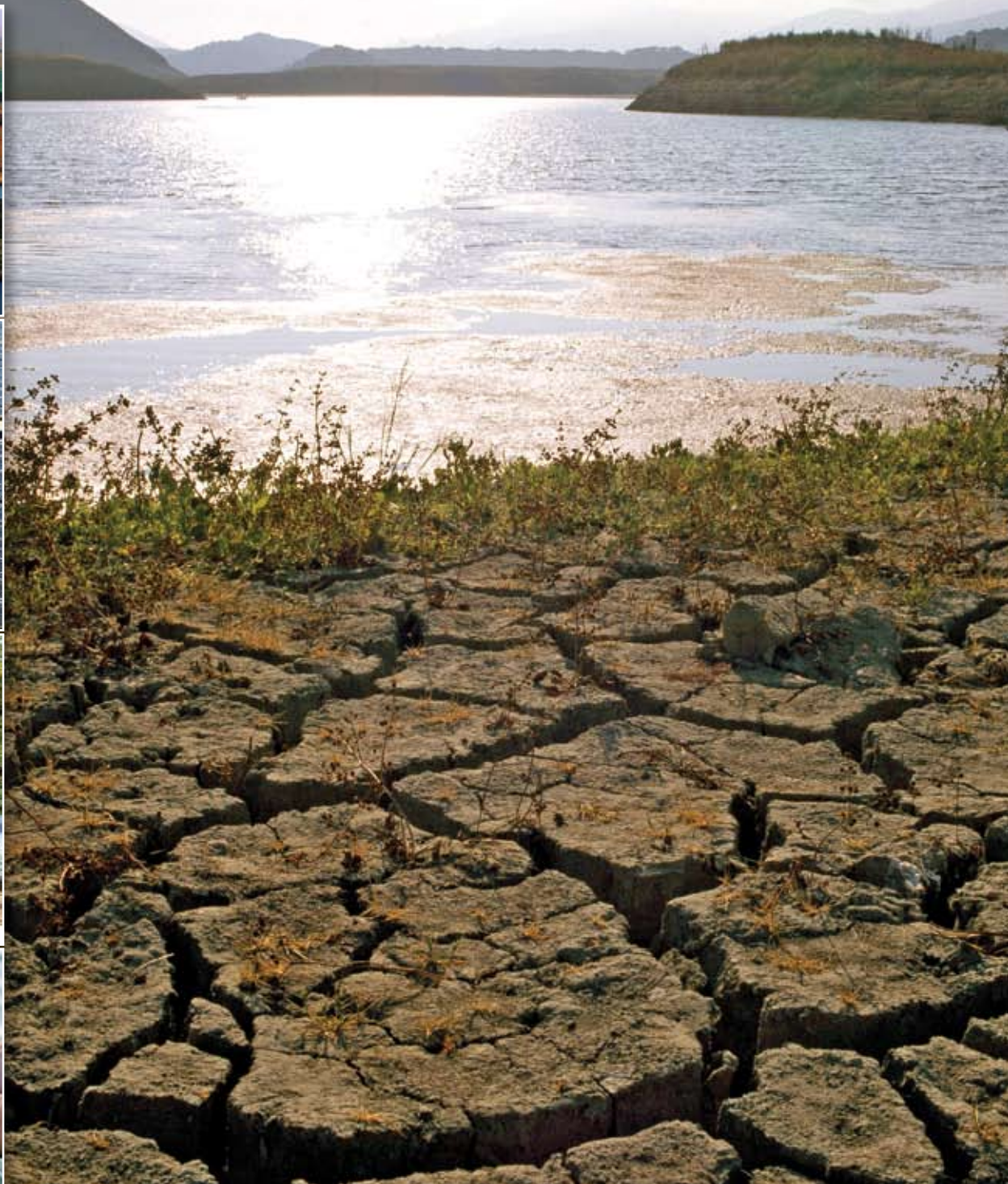


# Climate Change and Urban Water Resources

## INVESTING FOR RELIABILITY



CALIFORNIA URBAN WATER AGENCIES

DECEMBER 2007



# California Urban Water Agencies: Working Together for California's Future

**T**HE HALLMARK OF MODERN URBAN water systems is reliability: water is there when we turn on the tap. California's population centers have rarely experienced serious water delivery disruptions. But the droughts of the 1970s and 1990s gave us a picture of the importance of water supplies to our daily lives.

