NRDC Issue Paper
May 2009

Making Every Drop Work

Increasing Water Efficiency in California's Commercial, Industrial, and Institutional (CII) Sector

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THE EARTH'S BEST DEFENSE

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Acknowledgments

NRDC would like to thank our members and the following group of funders, without whom none of our work would be possible: the S.D. Bechtel, Jr. Foundation, the William and Flora Hewlett Foundation, the Rose Foundation For Communities & The Environment, the San Francisco Foundation, and Faye and Sandor Straus.

The authors would like to thank following individuals, who graciously contributed their time, knowledge, and input over the course of this report: John Koeller, Chris Brown, and Marsha Prillwitz, California Urban Water Conservation Council; Hossein Ashktorab, Jeannine Larabee, and Karen Morvay, Santa Clara Valley Water District; Bill McDonnell, Metropolitan Water District of Southern California; Chris Dundon, Contra Costa Water District; Dick Bennett, East Bay Municipal Utility District; Dana Haasz, San Francisco Public Utility Commission; Tom Cooper, Intel; Heather Cooley, Pacific Institute; Ann Thrupp, Fetzer Vinyard; Lou Bautista, Marcel Electronics International; Donald Ackey, Coachella Valley Water District; Karen Ustin, Delta Diablo Sanitation District; and Laura Shenkar, Principal, Artemis Project.

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The report is also available online at www.nrdc.org/policy.

This report is printed on paper that is 100 percent post-consumer recycled fiber, processed chlorine free.

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Executive Summary

Reliable and adequate access to water is critical for businesses and their surrounding communities. Across the nation, water shortages are triggering growing concern and an acceleration of efforts to increase water use efficiency. Adopting water-efficient technologies and practices that reduce consumption holds great potential for commercial, industrial, and institutional (CII) water users.[1] Such measures can help stretch limited water supplies, save businesses money, reduce energy consumption, improve water quality, and protect local, regional, and statewide ecosystems.

In February of 2008, California's governor called for a reduction in per capita urban water use of 20 percent by 2020, and the CII sector has a critical role to play in reaching this target. In California, CII sector water use is estimated to be 2.5 million acre-feet per year—or approximately one-third of total water use in California's urban areas.[2] The biggest water consumers in California's commercial and institutional sectors include office buildings, golf courses, and schools. Commercial and institutional facilities combined consume close to three times more water than the state's industrial users.[3] Of those industrial users, oil refineries, food processing facilities, and high tech manufacturers demand the most water.[4]

This issue paper will examine the range of potential water savings measures and practices, as well as their application in specific industries. In addition, we present case studies of water agencies and businesses across California to offer insights into how some of these programs have been implemented, the costs and benefits of the programs, and some of the barriers and challenges that water agencies and businesses face. Lastly, we offer recommendations for what water agencies, businesses and government can do to promote smart water efficiency practices and save water in the CII sector.

Increasing CII Water Efficiency is Cost Effective

Water use efficiency refers to practices, products, or systems that use less water without sacrificing performance. While great strides have been made to increase water efficiency in the residential sector during the last decade, implementing similar measures in the CII sector has lagged. Fortunately, there are numerous cost-effective strategies that can be applied to achieve significant water savings in the CII sector.[5] Estimates indicate that this potential ranges between 710,000 and 1.3 million acre-feet per year.[6]

Many water agencies are working to help CII customers reduce water use through programs that provide free water audits, equipment and technology rebates, and in some cases, free water-efficient products and installation. In doing so, agencies are able to reduce demand on existing water and energy supplies and meet long-term water reliability goals.

Increasing Water Efficiency Delivers a Range of Shared Benefits

Conserving water through greater efficiency in the CII sector can have a tremendous impact on overall water consumption and deliver a range of economic and environmental benefits.

Lowering the Cost of Business

Businesses can save money by investing in water efficiency measures and technologies. These savings include:

- lower water bills;
- reduced wastewater charges;
- lower energy costs; and
- reduced costs for chemicals and water purification.

The average estimated payback period for investing in water-efficient technologies in the CII sector is between one and four years, with a typical time of less than two and a half years.[7] Some investments have a payback period of less than one year when avoided wastewater and energy costs are taken into account.[8] In addition, funding may be available from public agencies or utilities to reduce the initial investment costs and shorten the payback period.

Extending Limited Water Supplies

Water use efficiency will help stretch limited supplies, which is particularly important during droughts. Nationwide, 36 states have or are likely to experience local, regional, or statewide water shortages in the next five years.[9] California is currently in the third year of a drought and facing the challenges of a growing population and increasingly unpredictable precipitation.

Potential CII Water Savings in Real Terms

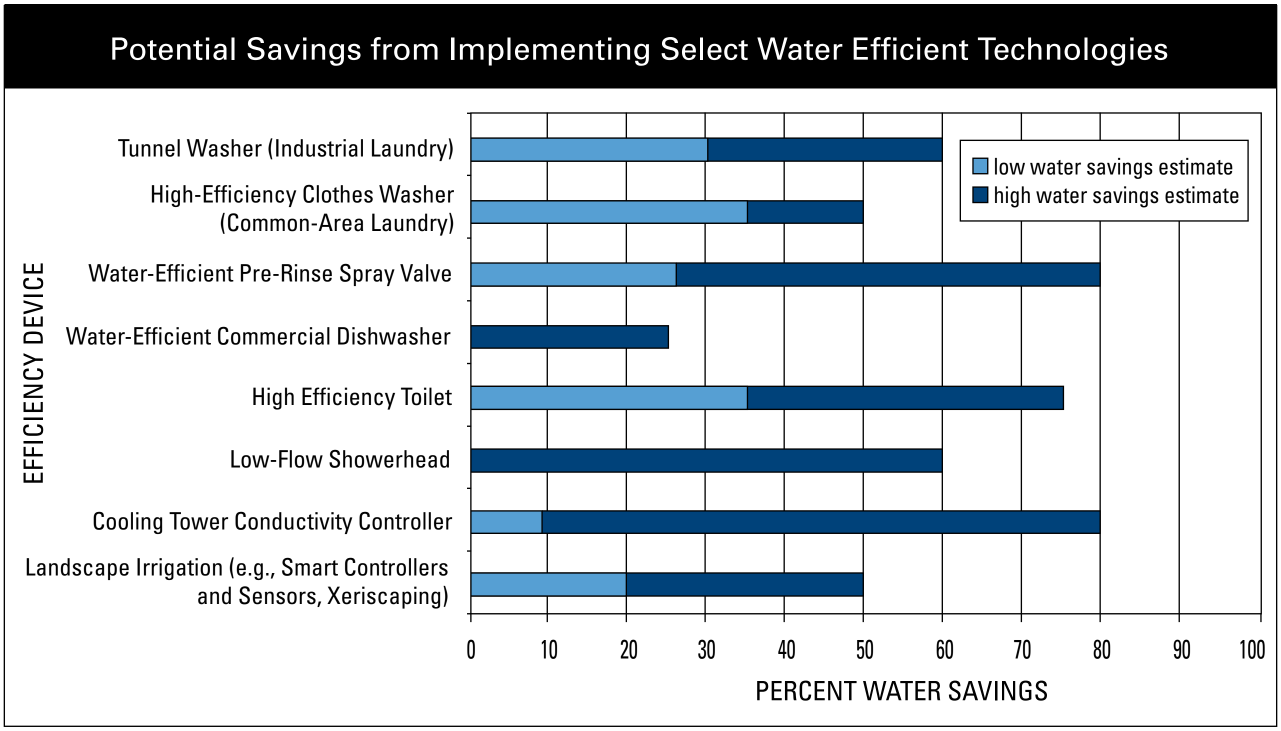
Potential water savings for the CII sector in California range between 710,000 and 1.3 million acre-feet per year (an acre-foot is the volume of water required to cover a one-acre area in one foot of water). Expressing that potential in real world terms further illustrates how significant these savings would be.

1 acre-foot would meet **the water needs of two families of four for an entire year**. The lower estimate of potential savings from CII water efficiency would **meet the annual water needs of the entire City of Los Angeles (residential and non-residential use).**

If we think of these savings as a **virtual river supplying California**, a middle-range savings of 1 million acre-feet would be equivalent to the **annual flow of the Merced River**, a wild and scenic river that flows out of Yosemite National Park.

COURTESY OF DAVID GREENWOOD

Rafters enjoying the Merced River



Saving Energy

It takes large amounts of energy to extract, treat, and deliver water—and yet more energy to use, collect, and dispose of it. Water use efficiency in the CII sector and the use of recycled water can generate significant energy savings, which reduces pressure on the power grid. The California Energy Commission (CEC) estimates that almost 20 percent of California's electricity use and more than 30 percent of non-power plant natural gas use is related to the use of water.[10]

Reducing Global Warming Pollution

Most energy production generates greenhouse gases. Reducing water use, especially hot water use, will reduce energy needs and therefore also reduce global warming pollution. The Santa Clara Valley Water District (SCVWD) showed a reduction of more than 14,000 metric tons of carbon dioxide since 2003 just by replacing pre-rinse spray valves in commercial food service operations.[11]

Adapting to the Effects of Global Warming

Increasing water efficiency in the CII sector will help businesses withstand drought and the effects of climate change. Investing in water conservation and efficiency provides businesses with more flexibility to weather these climatic uncertainties.

Restoring Fisheries and Other Ecosystems

Reducing water use in the CII sector will relieve pressure on over-tapped rivers. Using less potable water from our river system could support the recovery of the Sacramento-San Joaquin Delta ecosystem and its imperiled salmon fisheries—a $250 million industry in California that was shut down in April 2008 due to dwindling Chinook populations.

Improving Water Quality

Improving landscape water use efficiency in the CII sector can reduce urban runoff and the flow of lawn and garden chemicals and fertilizers into bays, rivers, and streams. Use of on-site recycling also reduces the volume of wastewater discharges—including regulated pollutants and other materials—that would otherwise be sent to wastewater treatment facilities. In addition, water use efficiency can stretch limited state and federal funds available for water and wastewater treatment upgrades by enabling communities to delay or reduce the size of system expansions.

Recommendations for Improving CII Water Efficiency

While some progress has been made during the last decade to improve water efficiency in the CII sector—from schools, to hotels, to microchip manufacturers—there remains tremendous potential for improvement. Realizing this potential will require matching the level of enthusiasm for increasing water efficiency expressed by water agencies and CII customers with the necessary funding for research and technical assistance. Water agencies, CII water users, administrative agencies, and the California legislature must cooperate to achieve the vast potential water savings from water efficiency and ensure that California successfully leads the nation in reducing water consumption, just as it has in reducing energy consumption. NRDC makes the following recommendations for improving water efficiency in the CII sector:

1. **Establish efficiency standards for water-using products.**
2. **Set performance-based water savings targets that provide water agencies with flexibility.**
3. **Prioritize water conservation above increasing supply.**
4. **Adopt a Public Goods Charge on water sales to provide a dedicated funding source for water efficiency programs, including expanded technical and financial assistance.**
5. **Encourage partnerships with—and financial support from—energy utilities and wastewater agencies.**
6. **Streamline the process for recycled water use.**
7. **Encourage volumetric pricing for sewer services.**
8. **Decouple water agencies' sales from revenue.**
9. **Improve water use data collection and management.**

CHAPTER 1

Available Technologies for Increasing CII Water Efficiency

Adequate water supplies are fundamental to a robust economy, thriving communities, and a healthy environment. Across the nation, water shortages are triggering growing concern and an acceleration of efforts to increase water use efficiency. California is in the third year of a drought, and while droughts have always been part of California's climate, the likely impact of global warming on the state's water supplies indicate that droughts may become even more frequent in the future.

In early 2008, California's governor called for a reduction in per capita urban water use of 20 percent by 2020. All water users, including the commercial, industrial, institutional (CII) sector, have a critical role to play in reaching this target.

Adopting water-efficient technologies and practices that reduce consumption holds great potential for CII water users.[1] Such measures can help stretch limited water supplies, save businesses money, reduce energy consumption, improve water quality, and protect local, regional, and statewide ecosystems. By implementing water efficiency measures that are proven reliable and cost-effective, CII facilities can potentially reduce their water demand by 15 to 50 percent.[2] More efficient replacements are available for smaller devices such as faucets and showerheads, appliances such as dishwashers and washing machines, and also larger systems such as irrigation, cooling, and industrial processes.

Keeping it Green with Water Efficient Landscaping

In California, nearly one million acre-feet of water per year—more than one-third of water use in the CII sector—is applied to CII facility landscapes such as offices, schools, parks, and street medians.[3] More than 70 percent of water for landscaping goes to turf —a particularly thirsty plant.[4] The typical California lawn, a cool-season turf grass, can require several times more water than native plants.[5]

Businesses and institutions can save significant amounts of water and money through investment in design, installation, and maintenance of water-efficient landscapes.[6] Using less water on landscapes can also reduce dry-weather runoff and waterborne contaminants.[7]

Nearly all CII customers can save water by replacing their turf with low-water use vegetation or investing in innovative devices such as smart controllers and moisture sensors.[8] Xeriscaping refers to landscaping that reduces the need for supplemental irrigation and it can reduce water use by 50 percent or more.[9]

Smart irrigation controllers are an emerging technology that maximizes outdoor water use efficiency by using climate, site, or soil moisture data as a basis for irrigation scheduling. The "Smart Water Application Technology" (SWAT) project—an international utility and irrigation industry initiative—is tasked with ensuring the successful introduction of smart controllers into the market.[10]

Water-efficient xeriscaping delivers beauty and water savings to a home in Southern California.

