AF) per year.

Cost

The cost of each water-saving kit for the steam sterilizers is $2,000, including installation and maintenance for the life of the device. Colorado State installed a total of 42 water-saving kits on its autoclaves, for a total of $84,000.[86]

Figure 19. Cost to Colorado State University for the Installation of Water-Saving Devices on 42 Autoclaves[87]



Conclusion

The autoclave retrofit program initially cost Colorado State University $84,000 to save 46 AF annually. As a result of the saved water, Colorado State saves an estimated $59,400 per year in water and sewer charges, or an average of $1,440 per device, making the payback period only 1.4 years.[88] Assuming a 10-year life span of the water-saving devices, the university will cumulatively save $510,000 in water and sewer charges.

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[82] Colorado State University Facilities Management, "Colorado State Water Conversation," http://www.fm.colostate.edu/sustain/Water_Consv/water.htm (accessed September 11, 2007).

[83] Carol Dollard and Mike Hays, Colorado State University, "Conserving Water and Reducing Costs Through Installed Equipment Modification," 2006 draft report.

[84] Photo provided by Carol Dollard of Colorado State, January 3, 2008.

[85] To determine water savings, Colorado State took a 12-month average of water consumption before the retrofit and a 12-month average after the retrofit. It is averaged over about 12 buildings.

[86] Phone conversation with Carol Dollard, utility engineer at Colorado State University, April 4, 2007.

[87] Taking into account avoided water and sewer charges for the university.

[88] Carol Dollard and Mike Hays, Colorado State University, "Conserving Water and Reducing Costs Through Installed Equipment Modification," 2006 draft report.

University of Washington Toilet Replacement Program

Seattle, WA

The University of Washington (U of W) undertook a toilet replacement program in 2003 to replace 1,856 units with low-flow toilets that use 1.6 gallons per flush.[89] The school took advantage of Seattle Public Utilities (SPU) rebate of $120 per toilet replaced, reducing the capital costs for the school and decreasing the payback period for the project.

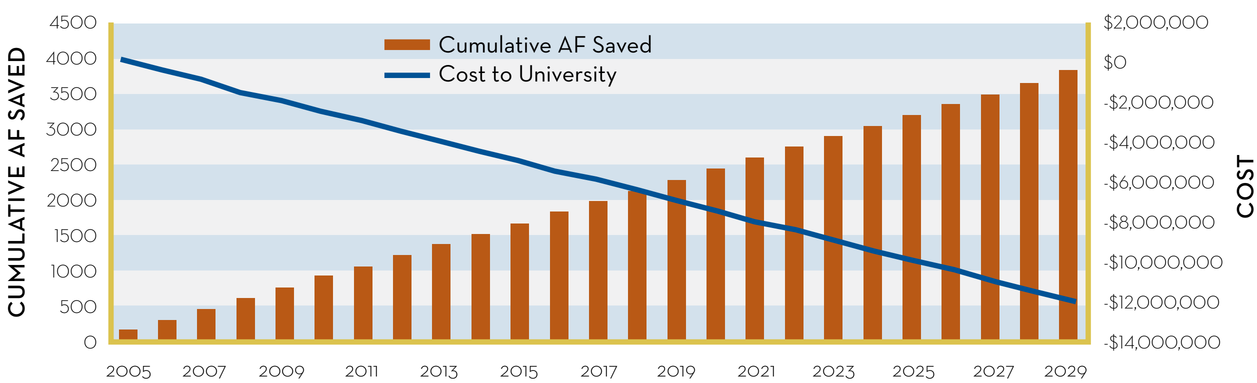
Water Savings

U of W estimates an annual water savings of approximately 50.3 million gallons (154 AF), based on the average number of flushes in a typical university building over 365 days. The University of Washington estimated that these water savings resulted in $559,745 of avoided costs related to water and sewer charges per year. However, this estimate was based on the 2003 combined water and sewer costs of $7 per 100 cubic feet (CCF). By 2007, this rate increased to $10.09 per CCF, thereby increasing the benefit to the university as avoided costs continue to rise.[90]

Cost

The total cost of the toilet replacement program was $900,541. Included in that cost is $487,363 for labor and $413,178 for materials. U of W received an incentive rebate from SPU of $220,720, making the total project cost for the university $679,821.[91]

Figure 20. Cost to the University of Washington for Toilet Replacement Program[92]



Conclusion

U of W's toilet replacement program cost $900,541 and saves 154 AF annually. However, taking into account the $220,720 rebate incentive by SPU and the $559,745 annual avoided sewer and water charges to the university, the payback period for the U of W's toilet replacement program is 1.21 years. Assuming a 25-year life of the 1.6-GPF fixtures, the university will cumulatively save $11.9 million by the year 2029 in avoided costs related to sewer and water charges. By targeting the oldest toilets on campus that used 3.5 GPF, the U of W maximized the water savings and effectiveness of its toilet replacement program.