The eleven major drinking water utilities that comprise the California Urban Water Agencies (CUWA) are leaders in the drinking water utility industry. Collectively, these public agencies deliver safe, clean, and reliable drinking water to their 23 million customers. CUWA studies and promotes progressive water management, and works to develop common understanding and solutions among urban water agencies to meet California's water needs.

CUWA agencies face a number of challenges. Predominant among these is global warming and its long-term effects on California water resources. Regional climate change is altering our watersheds and hydrology, threatening supply reliability, affecting drinking water quality, increasing the risk of floods, and taxing our environmental resources.

The science is clear and sobering. The 2007 reports from the Intergovernmental Panel on Climate Change (IPCC)

directly link human activities to global warming and changes to our climate, and point to a body of research that clearly identifies risks to our water resources: rising sea level, reduced snow pack, higher temperatures, and more extreme weather. Changes to our watersheds could be serious, altering rainfall and resulting in changes in vegetation and increased fire threats.

CUWA agencies are taking climate change seriously and are at the forefront of water utility leadership in California and the West. We are investing in programs and facilities to adapt to the changing climate. These efforts seek to improve water supply reliability and drinking water quality. At the same time, we are also investing in measures to mitigate our impact on the environment. These programs are designed to reduce carbon emissions. We are taking actions that make more sense from both an energy and a rate-payer perspective.

In many respects, these actions – adaptation and mitigation – are at the forefront of the water utility industry worldwide. This report describes the primary issues and concerns regarding climate change, and showcases actions taken by urban drinking water utilities to invest in our water supply future.

## CUWA Agencies

CUWA is a non-profit organization representing a geographic balance of California's major urban areas. The members provide water to two-thirds of California's population, and their service areas generate most of the state's \$1 trillion economy.

The following agencies comprise CUWA and participated in developing this report:



[Alameda County Water District \(ACWD\)](#)



[City of Sacramento](#)

CITY OF SACRAMENTO  
DEPARTMENT  
OF UTILITIES



[City of San Diego](#)



[Contra Costa Water District \(CCWD\)](#)



[East Bay Municipal Utility District \(EBMUD\)](#)



[Los Angeles Department of Water and Power \(LADWP\)](#)



[Metropolitan Water District of Southern California \(MWDSC\)](#)



San Diego County  
Water Authority

[San Diego County Water Authority \(SDCWA\)](#)



[San Francisco Public Utilities Commission \(SFPUC\)](#)

Santa Clara Valley  
Water District



[Santa Clara Valley Water District \(SCVWD\)](#)



[Zone 7 Water Agency \(Zone 7\)](#)

# Climate Change Threatens California's Water Supply

**F**OR MORE THAN A DECADE, scientific research has indicated that global warming and changes to our climate are underway. There is a great deal of recent information on climate change, both on the potential contributing factors and on potential impacts to our water resources systems.

The most recent comprehensive scientific work on climate change is published by the IPCC. Two United Nations organizations – the World Meteorological Organization and the United Nations Environment Programme – established the IPCC in 1988 to evaluate the risk of climate change caused by human activity. In its *Fourth Assessment Report: Climate Change 2007*, the IPCC points to dramatic changes to our water resources happening today, and identifies greenhouse gas emissions as the predominant contributor to global warming and resulting regional climate change.

## What are the changes we are facing?

There are four major consequences of global warming of particular concern to water supplies: increasing temperature, impacts on precipitation, receding glaciers, and rising sea levels. Collectively, these changes are forecast to have major potential impacts on water supply reliability in a variety of ways, including:

- reduced snow pack;
- changes in precipitation form, timing, and quantity;
- increased flooding;
- impacts on water quality;
- increases in water use.

The most important and measurable impact will be reduction in annual spring and summer runoff from the Sierra Nevada, the source of much of California's water supplies. It is the reduced Sierra snow pack that will change California's water supplies most directly.

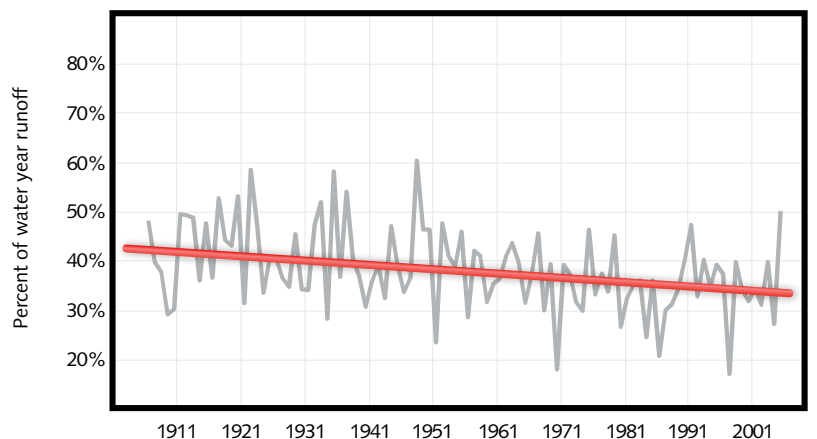
## How important is the Sierra Nevada snow pack to California?