Smart controllers utilize two types of irrigation control technologies: sensor-based control and signal-based control. Sensor-based controllers measure factors such as temperature, rainfall, humidity, solar radiation, and soil moisture to adjust irrigation timing. Signal-based controllers receive regular signals about weather conditions via radio, telephone, cable, cellular, web, or pager technology and use the information to update the irrigation schedule. Estimates for water savings achievable through the use of smart irrigation controllers on commercial-sized landscapes range between 40 to 50 percent daily.

An increasing number of water agencies offer rebates for these controllers. For example, the Metropolitan Water District's Save a Buck Program offers a $630 rebate per irrigated acre for the installation of smart controllers and sensors.[11] The California Energy Commission has recently initiated proceedings to establish efficiency standards for smart controllers and other irrigation equipment.[12]

By utilizing agency rebate programs, businesses and public institutions can invest in water-efficient landscape technologies with a short payback period and significantly reduce their monthly water bills. Implementing these technologies has the potential to reduce water use for landscaping in California by more than 50 percent in the CII sector.[13]

Avalon Communities: Saving Water with Smart Irrigation

AVALONBAY COMMUNITIES, INC.

Water-efficient courtyards surround the Avalon at Mission Bay apartments in San Diego.

Avalon Communities Inc. develops and manages luxury apartment communities throughout the country. The Avalon at Mission Bay apartments, located in San Diego are surrounded by lush and newly water-efficient garden courtyards. In 2007, the management of Avalon at Mission Bay decided to participate in the San Diego County Water Authorities 20-Gallon Challenge, a region-wide campaign to increase voluntary water conservation by 20 gallons per person per day. To achieve this goal, the management targeted landscape irrigation water use. They installed a wireless water management service, which adjusts the amount of water applied to aesthetic landscapes using advanced technology and National Weather Service data to monitor and control existing irrigation controllers and clocks. As a result, Avalon has reduced their normal outdoor water consumption by 67 percent. Over the course of one year they have saved more than 2.7 million gallons (eight acre-feet) of water.

Increasing the Efficiency of Water Intensive Cooling Systems

Cooling towers are the most common device used to regulate air temperature in buildings and to cool equipment. Cooling towers are used as part of large-building central cooling systems and for refrigeration, cold storage, dry cleaning, medical equipment, manufacturing, and other industrial facilities.[14] While they are more energy efficient than many other types of cooling system, they are also one of the largest single consumers of water in the CII sector: cooling towers can consume 20 to 50 percent of a facility's total water use.[15] In California's CII sector, cooling accounts for approximately 15 percent (375,000 acre-feet) of annual water consumption.[16]

Cooling towers are water intensive because of water lost to evaporation during the cooling cycle—a process called "drift." As water evaporates, dissolved solids naturally present in water build up in the cooling system. To prevent build up, water is released from the system to discard dissolved solids ("blowdown") and new source water is added to maintain the necessary amount of water in the cooling system. It should be noted that energy conservation reduces the load on the cooling tower and therefore lowers the total amount of water used in the cooling tower.

Improving water efficiency in cooling towers can be achieved by minimizing the amount of water lost in the cooling cycle.[17] The best ways to make cooling towers more efficient include installing a cooling tower conductivity meter and controller, which measures and continuously monitors the level of total dissolved solids in the water by measuring the electrical conductivity in an evaporative cooling system, or installing a pH controller to measure pH levels, which also helps prevent buildup of solids. In addition to saving water, conductivity and pH controllers will save energy, improve operational efficiency, and reduce the wastewater generation and chemical treatment costs that alone range from $5,000 to $10,000 per year.[18] Conductivity controller retrofits cost less than $1,500 for an average-sized cooling tower and can save as much as 800,000 gallons (more than two acre-feet) each year.[19] Upgrading one cooling tower can save businesses up to $4,000 in water and wastewater costs annually.[20] The average lifespan of conductivity and pH controllers is five years.[21]

Replacing the conductivity controller on older model cooling towers can also improve their water efficiency. For example, a medical services provider located in Southern California was able to save 437,000 gallons annually—or 34 percent of their average annual water usage—simply by replacing the old conductivity controller on their cooling tower.[22] Most water agencies offer their customers rebates on these devices. This financial assistance reduces the payback period down to less than two years.

Saving Water at the Tap

Faucets are most often found in kitchens and restrooms. In California's CII sector, the bulk of the faucet related water use is in kitchens to provide water for food preparation, to fill pot and pan soak sinks, and for garbage disposals. Estimates suggest that a medium-sized commercial kitchen serving approximately 250 meals per day draws between 455 and 590 gallons of water through the faucet daily.[23]

Current national standards and plumbing codes in the United States set the maximum flow rate for commercial faucets at 2.2 gallons per minute (gpm). In public restrooms, the faucet flow rate is limited to 0.5 gpm.[24] Commercial sinks in kitchens generally require the full 2.2 gpm flow for operation.[25] Traditional commercial faucets use 4 to 7 gallons per minute. Installing a faucet aerator reduces water use by combining air with water as it comes out of the tap. The common aerator flow rates are 0.5, 1.0, and 2.2 gpm.[26] Depending on the aerator and faucet use, installing a commercial low-flow faucet aerator can reduce a faucet's water flow by 30 to 50 percent without affecting performance or water pressure.[27] Low-flow aerators also reduce the energy cost of heating faucet water by up to 50 percent. Although the water savings from low-flow faucet aerators is small in comparison to installing a high efficiency toilet, the low cost of commercial faucet aerators—less than five dollars on average—make them a cost-effective water saving device.

Available Technologies and Potential Water and Energy Savings in the CII Sector

CII SECTOR	WATER USE IN CALIFORNIA IN CII SECTOR	WATER EFFICIENT TECHNOLOGY	WATER AND ENERGY SAVINGS POTENTIAL	ADDITIONAL SAVINGS AND INFORMATION
COMMERCIAL LANDSCAPING	• 1/3 of total water use in the CII sector (approximately 1,000,000 acre-feet of water per year)	• Xeriscaping • Smart Controllers and Sensors	• Xeriscaping reduces water use by 50 percent or more • Smart Controllers cut 20 to 40 percent of annual water use	Reduces dry-weather runoff and waterborne contaminants; Can improve the appearance of the landscape
COOLING TOWERS	• Cooling accounts for approximately 15% (375,000 acre-feet per year) of CII water use. Can account for 20 to 30% of a facility's total water usage	• Conductivity Controller • PH Controller	• Conductivity Controllers save 800,000 gallons (2 acre-feet per year) • Up to 80% potential water savings depending on the usage and facility	Upgrading one cooling tower can save businesses up to $4,000 in water and sewage costs; PH Controller reduces chemical costs; Overall reduction in wastewater bills
COMMERCIAL FAUCETS	• Urinals account for 15% of total restroom consumption in California's CII sector • Faucets account for 4% of total restroom consumption in the California CII Sector (approximately 14,400 acre-feet per year) • Medium-sized commercial kitchen faucets use 455 to 590 gallons per day	• Low-flow faucet aerators (0.5, 1.0, and 2.2 gpm)	• Reduces faucet water flow by 30 to 50% (range is based on aerator type and faucet use) • Low-flow aerators also reduce the energy costs of heating faucet water by up to 50%	Faucet aerators cost less than five dollars on average, making them very cost-effective
SHOWERHEADS	• Showers account for 7% of total bathroom consumption in the California CII sector (approximately 25,200 acre-feet per year)	• Low-flow showerhead (2.0 and 2.5 gpm)	• 2.5 gpm flow can save 2 gallons per shower • 2.0 gpm flow can save 3.5 gallons per shower	Low-flow showerheads can be purchased in bulk quantities for $5 to $12 each
TOILETS	• 15% of water used in CII facilities is used in restrooms • Toilets account for 72% of total restroom consumption in California's CII sector (approximately 259,200 acre-feet per year)	• Ultra low-flow toilets (ULFT) (1.3-1.9 gpf) • High-efficiency toilet (HET) ((1.28 gpf)	• ULFT can save 15,000 gallons per year depending on the facility • HET can save up to 19,000 gallons per year	Overall reduction in wastewater
URINALS	• Urinals account for 15% of total restroom consumption in California's CII sector	• High Efficiency Urinals (HEU) (0.5 gpf or less) • Waterless Urinals	• Each HEU can save 20,000 gallons of water per year • Each waterless urinal can save 45,000 gallons of water per year	Overall reduction in wastewater
COMMERCIAL KITCHEN DISHWASHERS	• 6% of total California CII water consumption (150,000 acre-feet) occurs in commercial kitchens. • Commercial dishwashers use 24% of water used in CA commercial kitchens or approximately 36,000 AF each year	• Water-Efficient Commercial Dishwasher	• Reduces water and energy use by 25% per year	Payback period for installing small efficient commercial dishwasher ranges between one and four years. Larger flight-type machines, however, have a much longer payback period
COMMERCIAL KITCHEN PRE-RINSE SPRAY VALVES	• 6% of total California CII water consumption (150,000 acre-feet) occurs in commercial kitchens. • Pre-rinse spray valves account for 14% of water consumption in California commercial kitchens (21,000 acre-feet per year)	• Water-Efficient Pre-rinse spray valve (1.6 gpm or less)	• Saves up to 50,000 gallons of water and 7,629 KWh of electricity per year (26% to 80% less water and energy compared to standard valves)	Replacing a traditional pre-rinse spray valve that is used roughly three hours per day with a water-efficient pre-rinse spray valve can save 180 gallons of water per day and up to $1050 in water and energy costs per year
MEDICAL EQUIPMENT	• X-ray film processors use 788,400 gallons of water per year on average • Steam sterilizers account for 10% of water consumption in some hospitals (between 1 and 5 gpm when in operation)	• X-ray film processor water recycling equipment • Steam sterilizer retrofit	• X-ray film processor recycling system reduces annual water use by as much as 98% • Steam sterilizer retrofit saves 45 to 50 gallons per hour (60%) per sterilizer	X-ray processor retrofit saves $600 on utility bills each year. Steam sterilizer retrofit can achieve cost savings of $2,500 per sterilizer per year
CLOTHES WASHERS	• Industrial and on-premise laundries in California use approximately 30,000 acre-feet of water per year • Approximately 3,000 additional coin-operated clothes washers in California each use up to 45 gallons of water per load	• High-efficiency commercial clothes washers (HEW) (common-area laundries) • Water efficient washer extractors (on-premise laundries) • Tunnel washers (industrial laundries)	• HEWs can reduce water consumption by 35 to 50% and achieve energy savings of up to 50% • Efficient washer extractors can reduce water consumption by up to 40% • Tunnel washers can reduce water consumption by 30 to 60%	More efficient washers can reduce energy bills by up to 50% and water and sewer costs by 35 to 50%. HEWs require 50% less detergent

Comparison of Plumbing Fixture Water-Flow Rates				
PLUMBING FIXTURE	BEFORE 1992	EPA 1992	CURRENT PLUMBING CODES	EPA WaterSense® OR HIGH EFFICIENCY SPECIFICATION
TOILET	4.0 to 7.0 gpf	1.6 gpf	1.6 gpf	1.28 gpf
URINAL	3.5 to 5.0 gpf	1.0 gpf	1.0 gpf	0.5 gpf
FAUCET	5.0 to 7.0 gpm	2.5 gpm	2.2 gpm for commercial faucets 0.5 gpm for public lavatories	1.5 gpm
SHOWERHEADS	4.5 to 8.0 gpm	2.5 gpm	2.5 gpm	2.0 gpm

Source: Domestic Water Conservation Technologies, Federal Energy Management Program. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, National Renewable Energy laboratory, october 2002

Reducing Water Consumption in the Shower

Showers are commonly found in CII facilities such as hotels, hospitals, gyms, and college dormitories. Although new standards were enacted in 1992 setting maximum showerhead flow rates at 2.5 gpm, many inefficient showerheads with flow rates exceeding 5.0 gpm are still in use.[28] In some facilities, replacing inefficient showerheads is one of the most cost-effective retrofits available; low-flow showerheads can be purchased in bulk quantities for $5 to $12 each and have an average payback period of less than two years. Installing low-flow showerheads can save 10 gallons of water for every five-minute shower, which equates to savings of more than $3,600 annually if one hundred people shower each day and water and sewer costs are one cent per gallon.[29] A study by the Santa Clara Valley Water District found that installing low-flow showerheads (2.5 gpm or less) across the county could save more than 1,000 acre-feet of water and 280 million kWh over their expected lifespan of five years.[30]

The California Energy Commission Public Interest Energy Research program is evaluating the potential for upgrading the standard for showerheads to 2.0 gpm. In addition, the WaterSense® Program is preparing a voluntary standard with a preliminary maximum flow rate of 2.0 gpm. Installed shower heads that use no more than 2.0 gpm have a water savings potential of 3.5 gallons per shower.[31]

Curtailing Toilet and Urinal Water Waste

Nearly every business, regardless of what it produces, whom it serves, or where it is located, can save water by installing water-efficient toilets and urinals. In 2000, 15 percent of water used in CII facilities was used in restrooms; toilets and urinals make up approximately 90 percent of that water.[32] In many commercial and institutional facilities such as hotels, hospitals, schools, and office buildings, the number of toilets and urinals on-site can reach into the hundreds. In these sectors, it makes sense economically to do a system-wide retrofit.