[89] Personal correspondence with John Leaden of the University of Washington, December 6, 2007.

[90] Personal correspondence with John Leaden of the University of Washington, December 5 and 6, 2007.

[91] Ibid.

[92] Taking into account avoided water and sewer charges for the university.

Australia is the driest continent on the planet. As such, the country is no stranger to the constant threat of drought and decreasing water supplies.

In 2004, much of the continent grappled with one of the worst droughts in 100 years. The reservoir behind Sydney's Warragamba dam, which provides 80% of the city's water, reached a record low. In the town of Gouldburn, a few hours southwest of Sydney, residents faced severe water restrictions that allowed each person 40 gallons per day for bathing, cooking, and cleaning.[93]

As of late 2007, the Murray-Darling Basin, which has an area of over one million square kilometers and extends into Queensland, New South Wales, Victoria, South Australia, and the Australian Capital Territory, continues to experience an epic drought that threatens the nation's agricultural food bowl.[94] Over three million people depend on the water resources stemming from the Murray River and Darling River, and roughly three-quarters of the total area of irrigated crops and pastures in Australia are in the basin.[95] Record low rainfalls have left the area in an unprecedented drought since 1997, causing the water allocations available for irrigation purposes to be next to nothing in order to meet the minimal necessities of urban communities.[96]

The most recent droughts have pushed already strained water supplies to the limit, threatening growing populations and their food source. As a result, cities such as Sydney have looked to alternate sources to meet their water demands, including water reuse, desalination, and urban water conservation.

To promote conservation, Sydney Water offers numerous incentives for homeowners and businesses to save water. The following case study takes a close look at Sydney Water's WaterFix program and the effectiveness of implementing such a program.

[93]Phil Mercer, BBC News, "Australia in grip of water crisis," November 8, 2004, http://news.bbc.co.uk/1/hi/world/asia-pacific/3992231.stm.

[94]Murray-Darling Basin Commission, "Murray-Darling Basin Water Resources Fact Sheet," July 2006, http://www.mdbc.gov.au/_data/page/20/MDB-WaterResources-FactSheet-July2006.pdf (accessed November 9, 2007).

[95]Environment News Service, "Murray-Darling Water Crisis Leaves Farmers, Environment Dry," April 20, 2007, http://www.ens-newswire.com/ens/apr2007/2007-04-20-02.asp.

[96]Murray-Darling Basin Commission, "River Murray System Drought Update No. 10," October 2007, http://www.mdbc.gov.au/_data/page/1366/RMSystem_Drought_Update10_October07.pdf (accessed November 9, 2007).

Sydney Water Residential WaterFix Program

Sydney, Australia

Sydney Water's WaterFix program provides customers with the opportunity to have a qualified plumber come to their home to upgrade their water using fixtures to more efficient fixtures. This includes the installation of a three-star-rated water-efficient showerhead (2.4 GPM) and flow regulators on existing showerheads, a toilet cistern flush arrestor that reduces the water used with each flush, and leak detection and repair for minor leaks in the participating homes. These services cost a total of $180, but are offered to participating homes for $22 while Sydney Water pays the remaining $158. Properties owned by the Department of Housing (DOH) receive these services for free.[97]

From the start of the residential WaterFix program in 2000 through June of 2006, a total of 347,874 households, including Department of Housing properties, have taken advantage of the program. This is 20% of all households in Sydney Water's service area.[98]