California's largest reservoir is a natural one: the Sierra Nevada snow pack. The snow pack is roughly equivalent to the sum of most of the large man-made reservoirs in Northern California: Shasta, Oroville, Trinity, and Folsom. Our urban, agricultural, and environmental water supplies rely on the melting snow pack, which begins each April and is largely completed by July. Our water supply systems rely on the releases from this natural reservoir.

California's snow melt as a percentage of annual runoff has been decreasing for many years (see Graph 1). We have been seeing a gradual shift toward more winter rainfall and less snow pack storage. Climate change threatens to eliminate up to one-third of the Sierra Nevada snow pack by the end of this century. Imagine losing one of our large reservoirs, such as Lake Shasta. This is the kind of water supply impact we must prepare for as the climate changes.

*Climate change threatens to eliminate up to one-third of the Sierra Nevada snow pack by the end of this century*

## Reduction in the April-July Sierra Nevada Snow Melt



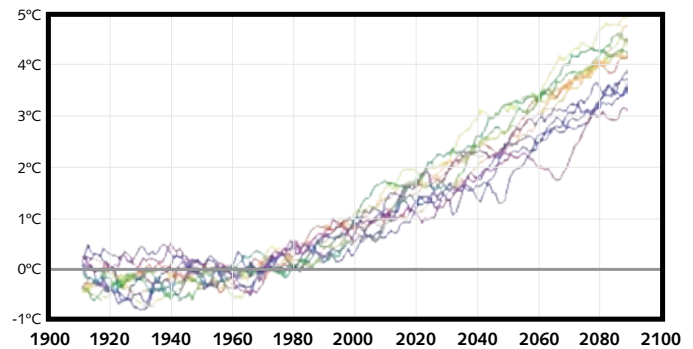
April-July snow melt runoff as a percentage of total water year runoff for the Sacramento River from 1906 to 2004

Graph 1: The percentage of April-July Sierra Nevada snow melt as a percentage of the total water year runoff for the Sacramento River is decreasing.

## What other changes are underway for the future?

Over the past decade, many computer models have been developed to predict the effects of climate change. Model results show clear evidence and forecasts that temperatures will continue to rise. One of the uncertainties of climate change is just how wet or dry our future will be; models present a full range from much wetter to somewhat drier (see Graphs 2 and 3).

### Northern California Temperature

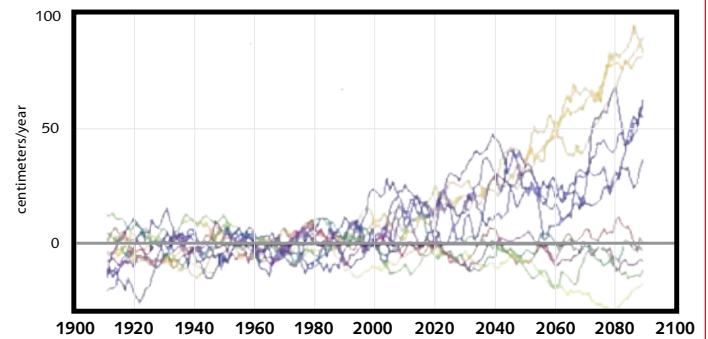


Graph 2: Models agree that air temperatures will continue to rise; they vary only in the magnitude and rate of increase.

*"Changes in our watersheds could be serious, altering rainfall and resulting in changes in vegetation and increased fire threats."*

*Lester Snow, Director,  
California Department of Water Resources*

### Northern California Precipitation



Graph 3: Models diverge on the amount and magnitude of changes in annual rainfall for Northern California.