Old water-guzzling toilets use up to 5 gallons per flush (gpf). The federal standards for all new toilets is 1.6 gpf, and California legislation passed in 2008 will reduce that to 1.3 gpf by 2014.[33] A 2005 report by the California Urban Water Conservation Council estimates that there are still 2.4 million toilets to retrofit in the CII sector.[34] Replacing one inefficient toilet with an ultra low flush toilet (ULFT) in the CII sector can save up to 15,000 gallons per year, and the savings from installing a high efficiency toilet (1.3 gpf) is up to 19,000 gallons per year.[35]

While the national water use standard for urinals is 1.0 gpf, traditional urinals that use up to two gallons per flush are still in use.[36] High efficiency urinals (HEU) are defined as devices that use 0.5 gpf or less. On average, replacing one inefficient urinal with a HEU saves 20,000 gallons of water per year.[37] High efficiency urinals cost between $300 and $625. Improved HEUs are introduced to the marketplace every year, with the latest models capable of saving up to 20,000 gallons of water per year in very high use applications. New ultra low water urinals utilize only 1 pint (0.125 gallons) of water to flush and can reduce water consumption by as much as 88 percent when replacing urinals using 1.5 gpf or more.[38] In January 2009, the EPA released its specification for high-efficiency flushing urinals for their WaterSense® labeling program.[39] Going a step further, waterless urinals can save an average of 45,000 gallons of water per year and can provide additional savings on wastewater costs. The payback period for installing water efficient urinals is between one and three years.

Many agencies have rebate programs to help their CII customers retrofit restroom equipment. For example, the Santa Clara Valley Water District offers a free installation program for high efficiency toilets (HETs) to businesses, including apartment buildings, hotels, office buildings, and restaurants. Santa Clara has installed more than 11,000 water-efficient HETs since 2005. For fiscal year 2007 to 2008, SCVWD installed approximately 3,100 HETs in nine different CII sectors. For these nine sectors, the district estimates an average savings of 43 gallons per toilet per day and per sector savings ranging from 21.6 gallons per toilet per day to 77 gallons per toilet per day.[40]

Enjoying Water and Energy Savings at the Gaia Hotel & Spa

CRISTINA FRANCIA

The koi pond at the Gaia Napa Valley Hotel & Spa is both relaxing and water smart.

The management of California's Gaia Napa Valley Hotel & Spa decided to pursue Leadership in Energy and Environmental Design (LEED) certification for the hotel in 2000. The hotel premises are now equipped with high efficiency toilets, low-flow showerheads, and faucet aerators. Their kitchen is outfitted with state of the art EPA-approved ENERGY STAR appliances. The koi pond even uses recycled water that is filtered and cleaned on-site. Their upgrades and retrofits have reduced water consumption by 45 percent and brought energy savings of 25 percent. The payback on their investment required between four and five years, and they have a gold LEED certification to show for it.[41]

Keeping it Clean with Less Water Using High-Efficiency Dishwashers and Pre-Rinse Spray Valves

It is estimated that in 2000 approximately 150,000 acre-feet—or 6 percent of total CII water use in California—was consumed by commercial food service operations.[42] Typically, washing dishes consumes up to two-thirds of all water used in restaurants.[43] The easiest and most cost-effective way for restaurants to reduce their water consumption is to improve the efficiency of their dishwashing and pre-rinse spray equipment.

Depending on their size, food service dishwashers use anywhere from less than one gallon to more than 20 gallons of water per rack of dishes. The average commercial dishwasher uses roughly four gallons of water per rinse. Upgrading to a water-efficient dishwasher reduces water and energy use by 25 percent annually.[44] The payback period for installing some smaller, more efficient commercial dishwashers ranges between one and four years. Larger flight-type machines tend to have a longer payback period.

Traditional pre-rinse spray valves, which are used to rinse dishes before they are put into a commercial dishwasher, use between one and five gallons per minute. Installing a water-efficient pre-rinse spray valve reduces water use from 3 gpm to 1.6 gpm or less.[46] The resulting savings can be a 15 to 30 percent reduction in annual water, energy, and sewer costs.[47] Installing just one pre-rinse spray valve can save a business up to 50,000 gallons of water and 7,629 KWh per year.[48]

The California Urban Water Conservation Council's Rinse 'n' Save pre-rinse spray valve installation program replaced nearly half of all hot water pre-rinse spray valves in the state (50,000 of the estimated 102,000).[49] In addition to hot water pre-rinse sprayers, applications such as vegetable washing in supermarkets often rely on cold water pre-rinse spray valves.

Taking into account the significant progress made in recent years, there remains great potential in California to further reduce CII water use by installing water-efficient dishwashers and pre-rinse spray valves.

Improving the Water and Energy Efficiency of Clothes Washers

Water, wastewater, and energy costs are the largest operating expenses for laundry facilities. Unfortunately, much of the water used in a laundromat is neither treated nor recycled; it just goes down the drain. Water efficiency potential in this arena is relatively untapped, presenting businesses with immediate opportunities to capitalize on implementing water efficiency practices in their laundry facilities.

Clothes washers used in the CII sector can be separated into three different categories: on-premise laundries (OPL), industrial laundries, and common area laundries. In California, the combined water use of on-premise and industrial laundries is approximately 30,000 acre-feet each year. Additionally, there are approximately 2,500 to 3,000 coin-operated and card-operated laundries in the state.[50] Machines in these laundries are often very inefficient and can consume between 35 and 45 gallons of water per load; replacing inefficient machines with HEWs can reduce water and energy costs by up to 50 percent.[51]

On-premise laundries are used by an array of businesses and industries such as, hotels, gyms, and prisons. Small- to medium-sized facilities generally use machines referred to as washer extractors that look and operate similar to residential front-loading machines, but hold between 30 and 800 pounds of laundry.[52] Standard washer extractors use 3 to 4 gallons of water per pound of laundry (gpp).[53]

Water efficient washer extractors have built in water recycling systems that lower water use to less that 2.5 gpp, resulting in tremendous water savings. The average hotel with 125 rooms and a 70 percent occupancy rate will use more than 604,000 gallons of water every year (about 1.8 acre-feet) just to wash bed sheets and towels with a standard commercial washing extractor (4.0 gpp). If that hotel installs a water-efficient washing extractor, it can save close to 227,000 gallons of water—a 38 percent savings.[54]

Industrial laundries are large operations that provide laundry services such as washing uniforms and restaurant linens to outside businesses. They often use tunnel washers—large volume equipment made up of numerous individual compartments where different phases of the wash cycle take place. Tunnel washers cost hundreds of thousands of dollars and are designed to be more water-efficient (typically use 2.0 gpp) and use 30 to 60 percent less water per pound of laundry than traditional washer extractors.[55] Tunnel washers are cost-effective if the business cleans 800 pounds of laundry per hour or more. To be cost-effective, most manufacturers recommend that the throughput be in excess of 800 pounds per hour.[56]

Common area laundry facilities, such as those in apartment buildings, dormitories, and laundromats, generally use machines similar to residential clothes washers except that they are slightly larger (16-pound capacity) and include a means for paying for the wash cycle. Between 35 and 50 percent of water can be saved in common area laundry facilities by installing high efficiency commercial washing machines (HEWs).[57] Advances in technology and design have improved washers, allowing them to be more water-efficient without compromising washing performance. In general, less efficient commercial washing machines are top-loaders with a vertical axis. More water and energy efficient HEWs have a horizontal axis and are front-loading, though top-loading HEWs do exist.

Historically, water use in coin-operated clothes washers (measured with a "water factor" rating) was quite high.[58] Since passage of the Energy Policy Act of 2005, water-guzzling devices are being phased out, and machines with lower water and energy use are now taking their place. Standard coin-operated washers have a water factor of 9.5 to 14. Some newer models have a water factor as low as 4, which translates to using only 15 gallons per load.[59] In a laundromat with 25 washing machines (average water factor of 12), approximately 3 acre-feet of water can be saved each year by installing HEWs (water factor of 6.5). Those water savings would be enough to meet the needs of three families of four for an entire year.[60]

Reducing water use is not the only incentive for installing commercial HEWs. Purchasing an HEW for a commercial facility can reduce energy bills by up to 50 percent and water and wastewater costs by 35 to 50 percent. There are dozens of HEW models available on the market and some are designed with water reuse systems that recover the final rinse water in a multi-cycle operation for use in the first rinse in the next washing cycle. Simple recycle systems can save 10 to 35 percent of water used in the full wash cycle. More complex systems can recover more than 85 percent of the water used in one cycle.[61] In addition, HEWs require 50 percent less laundry detergent. HEWs also last 5 to 10 years longer than standard top-loading machines.[62]

The Department of Energy is now in the process of updating its standards on commercial clothes washers. Unfortunately, the current proposal creates separate standards for front-loading and top-loading washers, essentially allowing a second class of less efficient machines.

Adapting Industrial Processes to Reduce Water Consumption

From processing the foods we eat, to sterilizing x-ray equipment inside hospital rooms, water is fundamental to a variety of industrial processes. The term "process water" encompasses all water uses unique to a particular industry for producing a service or product.[63] This can include water used for industrial boilers, heating systems, cooling systems, reverse osmosis systems, chemical dilution, and product sterilization or cleaning.

Approximately 445,000 acre-feet of water in California was used in industrial processing during the year 2000.[64] The amount of process water and the ways it is used vary greatly across industries. Water efficiency measures adopted to reduce process water must be site and process-specific. The best way to determine the potential ways to improve water efficiency at a particular site is to perform an on-site audit. Some examples of process water efficiency measures include:

- Rinse cycles employed by industrial and food processing facilities can be adjusted to save water. Reducing the rinse time, number of rinse cycles, and water flow rate, and reusing rinse water on-site, are common techniques for optimizing the efficiency of rinse processes.[65]
- Various industries use air scrubbers to remove pollutants from industrial emission streams. Instead of using potable water for the scrubbers, companies can use wastewater from production processes when available.
- Disinfecting products during food and beverage processing can be done with ozone rather than water. The high oxidation power of ozone makes it a very effective cleaning method.[66] Further, cleaning with ozone reduces or eliminates the need for chemicals or high-temperature disinfection cleaning processes, both of which require water, thereby reducing chemical and water costs.
- Automatic shutoff valves can be used to reduce process water consumption. Some process equipment runs continuously throughout the day. Installing automatic shutoff valves on process equipment stops the flow of water when production stops.

Many water agencies perform no-cost on-site water audits to CII customers. Through its Water-Efficient Technologies program, the Santa Clara Valley Water District offers its CII customers rebates of up to $50,000 to make process and equipment changes that reduce business water usage by at least 74,800 gallons per year.[67] The flexibility of the program has attracted high profile companies in the high tech sector and other areas.

Benefiting from On-Site Water Reuse and Recycling

In some cases water from one process can be reused in another process on-site. For instance, water used in the final rinse of fruits and vegetables can be reused as the first rinse for the next batch. Process water can be treated on-site and reused to water landscapes. Contra Costa Water District reports that some of their CII customers reuse their water as many as six to eight times.[68] Although some treatment may be necessary to reduce total dissolved solids, organic content, or chemicals—and this treatment may increase energy costs—such costs associated with water reuse are generally far smaller than the cost of new water and sewer treatment.

In many industries and commercial businesses, water can be treated and reused, especially in multi-cleaning processes. Marcel Electronics International (MEI), a small circuit board manufacturer in Orange County, reuses their water. With the help of grant funds from the Municipal Water District of Orange County, MEI was able to identify every wastewater stream at their California facility. They installed a closed-loop Wastewater Recycling System (WRS) that reroutes discharge water to locations on-site where it can be reused.[69] The company's WRS reduces water use and prolongs the life of chemical baths in areas that utilize deionized water.

Since the project was implemented in 2007, MEI has seen up to a 40 percent reduction in water use. The project has been so successful that MEI hopes to expand their water reuse program to include water for their air scrubbers and to install a smaller WRS in their inner layer wet process area. MEI's Environmental Manager Lou Bautista sees water efficiency as an evolving process: "Every gallon counts, which makes our savings goal ongoing. We are continuously looking at new chemistries and their compatibilities with our processes and equipment. Often we find we can change the direction of our waste water to WRS and reuse it."[70]

Updating Medical Equipment to Improve Water Efficiency

Hospitals use an average of nearly 140,000 gallons of water per day. Between 4 and 15 percent of that water is used for medical equipment such as x-ray processors, sterilizers, and lab aspirators that are all vital to a well-functioning healthcare facility.[71] Unfortunately, many of these machines run throughout the day and night and use large quantities of water.

There are numerous ways to reduce the amount of water medical equipment consumes, which in turn can save businesses money on water and energy bills. To achieve the highest water savings, all equipment that uses single-pass cooling water should be replaced with equipment that has a closed-loop cooling system. For example, x-ray film processors can use an average of 800,000 gallons of water per year. Installing water recycling equipment for x-ray film processors can reduce annual water use by as much as 98 percent and can save $600 on utility bills each year.