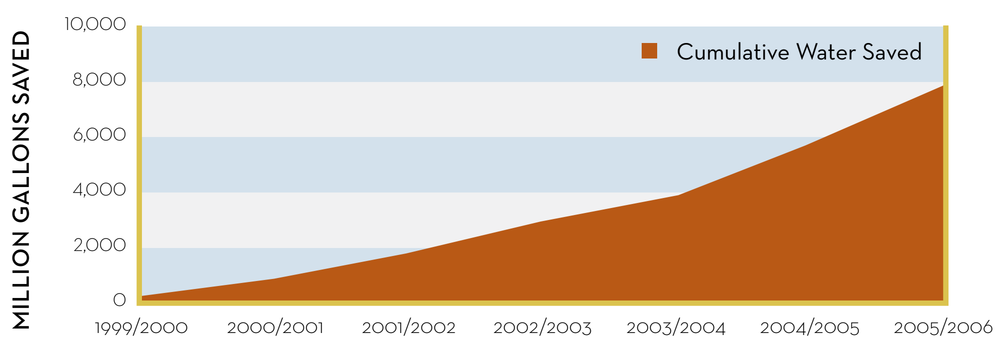
Water Savings

From 2000 to 2006, approximately 7.9 billion gallons (24,315 AF) have been saved as a result of the lifetime water savings from Sydney Water's residential and Department of Housing WaterFix programs.

Table 13. Cumulative Water Savings by Year (millions of gallons)[99]

Program	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Residential WaterFix	202	869	1,809	2,941	3,849	5,792	7,713
DOH WaterFix						44	210
Total	**202**	**869**	**1,809**	**2,941**	**3,849**	**5,836**	**7,923**

Figure 21. Cumulative Water Saved Due to Sydney Water's Water Fix Program 2000-2006



[97] Sydney Water, Water Conservation and Recycling Implementation Report, 2005-2006, http://www.sydneywater.com.au/Publications/Reports/WaterConservationAnnualReport2006.pdf.

[98] Ibid.

[99] Sydney Water determines cumulative water saved as a one-time savings achieved in the first year after implementation of the water-saving devices. For this study, WRA calculates cumulative water saved as the lifetime savings achieved from the water-saving devices year after year post-implementation.

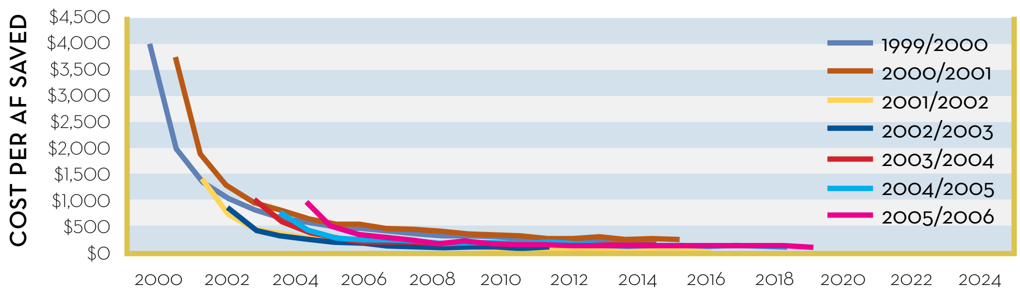
Cost

Since the commencement of the WaterFix program, Sydney Water has invested AU $42.5 million (US $26.5 million) on the residential WaterFix program and AU $4.2 million (US $2.6 million) on the Department of Housing WaterFix program, for a total of AU $46.7 million (US $29.1 million).[100]

Table 14. Investment by Sydney Water (in thousands of US$ per year)[101]

Program	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	Total
Residential WaterFix	2,490	7,512	4,051	2,869	2,573	3,277	3,713	**26,485**
DOH WaterFix						750	1,851	**2,601**
Total	**2,490**	**7,512**	**4,051**	**2,869**	**2,573**	**4,027**	**5,564**	**29,086**

Figure 22. *Cost per Cumulative AF Saved due to Sydney Water's WaterFix Program Retrofits from 1999 to 2006*



Conclusion

Sydney's WaterFix program has been widely successful in reducing water use within the service area of Sydney Water. Over 347,800 households have voluntarily taken part in the program since 1999 and over 402,450 water-efficient showerheads have been installed as a result. A cumulative total of 7.9 billion gallons have been saved through 2007.

Assuming a 20-year life span of the WaterFix devices, the utility program cost per lifetime AF saved averages AU $142 (US $88).

In contrast, Sydney Water's planned Kurnell desalination plant is estimated to cost over AU $2 billion dollars (US $1.245 billion) in construction costs plus AU $55 million (US $34 million) in annual operating costs and is expected to deliver over 132.1 million gallons (405 AF) per day to area residents.[102,103] This equals a total annualized cost of AU $1326 (US $825) per AF.[104]

[100]Using the average of the AU-US exchange rate from 1999 to 2005 (US $1 = AU $1.6064), http://eh.net/hmit/exchangerates/answer?yBegin=1999&yEnd=2006&nation%5B%5D=Australia.

[101]Ibid.