## California Leading the Way

California is often at the forefront of emerging environmental issues. In the case of climate change, state government has a remarkable level of engagement:

- The [California Climate Action Registry](#), set up in 2001 by legislation, established the first comprehensive program of regulatory and market mechanisms for achieving quantifiable and cost-effective greenhouse gas reductions.
- In 2002 California took another legislative major step in addressing climate change with AB 1493, which will regulate the tailpipe emissions of carbon dioxide from vehicles starting in 2009.
- In June 2005 Governor Schwarzenegger issued [Executive Order S-3-05](#), which recognizes the importance of climate change to California and calls for assessments of climate change impacts and development of mitigation and/or adaptation plans.
- In December 2005, in response to EO S-3-05, the California Energy Commission released its report, [Climate Warming and Water Supply Management in California](#). Subsequently, the California Department of Water Resources released its July 2006 report, [Progress on Incorporating Climate Change into Management of California's Water Resources](#). This is perhaps the best technical information relevant to urban water utilities in California.
- AB 32, the California Global Warming Solutions Act of 2006, reinforced the need for continued engagement by the state's Climate Action Team.
- Research continues to be supported by state government; the Fourth Annual California Climate Change Conference in September 2007 showcased results of recent research sponsored by the California Energy Commission through its California Climate Change Center. Scientific dialogue is an important part of these programs.

## What impact might global climate change have on water demands and supplies?

- Increased evaporation, warmer climates, and less soil moisture may increase the need for irrigation for agriculture and landscaping and, at the same time, could decrease water supplies. Supply and demand could diverge at an accelerating rate.
- Increased evaporation could result in lower river flow and lake levels in the summer. As stream flow and lake levels drop, groundwater supplies could also be reduced.
- Higher temperatures will result in reduced snow pack and earlier snow melt. Winter runoff could increase, while spring and summer runoff would decrease. Existing reservoirs may not be large enough to store increased winter flows for carryover to the summer. Unless the snow pack storage is replaced with additional storage, such as reservoirs or groundwater, water supplies could decline.
- More intense storm events and higher sea levels could increase flooding – both in the Sacramento-San Joaquin Delta and in upstream areas.
- The increased need for flood control could reduce the water supply benefits we now enjoy. It will be increasingly difficult to balance the dual purposes of flood control and water storage.
- The fragile environment of the Delta and its levee system network could be at risk from increased flooding and the upstream intru-

sion of saltwater from San Francisco Bay. This will have serious consequences for the environment, and an enormous impact on much of the state's developed water supplies. Diversions of water out of the Delta for urban and agricultural water supplies (within the region, as well as the export areas of the Bay Area, San Joaquin Valley, Central Coast, and Southern California) will be threatened by degraded water quality and potential collapse of the Delta's fragile levee network.

- A higher sea level could have impacts on coastal groundwater basins, making maintenance of water quality more difficult.



EBMUD

*EBMUD's Pardee Reservoir dropped to dangerously low levels during the 1976-77 drought.*

## Water Terminology

Following are some common water terms used in this report:

- **Groundwater:** Water found below ground. Much of California's water supplies are in soils as deep as 700 feet. Water is pumped out of the ground using wells.
- **Recharge:** Putting water back into groundwater storage. Where soils on the surface and well below ground are porous, like sand, water is recharged using ponds. This allows the water to percolate down to the groundwater. Other areas may require other means of recharge.
- **Intertie:** Physical connections between different water systems. The connections typically "tie" the distribution pipelines together at certain points so that water can be shared as needed – particularly during emergency conditions.
- **Conjunctive Use:** Intentional, coordinated use of groundwater and surface water. Recognizing that both sources of supply have different storage and operational characteristics, "conjunctive use" embodies the actions needed to maximize a water utility's combined supplies – particularly during drought conditions.
- **Water Bank:** Deliberate storage of water in wetter years into empty groundwater storage capacity so that it may be withdrawn during dry years. The Semitropic Water Bank is a set of facilities developed by the Semitropic Water Storage District at the southern end of the San Joaquin Valley. It has developed extensive storage and withdrawal facilities with its water banking partners, a number of urban water utilities throughout California.



# CUWA Agencies Are Meeting the Challenges of Climate Change

**C**LIMATE CHANGE IS REAL and threatens our water supplies. What are we doing about this? CUWA has been facilitating the discussion of how CUWA agencies will approach a future characterized by uncertainty in the face of climate change. As part of this process, we surveyed CUWA agencies to learn what steps they are taking at the local level. Specifically, the survey sought to:

- examine their level of engagement on climate change issues;
- review technical work in evaluating the vulnerability of water systems;
- get details on specific actions being taken to adapt to climate change;
- review a list of actions being taken to mitigate greenhouse gas emissions (in particular, carbon dioxide), the primary cause of climate change.