It is worth noting that the medical industry expects digital imaging to replace x-ray film processors in large medical facilities within the next 10 years. While this changeover will potentially limit the life of an x-ray water recycling system, the technology is still deemed cost-effective by water agencies. The initial installation cost of an x-ray machine water recycling system is approximately $5,000, with additional maintenance and supply costs estimated to be approximately $1,200 per year. The Metropolitan Water District of Southern California (Metropolitan) offers a $3,120 rebate per x-ray device.[72]

Accounting for approximately 10 percent of water use in hospitals, steam sterilizers are also ripe for efficiency upgrades. Traditional sterilizers use between one and five gallons of cold water per minute continuously to cool the hot condensate created in the sterilizing process prior to sending it down the drain. Studies show that retrofitting steam sterilizers with a water saving device that monitors the drain temperature and applies cold water only when needed can save approximately 45 to 50 gallons per sterilizer per hour, with a potential cost savings of $2,500 per sterilizer per year. Metropolitan provides a rebate up to $1,900 for the purchase and installation of each water-efficient steam sterilizer through the "Save a Buck" program.[73] While the average payback period for installing steam sterilizer water efficiency technology depends on the model of kit selected, initial constant water flow of the sterilizer being retrofitted, hours of operation, and the level of incentives provided by the utility, the average is less than three months.[74]

CHAPTER 2

Developing Alternative Sources of Water

In addition to traditional water efficiency measures, utilizing recycled and reclaimed water technologies and practicing low-impact development can help meet current and future water demand in the CII sector. Increased low-impact development and implementation of water recycling are both cost-effective solutions that can reduce water pollution and contribute to a "virtual river" capable of relieving pressure on our already overstretched water supplies and ecosystems.

Benefiting Business and the Environment through Water Recycling

Municipally reclaimed water, often called recycled water, refers to wastewater treated to remove solids and certain impurities and then used for beneficial purposes such as irrigation, industrial processes, toilet flushing, and ground water recharge. In an effort to promote regional self-sustainability, an increasing number of water agencies are exploring the potential of recycled water use, particularly in Southern California.

California is gearing up for expanded use of recycled water across the state. In its 2005 State Water Plan Update, the Department of Water Resources indicated that the state now recycles between 450,000 and 580,000 acre-feet per year (approximately 10 percent of municipal wastewater in California). Israel, by contrast, recycles almost 70 percent of its municipal wastewater.[1] The Scoping Plan for implementing AB 32, the California Global Warming Solutions Act of 2006, calls for an increase in municipal wastewater recycling to 23 percent by 2030.[2] In February 2009, the State Water Resources Control Board adopted a new recycled water policy and is expected to issue a general permit to facilitate the use of recycled water for landscape irrigation later in 2009.

In a recently released report, the California Sustainability Alliance showed that 415,000 acre-feet of treated wastewater could immediately be put to beneficial use in Southern California alone, not including water that is recycled to recharge the aquifer. That number is higher—about 580,000 acre-feet per year—when effluent with a lower level of pretreatment is included.

The study noted that the associated energy and greenhouse gas savings associated with using that tertiary and secondary treated wastewater to offset more energy-intensive supplies would be 1,400 gigawatt hours and 540,000 metric tons of CO_2 (the equivalent of 16 percent of California's annual energy efficiency goals).[3]

Recycled water is a virtually drought-proof supply, largely because it is treated from a steady supply of wastewater. And it is often provided to businesses at a rate that is cheaper than potable, freshwater. In some municipalities, the rate for recycled water is set at 50 percent of the rate for potable water.[4] In addition to this discount, some utilities do not charge a connection fee for recycled water, potentially saving a business thousands of dollars.[5]

PHOTO COURTESY OF EBMUD, BY WARDELL PHOTOGRAPHY

This "purple pipe" being installed by EBMUD will deliver recycled water to customers.

One of the biggest costs associated with recycled water is the installation of "purple pipe." Recycled water is typically distributed through a separate system of purple pipe to keep supplies separate from potable water. Depending on the project and site, the cost to lay purple pipe can be prohibitively expensive for some businesses and public agencies. The cost of installing purple pipe varies depending on factors such as pipe diameter, the type of pipe used, and where it is installed. The average cost in urbanized areas is between \$200 and \$500 per foot.[6] Retrofitting distribution systems on a particular site such as a golf course can cost between \$5,000 and \$150,000 depending on the irrigated area and what work needs to be done to separate the potable water from recycled water.[7] In general, it is less expensive to install purple pipe in newly developing areas.

Taking into account the public perception challenges to overcome with regard to water recycling, use of recycled water can be an attractive option when compared to more expensive surface storage projects. The Orange County Water District has demonstrated the potential of recycled water at their Groundwater Replenishment System in Orange County. The system takes tertiary treated wastewater, treated to beyond state and federal drinking water standards, and injects it into an expanded underground seawater intrusion barrier along the coast to keep ocean water out of the groundwater basin. The treated water percolates into deep groundwater aquifers where it eventually becomes part of the natural drinking water supply. The system generates enough pure water to meet the needs of 500,000 people.[8]

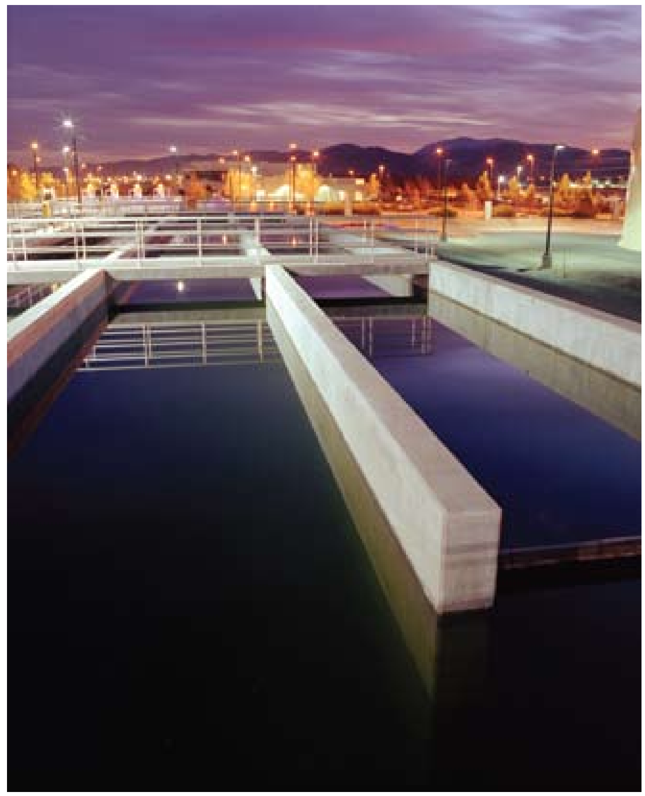
Water agencies encourage the use of recycled water in the CII sector, particularly in landscape irrigation, but also for industrial processes and for flushing sanitary fixtures. Metropolitan offers significant incentives (up to \$500 per acre-feet of recycled water used) for commercial and public institutional customers such as city, county, state, or federal facilities that receive public funding. These incentives are funded by Metropolitan's wholesale water rates. Some public agencies may also be eligible for financial assistance for the system retrofit.[9]

Delta Diablo Sanitation District

Serving the communities of Antioch, Bay Point, and Pittsburg, the Delta Diablo Sanitation District (Delta Diablo) is in the heart of the Delta, an area that provides 25 million Californians with a portion of their drinking water. The sanitation district processes and treats wastewater for tens of thousands of residents and businesses.

In 2000, Delta Diablo completed a treatment plant to produce recycled water, primarily to serve two major energy centers, Delta Energy Center and Los Medanos. The treatment plant now produces 12 million gallons of recycled water per day and more than 8,600 acre-feet per year—enough water for more than 17,000 families in California.

Power plants use water primarily for cooling, often taking their water directly from a river or the ocean. Power plants in the Delta may be one of the drivers behind the decline of the Delta Smelt, an endangered fish found only in the San-Francisco Bay Delta. Owned by CalPine Energy, Delta Energy Center and Los Medanos were required by law to run their plants on recycled water as part of their Federal Energy Regulatory Commission licensing. Delta Diablo delivered the water needed for their processes.



DELTA DIABLO SANITATION DISTRICT

Wastewater recycling facility at Delta Diablo.

Recycled water is cheaper to produce—and even uses less energy—than some sources of imported water. Untreated water provided by Contra Costa Water District costs $550 per acre-foot. With an approximate price of $1,200 per acre-foot, treated water costs more than twice as much. Tertiary-treated recycled water from Delta Diablo costs just $231 per acre-foot to produce. Simply put, recycled water is significantly cheaper for these businesses.

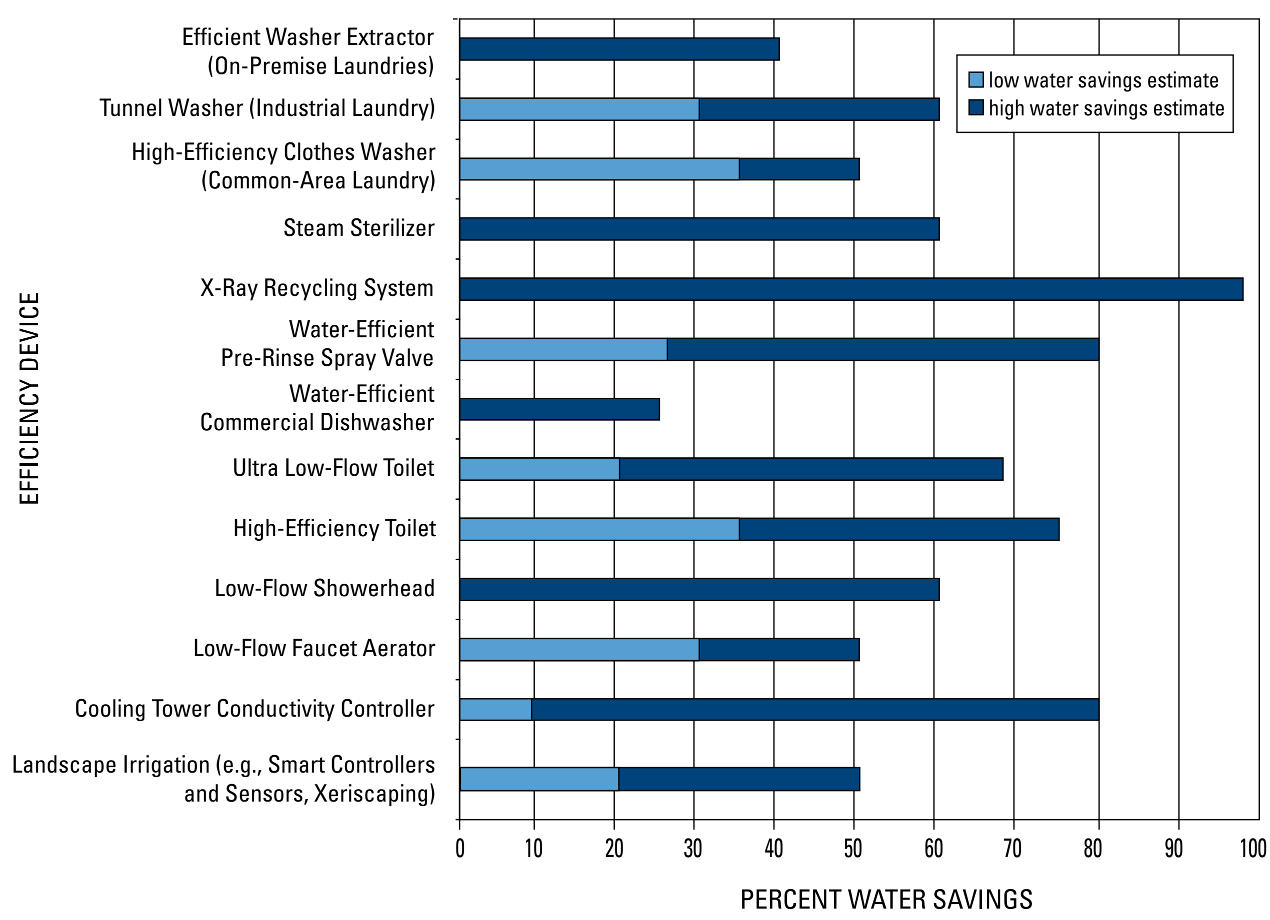
At this point, there is more industrial demand for recycled water than what Delta Diablo can serve. In addition to providing recycled water to the two power plants, which combined use more than 11,000 acre-feet of recycled water per year, the sanitation district sells recycled water to parks and golf courses in the city of Pittsburgh. Shortly, the municipal golf course in Pittsburgh will use recycled water almost exclusively (up to 575 acre-feet a year).

As the price for freshwater increases, recycled water becomes the more cost-effective and environmentally friendly option. As Karen Ustin of Delta Diablo said, "Recycled water is virtually drought-proof." People will continue to flush toilets and wash dishes, and Delta Diablo will continue to treat that water and provide it to commercial and industrial users.

Ms. Ustin recommends that any new power plant should use recycled water, if it is available, as the first option for cooling water. She also recommends that the state or the federal government invest in a regional project to develop more recycled water in the industrial corridor in the Delta.

It makes a lot more sense to use recycled water for industrial processes in the Delta than to further endanger the estuary by drawing off large amounts of freshwater.