[102]Brian Robins, "In the pipeline: a $2b desalination bill," The Sydney Morning Herald, November 12, 2007, http://www.smh.com.au/news/national/in-the-pipeline-a-2b-desalination-bill/2007/11/11/1194766506938.html.

[103]"Residents rally against desalination plant," The Sydney Morning Herald, July 17, 2005, http://www.smh.com.au/news/national/residents-rally-against-desalination-plant/2005/07/17/1121538857417.html.

[104]Assuming a 30-year time horizon and 5.5% interest rate.

Conclusion and Recommendations

Monitoring the effectiveness of each measure within a water conservation program is an essential component to a successful demand management program. Although an increasing number of water utilities across the western United States utilize demand management programs, our research found that few utilities track the effectiveness of their conservation measures, once implemented.

- **To ensure each measure is effective, each should be monitored and evaluated.** Water-use data should be assessed using pre- and post-implementation measures to gauge actual water savings. Customer participation should be tracked to make sure that the desired level of penetration is reached, allowing the utility to optimize potential water savings. Finally, program costs should be noted for each measure, including cost of implementation, incentive costs, and staff time.
- **Tracking each of these elements will allow utilities to make any necessary changes that can increase savings potential.** Adjustments may include varying the incentive to attract more participants, increased marketing to raise public awareness, or a change in the targeted water savings. The best demand management program will be tailored to what works best within a utility's specific service area.
- **Evaluations of conservation measures should be made available to customers and the public.** Sharing this information will allow participants to share in the success of water conservation, and it will allow other utilities to utilize the information during implementation of their own demand management programs. Knowledge of the diversity of conservation measures available, the water savings achieved by specific measures, and the costs associated with each will guide utilities in evaluating what will work for them.
- **In addition, utilities should educate consumers regarding the individual benefits of implementing conservation measures and the quick payback period that is often achieved with investment in water-saving devices.** Residential customers can save hundreds of dollars in avoided water and sewer costs each year, while large-scale entities may see millions of dollars saved as a result of large-scale retrofit programs. Publicizing the economic benefit to the customers of water conservation measures will greatly increase the penetration level of individual measures.
- **Nationally, a tool should be developed to help water utility staff track measures and forecast potential effectiveness in a standardized manner.** This will help utilities to collect and express data in a uniform way, thereby increasing the ease with which utilities can assess and evaluate the effectiveness of conservation measures. It will also allow utilities to readily share their findings and compare data across service areas.

Evaluating the effectiveness of conservation measures is an essential component of a demand management program. By closely monitoring and assessing the progress of each measure, the benefits to consumers, and the overall effectiveness, utilities will maximize their water savin

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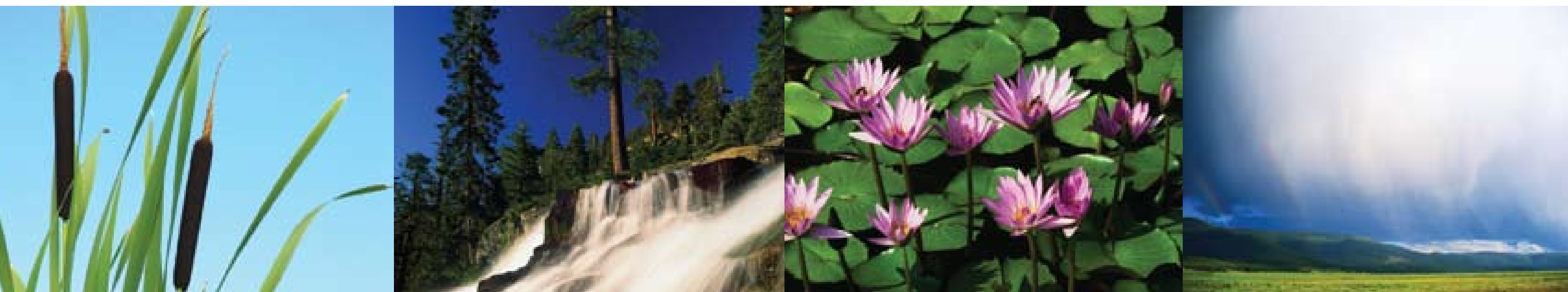

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Our lawyers, scientists, and economists:

1) advance clean energy to reduce pollution and global warming
2) promote urban water conservation and river restoration
3) defend special public lands from energy development and unauthorized off-road vehicle travel.

We collaborate with other conservation groups, hunters and fishermen, ranchers, American Indians, and others to ensure a sustainable future for the West.