## *CUWA agencies are at the forefront of water utility leadership in California and the West*

What did we find?



*Los Vaqueros: water quality improvements, emergency supplies.*

### *CUWA agencies are tackling climate change*

- CUWA agencies are engaged in climate change issues, with leadership typically at both the general manager and governing board levels.
- CUWA agencies are including greater climate variability in their long-term water supply reliability studies.
- CUWA agencies are adapting to this change and mitigating its impact.

### *CUWA agencies are taking a leadership role*

- CUWA agencies are incorporating climate change concerns in their public information programs.
- CUWA agencies are participating in regional and national forums on climate change, as well as contributing to major research.
- CUWA agencies are directly involved at the top leadership level in the new California Climate Action Registry.

### *CUWA agencies are aware of the vulnerability of California's water supplies*

- Vulnerability analyses are being incorporated into urban water management plans, integrated regional water management plans, agency strategic plans, and cooperative studies with other water utilities within many of the regions.
- Most CUWA agencies specifically mentioned Delta levee failures as a major water supply vulnerability, related to climate change and other factors.
- Special attention is being given to the methodology of climate change modeling – an inexact science at present that needs more attention.

The following sections provide real-world examples of adaptation and mitigation strategies. These are on-the-ground projects and programs.

# Adapting to the Changing Climate

**A**LL CUWA AGENCIES recognize that climate change is affecting water supply reliability. CUWA agencies are adapting to this change by developing diverse water supply portfolios to spread risk. Much of this is reflected in integrated regional water management and urban water management plans. Water management components include the following elements:

- local and regional storage
- groundwater/conjunctive use
- facility operations
- development of groundwater storage
- development of local supplies
- conservation opportunities
- water recycling
- stormwater runoff
- desalination solutions
- water transfers
- threats to Delta supplies

Following are examples of a few of our agencies' many activities.

## Optimizing local and regional storage

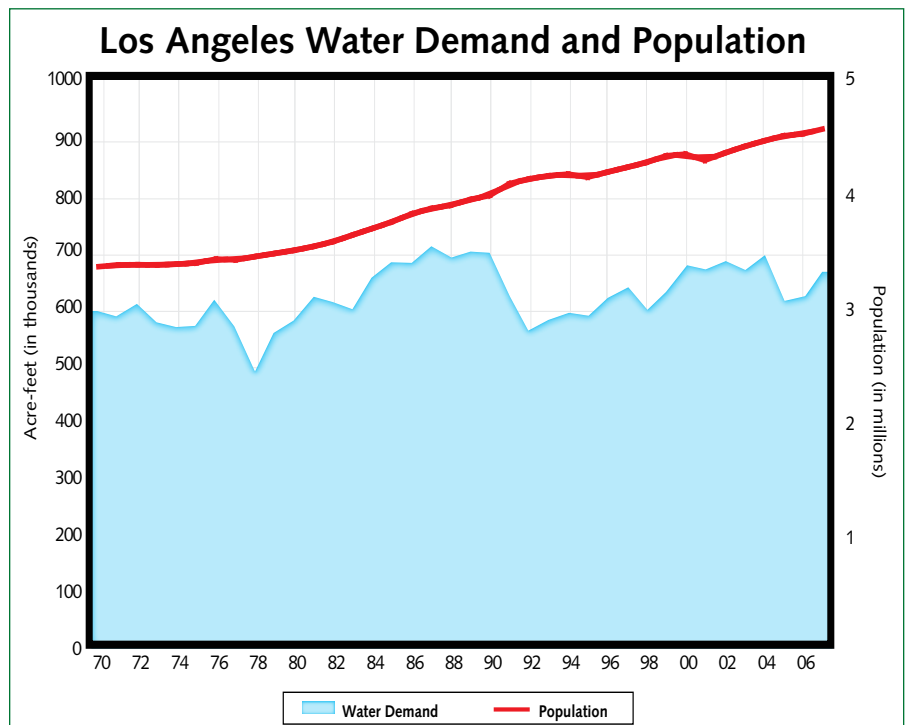
Many CUWA agencies identify local and regional storage as being essential to respond to future supply uncertainty:

- The City of San Diego is pursuing a specific local reservoir intertie and is studying other potential projects.
- CCWD is evaluating expansion of Los Vaqueros Reservoir for Bay Area water supply reliability and water quality, and for the protection of the Delta environment.
- EBMUD is evaluating conjunctive use programs and partnerships.
- CUWA agencies in the San Francisco Bay Area (ACWD, SCVWD, and Zone 7) have collectively secured more than 560,000 acre-feet of off-site storage at the Semitropic Groundwater Bank in Kern County.
- Several Bay Area agencies have constructed large interties to enhance the regional flexibility to address shortages and emergencies.
- MWDSC has invested over \$3 billion in regional storage and conveyance.
- SDCWA has an aggressive program to expand emergency storage in their region, including construction of Olivenhain Dam and expansion of San Vicente Dam.