Potential Water Savings from Installing Commerial Efficiency Devices



Increasing Low-Impact Development Reduces Water Consumption, Improves Water Quality, and Saves Energy

Low impact development uses common sense and simple technology—strategically placed beds of native plants, porous surfaces for parking lots and roads, and other tools—to retain rainfall on site and allow it to soak into the ground. Adopting low impact development practices has great potential to enhance water supply, protect water quality, and reduce greenhouse gas emissions.

Use of low impact development results in the diversion and capture of storm water and dry-weather runoff before it flows into surface waters. This water can then be used on- or off-site as an alternative water source for irrigation of parklands, sporting fields, cluster housing groups, or firefighting. Such an approach reduces storm water pollutants and saves energy by reducing the need for importing water.

Studies show that low impact development is a cost effective way to save water; total capital cost savings estimates range from 15 to 80 percent. For example, using low impact development at a single restaurant with a 30-car parking lot could capture enough water to meet the needs of a family of four for almost an entire year.[10] A preliminary estimate of the water savings from implementation of low impact development practices suggests that if low impact development were used in just 50 percent of all residential and commercial properties in Los Angeles, Riverside, and San Diego Counties, an additional 377,000 acre-feet of water could be infiltrated or otherwise reused each year. By offsetting energy-intensive imported water in like amounts, and after accounting for average energy requirements associated with pumping groundwater in these areas, low impact development could result in the reduction of up to 160,000 metric tons equivalent of CO_2 per year.[11]

CHAPTER 3

Examining CII Water Efficiency Successes and Potential in California

Some industries and institutions in California have achieved remarkable success implementing cost-effective technologies and processes to increase their water efficiency. Across the state, educational institutions and businesses making everything from soft drinks to microchips to paper pulp have developed innovative ways to save water.

Maximizing Water Efficiency at Bottling Plants

Beverage processing facilities use water for building operations (cooling, landscape, and restrooms) and in various phases of beverage manufacturing operations, including sanitizing containers, lubricating conveyor belts, and as part of the beverage itself. Beverage processors in California used 57,000 acre-feet of water in the year 2000—a 25 percent increase in water consumption since 1995. Approximately 46 percent of water used in beverage manufacturing plants is included in the final product. The other 54 percent is used in the beverage processing and building operations. By implementing water efficiency technologies and practices within processing and building operations alone, the beverage manufacturing sector has the potential to save between 6,000 and 10,000 acre-feet per year.[1]

Some beverage companies have made impressive commitments to improving their water efficiency. SAB Miller has committed to reducing its water use per liter of beer by 25 percent by 2015.[2] The Coca-Cola Company has committed to improve water efficiency by 20 percent by 2012, compared with a baseline of 2004.[3] Indeed, Coca-Cola, announced a goal to return to communities and to nature an amount of water equivalent to what they use in all of our beverages and their production. This means reducing the amount of water used to produce their beverages, recycling water used for manufacturing processes so it can be returned safely to the environment, and replenishing water in communities and nature through locally relevant projects.[4]

A bottling plant in San Leandro, California successfully implemented innovative technologies to cut water use and energy costs. They replaced their water rinsers used to clean beverage containers with de-ionized air rinsers. Site process water that was once discarded after one use is now funneled through a treatment system and reused for cooling and landscapes. Beverage containers are now shipped along a conveyor belt that uses a dry lubricant instead of a traditional water and soap lubricant. These retrofits save the facility millions of gallons of water per year.

Increasing Water Recycling to Supply Oil Refineries

California is home to more than 20 oil refineries. On average, 1,851 gallons of water are used to refine one barrel of crude oil. In 2005, California refineries produced 674 million barrels of oil and consumed 3.8 million acre-feet of water in the process. Petroleum refining is the industry with the highest water savings potential in California's industrial sector. It is estimated that petroleum refineries in California can reduce on-site water use by 39,000 to 78,000 acre-feet per year by adopting water-efficient technologies and practices.[5]

Oil refineries need water to operate cooling towers, flush out process equipment, and treat wastewater produced in the refining process. Chevron's Richmond refinery is East Bay Municipal Utility District's (EBMUD) largest customer. The facility uses an average of 10 to 12 million gallons of water every day—enough water to meet the indoor and outdoor needs of 30,000 EBMUD customers. In 1996, Chevron partnered with EBMUD to lower its freshwater consumption. EBMUD built a water reclamation plant that provides Chevron with 4 million gallons of recycled water every day for cooling and landscape maintenance.

EBMUD decided to focus on Chevron's boilers as a way to further reduce Chevron's potable water use. Boilers at refineries require ultra pure water (UPW)—potable water that goes through a purification process to ensure there are no harmful chemicals or bacteria in the water.[6] EBMUD, Chevron, and the West County Wastewater District are partnering to expand the recycled water facility to include an advanced recycling system at the refinery with the capacity to convert 4 million gallons of wastewater into UPW every day. EBMUD is responsible for building and maintaining the facility and Chevron is providing the land and paying for some of the operating costs. The recycled water rate is set for 25 years, at which point Chevron will have paid the cost of constructing the facility.[7] When the recycling system is completed in 2010, the Chevron refinery will use a total of 8 million gallons of recycled wastewater daily.

Meeting the High-Tech Demand for High-Quality Water

Semiconductor manufacturing—essential to computers, cell phones, and other consumer electronics—is a highly water-intensive process. The production of one semiconductor can require up to 2,400 gallons of potable water.[8] Much of the water used in the cleaning and processing of semiconductors must be either deionized or ultra pure water (UPW). A large facility can use up to 3 million gallons (more than 9 acre-feet) of UPW per day.[9] UPW is expensive to produce because it requires extensive treatment by public and private water suppliers.

Fortunately, 60 to 70 percent of UPW used in a manufacturing facility can be recycled on-site. For example, a reverse osmosis water recycling system reduces the amount of water used in the wafer production process. Leftover water from wafer processing can be transferred to other plant equipment such as scrubbers, waste drains, and cooling towers.

Driving Down Consumption for a Water Intensive Sport

Golf courses, especially in the western part of the country, use a tremendous amount of water. California has more than 900 courses which bring in nearly $7 billion dollars per year.[12] In California, 80 percent of the golf courses are located in areas that will be subject to water supply conflicts in the coming years.[13] In dry regions, golf courses typically irrigate for ten to twelve months out of the year.[14] Using turf for golf courses requires about 100,000 to 1,000,000 gallons per week depending on the climate and the size of the course.[15] The Northern and Southern California Golf Associations' survey of golf course superintendents found that the average statewide water use on a golf course was 345 acre-feet annually. The most recent data indicates that about 230,000 acre-feet of water is used to irrigate golf courses each year.[16]

A golf course water audit can assess the potential for recycled water use and the efficiency of current hardware like sprinkler heads and weather-based controllers, including the distribution uniformity of the sprinklers.[17] A 2003 study showed that replacing sprinkler heads with efficient models alone could result in more than a six percent water savings.[18] This not only saves water, but improves the uniformity of the turf on the golf course and can

Saving Water—and Giving It Back—in the High-Tech Sector

When Gordon Moore started Intel in Mountain View, California in 1968 he set out to build a revolutionary company with a minimal environmental footprint. With manufacturing plants all over the world, and many in very dry places, Intel has been forced to get smart about their water use. Since 1995, Intel has invested $100 million on water use efficiency, saving more than 90,000 acre-feet of water worldwide—or enough water to supply 180,000 homes for a year.

Their efforts are paying off. Intel's 1000-acre campus in Arizona was recently honored by the EPA as a Water Efficiency Leader. Intel designed their processing equipment to use 75 percent less water than the industry average.[10] Instead of using up to 8 million gallons of water per day, the Arizona Plant uses just 2.5 million gallons of water per day. Additionally, Intel constructed a system that treats water used at the Intel plant and then injects it into the local aquifer. Since its inception in 2000, the system has treated and injected more than 3.5 billion gallons of drinking-quality water into the aquifer.[11]

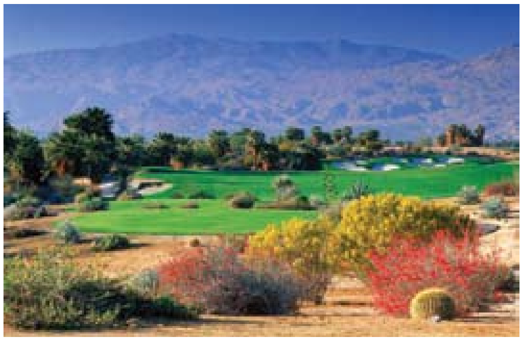
Intel relies on expert engineers to implement their water efficiency plans. Teams of representatives from most of the company's manufacturing plants communicate weekly to discuss ways to reduce the company's water use. The corporation also counts on the help of their local water agencies to implement their efficiency plans. At their plant in Santa Clara, California, Intel teamed up with the Santa Clara Valley Water District (SCVWD) and the City of San Jose's Water-Efficient Technologies Program.


INTEL CORPORATION

Intel's Corporate headquarters in Santa Clara, California.

One of the first things the water agency did was perform a "wall-to-wall" audit, which showed that air scrubbers and cooling towers were the largest users of water at the facility. Intel then developed a recycling system that allows them to take leftover water from the process of making Ultra Pure Water and reuse it for on-site cooling and landscaping. In place of the water generally used in air scrubbers to remove particulates and gases from the plant's emissions, Intel designed a way to use a caustic material to reduce emissions. Over the course of the retrofit, Intel received $175,000 in rebates from the SCVWD and the City of San Jose. Although the payback period was still fairly long (eight years), it made financial sense for the company and saved water.

Building a Water Efficient Golf Course in the Desert


DESERT WILLOW

Desert plants adorning the course consume less water.

Ten years ago, the designers of Desert Willow Golf Course located in Palm Desert, California decided to build something different. Rather than building the typical golf course in the desert, they and the owners decided to build a course irrigated almost entirely with recycled water—and to use less of it.

Palm Desert is in the Coachella Valley, a desert area known for its golf courses. Although Coachella Valley lies atop an aquifer and gets much of its water from the ground, the area also relies on imports from the Colorado River. With communities developing in the desert, and more than 120 golf courses in the area, the water district has to conserve and reuse its water.

Golf course water management can be challenging. Too much water and the golf ball thuds to the ground. Too little, and the grass withers. As a result, most golf courses in the area use sophisticated drip irrigation systems, weather stations, and a central irrigation control that continually checks for weather and soil conditions.[23] As Don Ackley of Coachella Valley Water District (CVWD) said, "Golf courses tend to be better irrigators than homeowners. The nature of golf is such that players demand a good playing surface. This dictates that you don't over- or under-water."

Desert Willow uses all of these sophisticated measures for saving water, but it goes several steps beyond other golf courses: it was designed to use less water. Built with less turfgrass and more desert plants, the course creates a striking contrast to the mountains behind it. By utilizing the water efficiency technologies available, Desert Willow has saved 565 acre-feet, or the equivalent cost savings of $84,600 a year.[24]

Recycled water uses a lot less energy than water pumped from the ground. One study showed that using recycled water requires less than half of the energy required when using groundwater.[25] In addition, using recycled water can be cheaper for the consumer. Given the 20 percent discount the Coachella Valley Water District offers for recycled water as compared to groundwater, golf course managers can irrigate their land for less using recycled water.[26]

improve water quality by reducing the amount of fertilizer and chemicals that runs off the course or leaches into the ground.

The savings potential for golf courses in California ranges from 56,000 to 212,000 acre-feet per year, with a best estimate of 85,000 acre-feet per year.[19] Reaching the high estimate for potential savings would be possible if all golf courses switched from potable freshwater to recycled water for their irrigation needs.

There is a strong economic incentive for saving water given that it represents one of the major operating costs for golf courses. According to the United States Golf Association, the industry has taken it upon itself to invest in research (nearly $18 million) on lower water use turf, improved irrigation practices, and alternative sources of water like recycled water.[20] Some courses in the Coachella Valley, which houses a third of all golf courses in Southern California, irrigate with recycled water. While significant strides have been made to reduce water use in this area, there is more to be done.

In an example outside of California, a recent study by the Golf Course Superintendents Association of America reveals that 29 percent of 18-hole golf course facilities in Georgia voluntarily participate in an environmental stewardship program.[21] These partnership between golf courses and the Georgia Department of Environment reduced water use by golf courses by 20 percent—before the state began its Level 2 drought preparation. By training golf managers in preparing water budgets, properly installing and maintaining smart controllers, planting more native vegetation, and educating managers that a drier course is preferable, golf courses in Georgia saved water and money.[22]

Using Less Water to Put Food on the Table

It takes water to make milk and cheese, to clean and pack vegetables and fruit, and to prepare meat for market. Water is used to pit, blanch, or peel fruits and vegetables—and more water is used to core, dice, and process the food down the line. Some studies show that it takes 500,000 gallons of water to produce one ton of canned cherries.[27] Current estimates indicate that agricultural processing, including meat, dairy, fruit, and vegetables, uses just more than 100,000 acre-feet of water per year in California.[28] This does not include the 30 million acre-feet per year used in the agricultural industry to grow food. More than 25 percent, or up to 27,000 acre-feet per year, can be saved by the agricultural processing industry in California by implementing conservation measures.[29]

Most water agencies already have guidelines for saving water, like installing high-pressure low-volume nozzles on spray washers, using fogging nozzles to cool the product, or installing in-line strainers on sprayers. There is more that a processing company can do, however, like ensuring all hoses are fitted with solenoid valves to stop the flow of water when production stops, reusing final rinse water, and recycling cooling water.