## Aggressively pursuing and encouraging water conservation

CUWA agencies are at the forefront of water conservation in California, taking the lead in innovation and implementation, and continually reviewing potential additional cost-effective actions. For example:

- Los Angeles' water use today is equal to levels 25 years ago, despite an increase in population of approximately 1 million people in LADWP's service area (see Graph 4).



Graph 4: Los Angeles' water use today is equal to levels 25 years ago, despite an increase in population of 1 million people.

- The City of San Diego's water usage is about the same level as it was 16 years ago, despite a substantial population increase.
- EBMUD has achieved similar savings, keeping current water demand below 1976 levels, despite a greater than 30% increase in the number of accounts it serves.

Following are additional examples of CUWA agencies' water conservation efforts:

CCWD

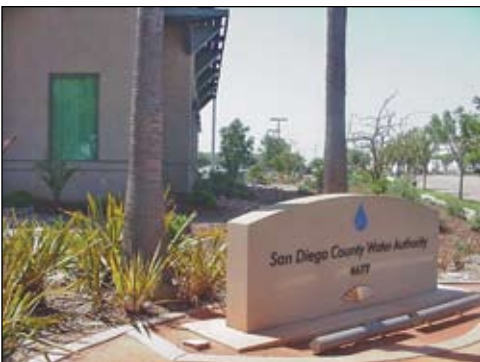


*High-efficiency clothes washers utilize technological advances to deliver excellent wash performance, while saving both water and energy.*

- SCVWD's aggressive water conservation measures will conserve over 100,000 acre-feet/year of water (18% of total demand) by 2030.
- MWDSC has proven to be a leader in the support of both new technologies, as well as in the implementation of innovative conservation programs, earning national recognition. A five-year Conservation Strategy Plan, adopted in 2005 at the request of MWDSC's member agencies, supports the pursuit of new partnership opportunities with wastewater treatment agencies, energy providers, and watershed management groups to join in conservation programs with mutual benefit. MWDSC has undertaken a major initiative to gain landscape water savings through its "California Friendly" program.

- Many CUWA agencies are undertaking programs to conserve water in urban landscapes and, in many cases, are involved in programs that go beyond existing best management practices. These agencies take an active role in developing and promoting demonstration landscape gardens. One example is the Water Conservation Garden at Cuyamaca College, supported by the City of San Diego, SDCWA, and other urban water utilities in the region.

SDCWA



*SDCWA headquarters includes a demonstration garden.*

- In August 2007 SDCWA, the City of San Diego, and other stakeholder agencies within

the San Diego region, partnered to cooperatively produce a Blueprint for Conservation, intended to serve as "a roadmap for creating and implementing new, long-range residential and commercial water conservation programs across the San Diego region." This was a key product of their first Conservation Summit, held in October 2006.

- LADWP has had continued focus on a strong water conservation program, with increased emphasis on outdoor water use. Los Angeles has been very effective and has served a leadership role in the area of water use efficiency. Conservation is a key component of LADWP's water resource planning efforts and will continue to be implemented over the long-term.
- CCWD has been growing a quality conservation program for nearly 20 years. The program now includes numerous survey, education, and incentive programs for every customer type. Incentives are offered for high-efficiency toilets, clothes washers, smart sprinkler timers, shower heads, and numerous commercial fixtures and devices. CCWD's survey programs focus on equipment and management improvements that can result in significant water savings. The conservation program will continue to be implemented over the long term as an integral component of the District's future water supply.
- EBMUD is pursuing more aggressive water conservation through innovative "WaterSmart" home certification programs and recycled water projects.
- The SFPUC has been implementing water conservation programs for its retail customers for approximately 20 years, recently expanding both the goals and scope of the programs. In 2004 the SFPUC completed a detailed analysis, quantifying where and how water is being used in the city and the potential savings, and identified programs to capture that potential. SFPUC also developed three programs – water savings; information, tracking and monitoring; and outreach/policy – with a goal of saving up to an additional 4 million gallons per day (mgd) by 2030. The programs also reflect an



increased focus on the non-residential sectors to include commercial, industrial, and municipal customers who have traditionally been more difficult to engage.

- ACWD actively promotes water use efficiency through programs offering financial incentives and technical assistance for all residential, business, and landscape customers.



CCWD

*CUWA agencies work directly with their customers to help them conserve water.*

## Developing regional water projects and partnerships

- EBMUD entered into a partnership with Sacramento County Water Agency (SCWA) to design and build the Freeport Regional Water Project – a regional water supply project that will assure water for East Bay customers in dry years, and a steady supply of water for planned growth in the Sacramento region. The project will have the ability to divert up to 185 mgd of water from the Sacramento River near the town of Freeport, delivering up to 100 mgd to EBMUD customers in dry years to reduce the need for rationing, and up to 85 mgd to SCWA in all years to help meet the future drinking water needs in central Sacramento County.
- CCWD, EBMUD, SFPUC, and SCVWD are jointly exploring the development of a Bay Area Regional Desalination Project. The project could consist of one or more desalination facilities with an ultimate total capacity of up to 71 mgd, and would benefit over 5 million Bay Area residents and businesses served by these agencies. The goals of the project are as follows:
  - provide additional sources of water during emergencies, such as earthquakes or levee failures;
  - provide a supplemental water supply source during extended droughts;
  - allow other major facilities, such as treatment plants, water pipelines, and pump stations, to be taken out of service for maintenance or repairs;
  - increase supply reliability by providing a full-time supplemental water supply from a regional facility.
- SCVWD is working on measures to meet demand during times of drought. It has acquired significant storage in the Semi-tropic Water Bank, and local storage will be maximized as a hedge against future droughts. SCVWD's Urban Water Management Plan also outlines climate change response strategies – including water conservation, recycled water, and desalination as supplies for all weather conditions – as part of its investment portfolio.
- Zone 7 has instituted a Chain of Lakes project designed to integrate flood control and groundwater recharge. These measures seek to respond to dual threats of climate change: flood control and water supply reliability.
- SDCWA completed the Colorado River Quantification Settlement Agreement (QSA), a historic water conservation and transfer agreement in October 2003. The QSA will provide an additional 277,700 acre-feet of water annually to the San Diego region. The cornerstone of the QSA is a water transfer agreement between SDCWA and Imperial Irrigation District that will provide 200,000 acre-feet of water a year through water conservation measures in the Imperial Valley. The QSA also includes projects to conserve water by lining portions of the earthen All-American and Coachella canals. SDCWA has taken the lead on these canal lining projects that will yield 77,700 acre-feet of water annually for 110 years for San Diego County.

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*CUWA agencies are adapting to changes in water supplies by making diversified water investments to reduce risks and meet customer needs*

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## Taking a leadership role

In 2007 the SFPUC Water Utility Climate Change Summit attracted top managers and board members of 30 water utilities (including many other CUWA agencies) from 8 states, representatives from 17 regional, state, and federal agencies, as well as leaders from the non-governmental and business communities, and members of the public.

SFPUC organized the summit by and for the water utility community, and the focus was on adaptation. The second day was focused on brainstorming action items, including enhancing technical tools to help us better predict climate change impacts, increasing (or reversing decreases in) funding for snow pack, stream flow, and related data gathering, and developing a collective voice for the water utility community.

CUWA agencies are providing leadership in the research and development of strategies to adapt to climate change. Following are two examples of projects that are currently underway:

- CCWD is leading a research project with the American Water Works Research Foundation (AwwaRF), LADWP, and SDCWA to evaluate the effects of climate change on planning criteria and design standards.
- All CUWA agencies are collaborating on another AwwaRF project to develop a water utility-specific reporting protocol for greenhouse gas emissions.

SFPUC



*Water Utility Climate Change Summit organized by the San Francisco Public Utilities Commission. Top water leaders attended the summit and focused on urban water utility actions.*

Water agencies are no different from any other business; they rely on research to identify new technologies and strategies. Finding innovative solutions to the challenges of climate change requires investment in research and development. Participation with groups like AwwaRF leverages water agency investment to a greater extent, and the result is a cost-effective tool available for use by the entire water community.