The owners of Stahlbush Island Farms—a farm and food processing company located outside Corvallis, Oregon—process more than a dozen fruit and vegetable products and are well aware of how water and energy intensive food processing can be. Blanching—a critical step in food processing—is particularly water and energy intensive. The owners installed a water-efficient blanching machine that saves the company $16,000 per year in energy and wastewater costs. In addition, the processing facility has an innovative water recycling and recovery system that allows water to be reused up to three times before it is discarded.[30] Since the business was started more than 20 years ago, total water consumption has been reduced by more than 50 percent.[31]

Innovation at the Vineyard

Since 1999, Fetzer Vineyard has worked hard to be water conscious in their operations. While the wine industry on average uses eight gallons of water to produce each gallon of wine, Fetzer's water-saving strategies have reduced their consumption to just 2.1 gallons for every gallon of wine. Fetzer has managed to reduce their total water usage by 24 percent (8 million gallons) annually. Water meters are located throughout the Mendocino County vineyard and are read weekly to determine where water is used and where it can be saved. As a result, the business is able to find and repair leaks more easily. They also use aeration ponds to treat their own wastewater, which is reused to irrigate the organic grapes and landscaping.[32]

FETZER VINEYARDS

Fetzer's vineyards consume roughly 75 percent less water than the industry average.

Increasing Recycled Water Use by Pulp and Paper Companies

The pulp and paper industry uses millions of gallons of water in the United States per day. It takes up to 17,000 gallons to process one ton of paper from wood that has been stripped, chipped, and formed into pulp.[33] This process is both water and energy intensive. In California, the industry uses 22,000 acre-feet of water per year.

One of the best ways for pulp and paper industries to save water and save money is to use reclaimed or recycled water. Some estimates show that the industry can save more than half of its water by recycling.[34] The process is fairly simple: water and effluent removed from the first "dewatering" process during pulp processing is reused in subsequent dewatering treatments. Metropolitan Water District reports that one pulp and paper company in its service area reduced its water bill by 35 percent and got a $600,000 rebate check by implementing a $3 to 4 million efficiency program.[35]

Learning and Implementing Water Conservation Strategies at Our Schools and Universities

California's schools consume more than 250,000 acre-feet of water each year. This water is distributed throughout various school facilities and operations such as restrooms and student housing, cafeterias and kitchens, gyms, laboratories, and irrigated landscaping. Installing water conservation measures and efficiency devices can reduce total water use on school and university campuses by an average of 44 percent. In California, potential total water savings range from 92,000 to 124,000 acre-feet per year.[36]

To achieve significant water savings in schools and universities, planning committees can change institutional practices, make infrastructure upgrades, and boost efficiency awareness among students, faculty, and staff through education campaigns.

It can be very cost-effective to retrofit building and dorm facility restrooms with water-efficient toilets, low-flow showerheads, and high-efficiency WaterSense® faucets. Installing water-efficient pre-rinse spray valves, dishwashers, and using water brooms rather than traditional hose nozzle sprayers to clean food service facilities can reduce water and energy use. Extensive landscaping commonly found at schools and universities can demand large amounts of water. Improving irrigation systems and practices can reduce total water use for irrigation by up to 50 percent.[37]

Rebates that encourage the implementation of water efficiency measures at schools and universities are available through some water agencies. The Santa Clara Valley Water District and the City of San Jose's Water-Efficient Technology Program encouraged Santa Clara University to replace 32 inefficient toilets with HETs and waterless urinals in student dormitories. The University received a rebate of $4,500 for the retrofit, which reduced the payback period to less than two years. Over the five-year minimum lifetime of the project, the University will save a minimum of 4.2 million gallons, or 13 acre-feet.[38]

Similarly, EBMUD and the University of California, Berkeley (UC Berkeley) are working to install a recycled water treatment plant that could treat 25,000 gallons per day to irrigate campus landscapes. EBMUD estimates that the treatment plant could save UC Berkeley $7,500 annually in water and wastewater costs, as well as provide reliable water supply for irrigation during water shortages. EBMUD will be responsible for the financial costs of installation and maintenance of the plant.[39]

CHAPTER 4

Case Studies: Successful Water Agency Programs

Some water agencies have had tremendous success working with CII customers to overcome the many challenges they jointly face when implementing water efficiency programs. In this chapter we highlight several programs that exhibit novel approaches for realizing win-win benefits for the water agencies, their customers, and all who depend on shared water resources in their region.

Taking a Regional Approach in Southern California

The Metropolitan Water District of Southern California (Metropolitan) provides water to more than 18 million people in an area exceeding 5,000 square miles. Metropolitan works with retail and wholesale agencies within its service area and provides several very significant regional programs in conservation.

Launched in 2001, the CII program is led by Bill McDonnell, who manages a team working to implement innovative efficiency projects in the region. In the program's early phases, Mr. McDonnell met with member agencies to discuss ways to improve activity in the CII water efficiency sector. At that time, CII programs were funded by Metropolitan but managed by each city or water agency. In response to water agencies' expressed desire for training to better understand the technology and potential for real economic savings, Metropolitan developed a series of classes for member agencies' conservation staff to educate them about commercial toilets and urinals, cooling towers, and washing machines. Unfortunately, this effort did not increase conservation savings. What they did next, however, transformed the program.

Developing the One-Stop-Shop Solution

The water agencies shared with Metropolitan their desire for a regional approach to the problem instead of the existing patchwork of CII programs operating with different applications, rules, and vendors. With a "one-stop-shop" solution in mind, Metropolitan approached the U.S. Bureau of Reclamation to request a grant to start a regional rebate program for their entire service area. The Bureau of Reclamation awarded $250,000 to Metropolitan to increase rebates for certain technologies and to pay a vendor to implement the CII program on a regional basis. The success of the program quickly became evident as participation grew and funds were spent at a rate that would exhaust the grant within less than a year. Metropolitan's Board of Directors, seeing the success in the pilot regional program, then allocated nearly $8 million dollars for a regional rebate program.

ANTHONY CLARK

Metropolitan works with CII facilities throughout the San Diego area.

The CII program currently operates with Metropolitan hiring a vendor through a request for proposal (RFP) process every five years; Honeywell International Inc. is the current vendor. The vendor markets the program, maintains a web page, answers the phone, keeps a database of the program's participants, activities, and expenditures, and cuts the check to the customer. The vendor has an incentive to do this work well because it gets paid on a per-unit basis for each rebate in addition to a marketing fee based on the water savings for the technology. This creates an even greater incentive for the vendor to market a product that saves more water. To increase the flexibility of the program, member agencies can add additional funding to the program for customers in their area.

The regional approach also works well for state grants to add funding and for partnering with energy utilities like SoCal Gas or Southern California Edison. Energy utilities would not be able to partner with hundreds of individual cities, but with a "one-stop-shop" approach under a single vendor, energy utilities can partner with Metropolitan on common technologies such as ice machines, washing machines, pre-rinse spray valves, food steamers, and more.

The success of the CII program led to the inclusion of multifamily residential properties into the program a few years ago. Multifamily properties are often owned by large businesses that own many properties throughout a service area and it therefore made sense to have them under the regional CII program**.**

In addition to rebate for specific water saving technologies, Metropolitan offers a Measured Water Savings Program that pays $195 per acre-foot of water saved. This program is for customers who have customized processes like laundry, metal plating, or beverage. The customer first develops their efficiency program. Metropolitan then reviews the program, and if approved, signs a contract with the customer. After the system is installed and operating, the customer can receive up to one half of their projected incentive payment. After a year of monitoring, the customer is paid the remainder based on actual water saved.

Working Closely with Public Agencies and Homeowners to Increase Water Efficiency

Metropolitan recently launched a new pilot program called the Public Sector Program to assist public agencies. This program provides an even higher incentive for saving water that is 2.5 times more than the standard rebate—up to $500 per acre-foot saved. This funding is up front because most public agencies like school districts do not have the funding to buy equipment and then apply for a rebate. The Public Sector Program also provides funding to assist a public agency such as a park with the cost of connecting to a recycled water supply. This program has been so successful that two years worth of funding was allocating within nine months of the program's inception.

The regional approach to water conservation piloted by this CII program has proven to be very successful and is now the model for Metropolitan's other conservation programs. In 2008, Metropolitan launched a regional residential program modeled on the CII program. Once again, the one-stop-shop setup works well for both the water agency and for the customer.

Linking Water Efficiency, Energy Savings, and Global Warming South of the Bay

The Santa Clara Valley Water District (SCVWD) is a wholesale water supplier for 15 cities and more than 45,000 CII establishments through its service to 13 water retailers. The district has an array of water efficiency programs that target CII customers, including free water surveys and rebates for installing water-efficient technologies. In fiscal year 2006 to 2007, the district's CII efficiency programs achieved an annual water savings of 9,800 acre-feet.

The SCVWD is also at the forefront of linking their water efficiency programs to the state's efforts to reduce global warming emissions. The District recently examined the energy savings and reductions in carbon dioxide and other air emissions that occurred as a result of its water use efficiency programs. During the period beginning with their fiscal year 1992 through their fiscal year 2006, the District saved 1.42 billion kWh of energy (worth $183 million assuming average residential electricity rates) and eliminated almost 370,000 tons of carbon dioxide emissions; the latter is equivalent to removing 72,000 passenger cars from the roads for one year.[1]

SCVWD's Commercial Washer Rebate Program offers CII customers a rebate of $400 for each leased or purchased commercial high-efficiency washer. The program has issued more than 2,900 rebates and has saved 450 acre-feet of water since the program's inception in 2000. The HET program was developed with the help of a $500,000 grant from the California Department of Water Resources. Over the last four years, SCVWD has installed 11,000 water-efficient toilets in nine different CII sectors; the per sector savings range from 21.6 gallons per HET per day to 77 gallons per HET per day, with an average savings across all nine sectors of approximately 43 gallons per HET per day.[2] In addition, the SCVWD has participated in the CUWCC's Rinse and Spray pre-rinse spray valve program and has successfully installed 3,511 sprayers since the program started in 2003.

The flexibility of the SCVWD's and the City of San Jose's innovative Water-Efficient Technologies Program (WET) has attracted more than 75 CII customers. The WET Program provides rebates of up to $50,000 for implementing any process, technology, and equipment retrofits that reduce business water usage by at least 74,800 gallons annually. The program, funded jointly by SCVWD and the City of San Jose, has provided $1.6 million in rebates with an expected savings of more than 2.2 billion gallons over the lifetime of the projects.[3]

Pioneering Water Conservation around the East Bay

The East Bay Municipal Utility District (EBMUD) was one of the very first water agencies in the nation to develop a conservation program. Since EBMUD conducted its first CII water audit in 1992, the agency has built an extensive program that offers its CII customers a variety of services and rebate programs to help businesses save money by reducing water and energy consumption. With their facilities right on the edge of the San Francisco Bay adjacent to the port of Oakland, EBMUD has 26,000 CII service accounts.

The objective of EBMUD's CII program is to help the agency reach its water conservation savings goal of 35 million gallons per day by 2020. EBMUD aims to further reduce water use by increasing its water recycling capacity to 5.1 billion gallons per year by 2020. The CII program is funded primarily by rates and additional outside grants from agencies such as the California Department of Water Resources, the Bureau of Reclamation, and the Environmental Protection Agency.

To achieve their conservation goals, EBMUD provides free water surveys for all of its CII customers. Surveys include a review of domestic, sanitary, landscape, and process water usage and recommendations for increasing water-use efficiency. Based on water survey findings, EBMUD offers rebates for eligible water saving equipment and fixtures to offset a portion of the cost and shorten the payback period for customers. EBMUD also helps customers prevent water waste by providing leak repair and site maintenance. Some of the most successful rebate programs include toilet replacement, commercial clothes washer rebates, and commercial dishwashing spray valve replacements. In 2007, EBMUD provided 128 CII customers indoor conservation rebates totaling $22,000 that resulted in a savings of more than 130 million gallons (400 acre-feet) of water.

Some examples of EBMUD CII projects include:

- EBMUD worked with the Hilton Garden Inn in Emeryville to help implement an ozone cleaning system at their laundry site. The hotel is able to save approximately 2,200 gallons of water usage per day for their laundry services. Based on a 10-year measured life and two-year payback period, EBMUD issued the hotel a $1,740 financial incentive rebate for their water conservation efforts.
- The Kaiser Foundation Health Plan in Oakland was approved for an EBMUD grant of $21,879 to install 172 high efficiency toilets and 61 urinals. The retrofit is estimated to save close to 2.5 million gallons of water each year and save Kaiser $15,900 per year in avoided costs. The project payback period for the Kaiser Foundation is less than six years.
- EBMUD now has seven recycled water projects underway in their service area. Customers include the Richmond Country Club, Chevron Refinery, and Alameda County. The projected savings upon completion of all seven recycling projects is 6 million gallons per day, or more than 67,000 acre-feet per year.

Building Water Savings in from the Beginning
EBMUD is launching a pilot program funded by a DWR grant to work with the building commission during the planning review process for all new CII buildings. The goal of this pilot project is to incorporate water efficiency technologies in the design and construction of new commercial and industrial facilities. Requiring certain water efficiency standards for new development is more cost-effective for both water utilities and businesses than retrofitting businesses with water-efficient technologies after construction.[4]

Creating a Market for Water Savings in the Bay Area

The San Francisco Public Utilities Commission (SFPUC) is the third largest municipal utility in California, serving 2.4 million residential and CII customers in the Bay Area. Roughly one-third of their delivered water goes to retail customers in San Francisco, while the other two-thirds is delivered to 28 wholesale suburban agencies in Alameda, Santa Clara, and San Mateo counties.

In 2006, the SFPUC launched a two-year pilot program called Water Savers, which targets high water users in the CII sector. This program is unique because it takes a performance-based approach—offering financial incentives based on the volume of water saved—that differs from many device-based programs that measure success solely by the number of products installed or number of rebates issued. The goal of the Water Savers program is to create an open market for water savings, with vendors bidding on a volume of water savings and proposing reasonable, lasting, and cost-effective ways to meet the savings goals. The process is designed to draw from the skill, experience, and creativity of the water conservation community and to focus the process on the desired outcome of water savings.

The program offers customers flexibility. Any water conservation project is eligible for financial assistance so long as it meetings the following three criteria:

- savings must be "permanent" (defined as having at least a 10 to 15 year lifetime);
- savings must result from activities or devices that are not captured in the plumbing code; and
- savings must be measurable and verifiable (6 weeks of metering before and after)

A number of interesting projects have been initiated, including one at a large historic hotel in San Francisco. By replacing 28 water-cooled ice machines with air-cooled machines, the hotel saves $112,000 annually in water and wastewater costs. The SFPUC paid 57 percent of the total project cost, reducing the payback period for the hotel's initial investment down to four months.

The Water Savers program has proven to be cost-effective for both customers and the water district. Conservation projects implemented cost significantly less than the cost of water and the return on investment for customers ranged from four months to three years. The SFPUC sees their performance-based program as the next logical step at achieving cost-effective, guaranteed savings in the commercial sector, which is traditionally hard to reach due to lack of uniformity.

CHAPTER 5

Conclusion and Recommendations

The research and case studies presented in this issue paper make clear that despite important progress made during the last decade to improve water efficiency in the CII sector, tremendous untapped potential remains. Efforts to realize this potential are hindered by a lack of funding, inadequate data, and a relatively low cost for water that obscures the true cost of business-as-usual water consumption and the value of increased efficiency. NRDC has identified several of the key barriers to increasing CII efficiency and developed a list of recommendations for water agencies and governments at the federal, state, and local level to overcome those barriers. By implementing these recommendations, we can stretch limited water supplies, save businesses money, reduce energy consumption, improve water quality, and protect local ecosystems.

Lack of Customer Capital or Awareness of Financial Assistance
Some businesses simply do not have the capital for large scale retrofits. It can cost millions of dollars to install a deionizing or reverse osmosis system that will allow a silicon manufacturer to reuse water, or tens of thousands of dollars to change out existing landscapes for more water efficient alternatives. In some cases water agencies have rebate programs but not the capability to inform their customers about these programs, leaving those customers unaware of the cost-effective benefits of retrofitting their high water use devices.

Insufficient Funding for Rebate Programs
Larger water agencies like Metropolitan can offer an avoided-cost rebate (paying a business to save water) or a wide range of more traditional rebates. Smaller water agencies do not always have the funds to offer rebates and rely instead on the state or federal government to fund their conservation programs. With the current budget concerns at the state and federal level, reduced funding may prevent water agencies from offering significant rebates to their customers.

Lack of Technical Assistance and Shortage of Trained Staff
Although technical expertise in the field of water efficiency is in high demand, the availability of such assistance lags far behind. The lack of trained staff at water agencies possessing the significant technical expertise required

to install and maintain water-efficient technologies remains a significant barrier. And the staffs devoted to conservation at many smaller water agencies tend to be too few, thereby limiting the potential for water agencies to work with potential CII customers.

Lack of Data

Good information is the foundation of sound resource planning and management. Water resource management in California is handicapped by inadequate, incomplete, and potentially inaccurate information about water use. Indeed, the Department of Water Resources recently assessed the state of water use data and found that the DWR Public Water Systems Survey is collected voluntarily, which impacts data completeness and accuracy, and does not include information from 2005 to the present.1 Furthermore, California is one of two states in the U.S. that does not measure or regulate groundwater use. To meet achievable water conservation targets in the CII sector and others, the State of California should implement comprehensive electronic statewide water use reporting and consolidate that information into a shareable central database.

Third Party Lessors and Misaligned Incentives

Businesses that lease their equipment from a third party that assumes responsibility for its maintenance and operation may face an additional barrier when trying to retrofit appliances and process equipment. Since they are not generally responsible for the cost of operating the leased equipment, lessors frequently have no incentive to increase the equipment's efficiency. Providing incentives to lessors is critical to improving adoption of water and energy efficient technologies.

Relatively Low Water Costs

The relatively low cost of water and wastewater disposal in California leads many businesses to overlook the many benefits of increasing their water efficiency. Given the small portion of overall operating costs water may represent, businesses often are not motivated to make efficiency improvements even if those measures are cost-effective with short payback periods.

Incompatible Expectations for Returns on Investment

Businesses often make capital investment decisions with the expectation of short-term returns on their investment (ROI). The ROI for utility-based rebate programs may be spread out over years (still short when compared to water supply projects that take as long as a decade to plan, design, and build). In effect, a utility and its CII customers calculate the value of money over time in very different ways. The difference in what is a reasonable time period for an ROI, sometimes combined with differences in the calendar periods upon which utilities and businesses may plan, can create significant barriers to aligning the investment strategies of both parties.

Recommendations for Improving CII Water Efficiency

1. **Establish efficiency standards for water-using products.** The California Energy Commission (CEC) should establish such standards for buildings, appliances, and landscape irrigation equipment. Setting robust efficiency standards will play a critical role in spurring innovation to bring more water-efficient technologies to market and in accelerating their adoption in the CII sector.
2. **Set performance-based water savings targets that provide water agencies with flexibility.** The State of California should establish a savings target and allow agencies to choose the measures most appropriate for their region in order to reach established targets. A 20 percent target appears to be well within the range of cost-effective savings.

3. **Prioritize water conservation above increasing supply.** The State of California should codify the requirement that efficiency improvements precede supply side resources—as it did in the energy sector—to motivate investment in water efficiency and recycling by agencies who might otherwise be awaiting development of traditional water supplies.
4. **Adopt a Public Goods Charge on water sales to provide a dedicated funding source for water efficiency programs, including expanded technical and financial assistance.** A dedicated funding source, based on a small additional charge for each gallon of water delivered, could provide a reliable source of funds for water efficiency and recycling programs.
5. **Encourage partnerships with—and financial support from—energy utilities and wastewater agencies.** Such partnerships reflect the multiple benefits of water efficiency and could help direct additional resources to efficiency programs. In addition, integrated energy and water audits save customers time and may uncover efficiency measures that would not be cost-effective if water and energy were considered separately. The State of California should consider giving preferential funding for projects involving such partnerships.
6. **Streamline the process for recycled water use.** The State Water Resources Control Board should adopt a general permit for use of recycled water for landscape irrigation while also ensuring protection of water quality.
7. **Encourage volumetric pricing for sewer services.** Studies show that a 10 percent increase in water price results in a 2 to 3 percent reduction in demand. By increasing the price signal, volumetric rates for sewer service could dramatically reduce demand for water use and disposal.
8. **Decouple water agencies' sales from revenue.** Water agencies should not need to rely on water sales to assure their fiscal stability. Water agencies should instead adopt a structure that allows them to recover additional money from customers if sales are significantly below projections. This revenue adjustment mechanism will enable water agencies to aggressively promote efficiency and maximize the conservation price signal for customers.
9. **Improve water use data collection and management.** The state should implement comprehensive electronic statewide water use reporting and consolidate that information into a shareable central database. The data should be collected with sufficient granularity to help assess efficiency and to identify and target sectors with high potential for improvement.

Endnotes

EXECUTIVE SUMMARY

1 The CII sector is comprised of commercial water users that provide or distribute a product or a service, industrial water users that are primarily manufacturers or processors of materials, and institutional water users that include all establishments dedicated to public service.

2 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 77.

3 Ibid. p. 95.

4 Ibid. p. 77.

5 Cost-effective is defined as economical in terms of the goods or services received for the money spent.

6 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.77.

7 Vickers, Amy, *Handbook of Water Use and Conservation.* (Amherst, Massachusetts: WaterPlow Press, 2001). p.329.

8 The avoided cost of water refers to the incremental savings associated with not having to produce additional units of water or water service while meeting demand requirements. Not all water agencies pay the same amount for per acre-foot of water, so the avoided cost per acre-foot varies.

9 United States General Accounting Office, "Freshwater Supply: States' Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages," July 2003. Available at: http://www.gao.gov/new.items/d03514.pdf

10 California Energy Commission, "Water-Related Energy Use in California," available at http://www.energy.ca.gov/2007publications/CEC-999-2007-008/CEC-999-2007-008.PDF

11 Santa Clara Valley Water District, *From Watts to Water: Climate Change Response through Saving Water, Saving Energy and Reducing Air Pollution*, (Santa Clara, CA: Santa Clara Valley Water District, 2007).

CHAPTER 1

1 The CII sector is comprised of commercial water users that provide or distribute a product or a service, industrial water users that are primarily manufacturers or processors of materials, and institutional water users that include all establishments dedicated to public service.

2 Vickers, Amy, *Handbook of Water Use and Conservation.* (Amherst, Massachusetts: WaterPlow Press, 2001). p.239

3 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 83.

4 Ibid.

5 Hanak, Ellen and Matthew Davis, *Lawns and Water Demand in California*. (San Francisco, CA: 2006) Available at: http://www.ppic.org/main/publication.asp?i=691

6 Many water agencies offer landscape audits that are certified by the Irrigation Association. The Environmental Protection Agency, through its WaterSense® program, now also certifies irrigation specialists.

7 Aquacraft Inc. "Interim Process Evaluation Report on Prop 13 Smart controller Programs," August 10, 2006. Available at: http://www.cuwcc.org/WorkArea/showcontent.aspx?id=2260

8 Some water agencies in California are offering their CII customers rebates to replace grass with synthetic turf. However, synthetic turf is not appropriate for all applications. There are many varieties of artificial turf including some that are made with recycled tires, which can have high amounts of lead. This public health concern led health officials in New Jersey to shut down its synthetic turf-laden sports fields after they were shown to have high levels of lead, further prompting the United State Consumer Product Safety Commission (CPSC) and the EPA to study the risks of lead exposure. In June of 2008, the CPSC reported that their studies indicated that the threat to lead exposure was minimal, but still recommended that manufacturers reduce the amount of lead used in synthetic turf fibers. Lead is not the only problem; opponents also say that turf is hot, with the surface reaching up to 160 degrees Fahrenheit. As a result, synthetic turf on athletic fields in certain climate zones must be "watered down" to cool surface temperatures before it can be used. Clearly, these risks need to be considered before a business or agency switches to artificial turf.

9 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

10 Smart Water Application Technology, "Landscape Contractors," available at http://www.irrigation.org/SWAT/Industry/

11 Metropolitan Water District, "Save a Buck Program," Available at: http://www.mwdsaveabuck.com/devices_01.php?id_dvce=8

12 Docket No. 09-AAER-1A. Information available at http://www.energy.ca.gov/appliances/irrigation/notices/2009-04-01_notice_workshop.html

13 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 91.

14 Alliance For Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx

15 North Carolina Department of Environment and Nat Resources, "Water Conservation Guide," available at www.p2pays.org/ref/41/40077.pdf - 2007-03-07.

16 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.83.

17 Vickers, Amy, *Handbook of Water Use and Conservation.* (Amherst, Massachusetts: WaterPlow Press, 2001). p. 290.

18 Ibid. p.303.

19 Alliance For Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx.

20 Metropolitan Water District of Southern California, "Cooling Tower Conductivity Controllers," available at http://mwdsaveabuck.com/devices_01.php?id_dvce=6

21 California Urban Water Conservation Council, "Conservation Programs for CII Accounts," available at *www.cuwcc.org/WorkArea/downloadasset.aspx?id=9892.*

22 San Diego County Water Authority, "The 20 Gallon Challenge," Available at: http://www.20gallonchallenge.com/partners.html

23 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California Appendix E.* (Oakland, CA: Pacific Institute, 2003). p.14.

24 California Urban Water Conservation Council, "Conservation Programs for CII Accounts," available at *www.cuwcc.org/WorkArea/downloadasset.aspx?id=9892*

25 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

26 Ibid.

27 U.S. Environmental Protection Agency WaterSense® website, http://www.epa.gov/watersense/.

28 http://www.allianceforwaterefficiency.org/hotels_and_motels.aspx.

29 The North Carolina Division of Pollution Prevention and Environmental Assistance, "Hotel/Motel Waste Reduction," available at http://www.p2pays.org/ref/14/13910.pdf

30 Santa Clara Valley Water District "CII baseline Water Use and Conservation Baseline Study," available at http://www.valleywater.org/conservation/media/Documents/CII%20Baseline%20Study_COMPLETE.pdf.

31 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

32 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.81.

33 Vickers, Amy, *Handbook of Water Use and Conservation.* (Amherst, Massachusetts: WaterPlow Press, 2001). p.303.

34 Koeller & Company, (2005) "High-Efficiency Plumbing Fixtures – Toilets and Urinals," pg. 10. Available at: http://www.allianceforwaterefficiency.org/toilet_fixtures.aspx

35 Metropolitan Water District, "Save a Buck Program," Available at: http://www.mwdsaveabuck.com/devices_01.php?id_dvce=3

36 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

37 Ibid. Available at: http://www.mwdsaveabuck.com/devices_01.php?id_dvce=14

38 Metropolitan Water District, "Save a Buck Program," Available at: http://www.mwdsaveabuck.com/devices_01.php?id_dvce=3

39 U.S. EPA WaterSense® Program, "The WaterSense Current," Available at: http://www.epa.gov/watersense/news/current/summer2008.htm#5

40 Karen Morvay, Presentation at the AWWA Water Sources Conference, February 7, 2006, available at http://209.85.173.132/search?q=cache:xR9WJrw1U20J:www.cuwcc.com/WorkArea/downloadasset.aspx%3Fid%3D8066+high+efficiency+toilets+in+the+commercial+sector&hl=en&ct=clnk&cd=3&gl=us&client=mozilla

41 Personal Communication with manager of the Gaia Hotel, November, 2008.

42 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.82.

43 Alliance For Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx

44 Ibid.

45 United States Environmental Protection Agency, Summary of Rationale for ENERGY STAR® Commercial Dishwasher Specification," February 2008, available at http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/Comm_Dishwasher_Decision_Memo.pdf

46 Santa Clara Valley Water District "CII baseline Water Use and Conservation Baseline Study," available at http://www.valleywater.org/conservation/media/Documents/CII%20Baseline%20Study_COMPLETE.pdf.

47 Metropolitan Water District of Southern California, "Pre-rinse spray valves," available at http://mwdsaveabuck.com/devices_01.php?id_dvce=5

48 Alliance for Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx

49 The California Urban Water Conservation Council (CUWCC), a partnership comprised of 396 water suppliers, environmental groups, and other stakeholder groups, work together to establish best management practices for water conservation and efficiency in California.

50 Ibid. p. 5.

51 Estimates show that there are more than 35,000 coin-op laundries in the US, with more than 400,000 commercial washers associated with them. (Coin-op Laundry Association).

52 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

53 Alliance For Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx

54 Ibid.

55 Ibid.

56 Ibid.

57 California Urban Water Conservation Council, "High-Efficiency Clothes Washers (HEWs)," available at http://www.cuwcc.org/products/high-efficiency-clothes-washers-main.aspx

58 According to the U.S. Department of Energy, the Water Factor is a the number of gallons per cycle per cubic foot that the clothes washer uses. The lower the water factor, the more efficient the washer is. So, if a clothes washer uses 30 gallons per cycle and has a tub volume of 3.0 cubic feet, then the water factor is 10.0.

59 Alliance for Water Efficiency, "Laundromats and Common Area Laundry Facilities," Available at: http://www.allianceforwaterefficiency.org/laundromats.aspx

60 Calculation based on: Alliance for Water Efficiency, "Laundromats and Common Area Laundry Facilities," Available at: http://www.allianceforwaterefficiency.org/laundromats.aspx

61 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," Available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

62 Flex your Power "Laundromats," Available at: http://www.fypower.org/com/sbs/laundry.html

63 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 81.

64 Ibid.

65 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California Appendix C*. (Oakland, CA: Pacific Institute, 2003). p. 7.

66 Ibid. p.8.

67 Santa Clara Valley Water District, "Water Efficient Technologies (WET) Program," available at http://www.valleywater.org/Water/Water_conservation/In_business/WET_Program/WET_FAQs.shtm

68 Personal communication with Chris Dundon of Contra Costa Water District

69 A "closed-loop" system allows most or all wastewater to be reused internally, requiring only small amounts of freshwater to replace water lost to evaporation.

70 Personal communication with Lou Bautista of Marcel Electronics International

71 Southwest Florida Water Management District, "Hospital Checklist," available at http://www.swfwmd.state.fl.us/conservation/waterwork/checklist-hospital.html

72 Metropolitan Water District of Southern California, "X-Ray Film Processor Recirculation System," available at http://mwdsaveabuck.com/devices_01.php?id_dvce=7

73 http://www.sterilizer.net/news

74 Personal Communication with Gary Tilkian, CII Commercial Water Conservation division of Metropolitan Water District of Southern California, Jan, 7, 2008.

CHAPTER 2

1 http://www.israelnationalnews.com/News/News.aspx/130565

2 California Air Resources Control Board, "Proposed WETCAT Strategies and Measures," March 24, 2008. Available at: http://www.waterplan.water.ca.gov/docs/meeting_materials/ac/03.20-21.08/wetcat-strategy_summaries3-24-08.pdf

3 "The Role of Recycled Water in Energy Efficiency and Greenhouse Gas Reduction." California Sustainability Alliance 2008. Available at: http://www.sustainca.org/files/FINAL%20RECYCLED%20WATER%20MAY%202%202008a.pdf

4 This is the case with the city of Roseville. A number of other cities charge significantly less for recycled water.

5 City of Roseville, http://www.roseville.ca.us/eu/water_utility/water_conservation/for_business/programs_n_rebates.asp.

6 Personal communication with Lauie Steer from East Bay Municipal Utility District, January 22, 2009.

7 Personal communication with Ray Mokhtari from Metropolitan Water District of Southern California, January 8, 2009.

8 Orange County Water District, "Groundwater Replenishment System," Available at: http://www.gwrsystem.com/about/facts.html

9 From http://www.bewaterwise.com/PubSectorProg/PublicSectorFactSheet.pdf and personal communication with Bill McDonnell, Senior Resource Specialist, Metropolitan Water District of Southern California.

10 Horner, Richard, "*Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County,"* (Feb. 2007) p.15. Available at: http://www.projectcleanwater.org/pdf/permit/case-study_lid.pdf. The prototypical restaurant studied by Dr. Horner would capture 0.88 acre-ft. of runoff per year. A typical family of four uses approximately 1 acre-foot of water per year.

11 Horner, Richard, "*Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County,"* (Feb. 2007). Available at: http://www.projectcleanwater.org/pdf/permit/case-study_lid.pdf

CHAPTER 3

1 Horner, Richard, *"Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County,"* (Feb. 2007). p. 95.

2 http://www.sabmiller.com/files/newsreleases/newsrelease_131108_newwatertarget.pdf

3 http://www.thecoca-colacompany.com/citizenship/pdf/wwf_partnership_fact_sheet.pdf

4 http://www.thecoca-colacompany.com/citizenship/water_pledge.html

5 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.91.

6 Ibid.

7 East Bay Municipal Utility District, 2007 Water Conservation/Water Recycling Annual Report, Available at: http://www.ebmud.com/about_ebmud/publications/annual_reports/2007_wc_ar.pdf.

8 Texas Agricultural Experiment Station, "Efficient Water Use for Texas: Policies, Tools, and Management Strategies," September 2002, available at http://twri.tamu.edu/reports/2002/tr200/tr200.pdf.

9 Pacific Northwest Pollution Prevention Resource Center, "Energy and Water Efficiency for Semiconductor Manufacturing," February, 2000, available at http://www.p2pays.org/ref/04/03271/.

10 Personal conversation with Tom Cooper, Intel Conservation Manager, November, 2008.

11 Ibid.

12 http://www.scga.org/tourney/showhot.cgi?file=CVWaterSymposium1031.res

13 http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf

14 Southern California Golf Association, et al., "Improving California Golf Course Water Use Efficiency," available at http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf http://www.owue.water.ca.gov/docs/2004Apps/2004-079.pdf

15 Alliance for Water Efficiency, "AWE Resource Library: Commercial, Institutional, and Industrial Water Users," available at http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx.

16 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 79.

17 The most common calculation for uniformity is known as Distribution Uniformity or DU. DU is the ratio of the dry or under-watered area to the average applied within the sprinkler coverage area.

18 Zoldoske, D, "Improving Golf Course Irrigation Uniformity: A California Cast Study," (The Center for Irrigation Technology, 2003). Available at: http://cati.csufresno.edu/cit/Golf%20Course%20Irrigation%20Nozzle%20Study.pdf

19 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California Appendix E*. (Oakland, CA: Pacific Institute, 2003). Available at: http://www.pacinst.org/reports/urban_usage/appendix_e.pdf

20 Use of recycled water for golf courses is mandatory at some water agencies in the southwest. Personal communication with Don Ackley of Coachella Valley Water District.

21 Brzozowksi, Carol, "Water Savings Under Par," Water Efficiency, available at http://www.waterefficiency.net/may-june-2008/water-savings-par-2.aspx

22 Green, Robert, "Trends in Golf Course Water Use and Regulation in California**,"** University of California, Riverside, available at http://ucrturf.ucr.edu/topics/trends_in_golf_course_water_use.pdf and http://www.waterefficiency.net/may-june-2008/water-savings-par-2.aspxes.

23 Central Controllers can control timers and sprinklers remotely. If it starts to rain, a facilities manager can, with a flip of a switch, turn off the sprinklers. It's ease of use offers more control to the manager, and prevents someone from having to turn off each sprinkler separately.

24 Personal communication with Donald Ackley from Coachella Valley Water District, December, 30, 2008.

25 http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF A study of the energy requirements of different water supply options in the Inland Empire Utilities Agency showed that the recycled water used 1228 kWh per million gallons of water, and groundwater pumping used 2915 kWh per million gallons.

26 Personal conversation with Olivia Daniels at Coachella Water District, January 9, 2009.

27 North Carolina Department of Environment and Natural Resources, "Water Efficiency Fact Sheet," available at http://www.p2pays.org/ref/04/03106.pdf

28 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.79.

29 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p. 95.

30 Oregon Department of Energy, "Sustainable farmers find food processing requires large volumes of energy,water resources," Available at: http://www.nwfpa.org/eweb/docs/Energy_Portal_Doc/Efficiency_Practices/general%20case%20studies/Stahlbush%20Energy%20Efficient%20Blancher%20FIRE%20Case%20Study.pdf

31 Masanet,Eric, *Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry. An ENERGY STAR Guide for Energy and Plant Managers*, (Lawrence Berkeley National, 2008). Laboratory Available at: http://repositories.cdlib.org/cgi/viewcontent.cgi?article=6463&context=lbnl

32 Personal Communication with Ann Thrupp, sustainability specialist at Fetzer Vinyard, January 9, 2009/ __

33 Vickers, Amy, *Handbook of Water Use and Conservation.* (Amherst, Massachusetts: WaterPlow Press, 2001). p. 266.

34 Ibid.

35 Personal Communication with Bill McDonnell from Metropolitan Water District.

36 Gleick, P. et al., *Waste Not Want Not: The Potential for Urban Water Conservation in California*. (Oakland, CA: Pacific Institute, 2003). p.90.

37 Alliance for Water Efficiency, "*Schools and Universities Introduction*," Available at: http://www.allianceforwaterefficiency.org/Schools_and_Universities.aspx

38 It should be noted that the Water Efficient Technologies rebate program assumes a minimum project life expectancy of five years for the purposes of cost-benefit calculations. It is possible (and quite likely) that projects remain in place for longer than that, increasing the water savings values. For example, waterless urinals have a device lifespan of 25 years. Further information about water savings opportunities in the CII sector for Santa Clara County can be found in the Santa Clara Valley Water District's CII baseline report. Available at: http://www.valleywater.org/conservation/media/Documents/CII%20Baseline%20Study_COMPLETE.pdf

39 Chancellors Advisory Committee on Sustainability, "UC Berkeley Campus Sustainability Assessment: Water," Available at http://sustainability.berkeley.edu/assessment/pdf/CACS_UCB_Assessment_3_Water.pdf

CHAPTER 4

1 Santa Clara Valley Water District, *From Watts to Water: Climate Change Response through Saving Water, Saving Energy, and Reducing Air Pollution, (*Santa Clara, CA: Santa Clara Valley Water District, 2007).

2 These values are based on savings numbers published in the CUWCC's "BMP Costs and Savings Study" by A&N Technical, available at http://www.cuwcc.org/resource-center/publications.aspx?ekmensel=b86195de_24_0_128_4

3 Santa Clara Valley Water District, "Water Use Efficiency Program Year End Report," available at http://www.valleywater.org/pdf/SCVWD20annual20LR.pdf The SCVWD cost-shares with the City of San Jose for the Water Efficient Technologies Program for the Tributary part of Santa Clara County-those cities that discharge into the Santa Clara/San Jose Water Pollution Control Plant. The SCVWD is the sole administrator of the Water Efficient Technologies Program for the rest of Santa Clara County.

4 East Bay Municipal Utility District, "The WaterSmart Guidebook: A Water Use Efficiency Plan and Review Guide for New Businesses," available at: http://www.ebmud.com/conserving_&_recycling/non_residential/WaterSmart%20Guidebook/default.htm

CHAPTER 5

1 20x2020 Task Force, *Public Draft Technical Memorandum Task1: Establishing Baseline*, September 5, 2008.

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