## Awards and Recognition

- ACWD received the Early Innovator Adaptor Award from PG&E for participation in the automated critical peak pricing demand reduction response program (Auto-CPP).
- SCVWD received the 2005/2006 Outstanding Energy Management Award from the American Water Works Association. In May 2007 SCVWD received a Clean Air Leadership Award from Breathe California for its climate protection efforts.
- EBMUD and the City of San Diego are on the U.S. Environmental Protection Agency's Green Power Partnership 2007 Top Ten list of local governmental agencies nationwide.
- The City of Sacramento has seven buildings registered (or soon to be registered) under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) benchmarking program.
- SDCWA's San Vicente Pump Station was recognized in early 2007 by SDG&E for the energy-saving design of the facility. The pump station uses energy-efficient variable frequency drive (VFD) units, compared to traditional fixed-speed units, to run its three 7,000 horsepower pumps. This innovation will save over 1 million kWh of electricity annually. Following installation of the VFD units, SDCWA will receive a cash payment from SDG&E in the amount of \$84,000.
- SDCWA's Rancho Penasquitos in-line hydroelectric generation facility was awarded the American Public Works Association Project of the Year in the category of local environmental projects over \$8 million.



# Mitigating Our Impact on Climate Change

ENERGY IS USED IN MANY ASPECTS OF OUR WATER RESOURCES SYSTEMS: transporting water from the source to the areas of use, treating to meet drinking water standards to protect public health, and delivering to customers through extensive distribution systems. In addition, we use energy to treat and dispose of wastewater. All-in-all, modern water systems use energy to meet the needs of our customers. Some of this is offset through the generation of hydropower at large reservoirs, and several of California's water systems deliver water by gravity to their treatment plants due to a direct connection between their Sierra Nevada reservoirs and their service areas.

There are opportunities to reduce energy use in our water systems, recognizing that some actions in one area may not be appropriate for another. CUWA agencies are mindful that actions to improve the reliability of their water supplies could both increase and decrease energy use. That is why CUWA members are engaged in both adaptation and mitigation – both are essential.

In addition to adapting to climate change, CUWA agencies are taking actions to reduce the main contributor to climate change: CO<sub>2</sub> emissions. This is more popularly characterized as reducing our carbon footprint – saving energy, generating more electricity in ways that reduce emissions, and implementing projects that reduce our need to pump, treat, and distribute water. Projects include:

- employing renewable energy generation
- developing water facilities and systems energy conservation
- converting fleet vehicles to electric and alternative fuel vehicles

Following are a few examples of what CUWA agencies are doing.

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*CUWA agencies  
are taking action  
at the local level  
to reduce our  
carbon footprint*

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## Employing renewable energy generation

Several CUWA agencies have installed solar photovoltaic systems and other renewable energy projects:

- Evaluating solar energy systems for new and existing facilities is a standard procedure and illustrates EBMUD's commitment to renewable energy. EBMUD installed a solar photovoltaic system at its Adeline Maintenance Center in West Oakland. The system produces 42,000 kWh of energy per year and saves 5% of the facility's annual energy use. Another photovoltaic system at EBMUD's Sobrante Water Treatment Plant will generate approximately 600,000 kWh per year and provide power for 10% of that plant's water treatment needs. Additional solar energy systems throughout EBMUD's service area help power neighborhood reservoir operations.
- MWDSC is designing a solar-powered generation plant for its Robert A. Skinner Water Treatment Plant.
- SCVWD installed carport and rooftop photovoltaic solar systems at its Almaden headquarters in 2004. With the production of 350,000 kWh annually, the system has reduced electricity usage by 10%.
- SFPUC plans to install photovoltaic solar systems on City of San Francisco facilities (including Moscone Center and San Francisco International Airport) by the end of 2007, generating an estimated 2.5 million kWh of electricity per year.
- ACWD installed a photovoltaic system at its headquarters facility in 2003. The ACWD board has approved \$3.7 million in its 25-year capital improvement program for the installation of future photovoltaic systems.
- ACWD also operates its largest surface water treatment plant in a manner that optimizes the generation of electrical power (3 million kWh of electricity annually) from an on-site hydropower



Part of ACWD headquarters' 54 kW solar voltaic system.

ACWD



City of San Diego Alvarado Water Treatment Plant: green and solar!

### Units of Measure

Electricity is measured in standard units:

- One **kilowatt (kW)** is equal to a little more than one horsepower, and represents 1,000 watts of electrical power.
- One **megawatt (MW)** is equal to 1,000 kW.

**Energy production** is measured as power produced over time. For example, 1 kW of generation for 24 hours is equal to 24 kilowatt hours (kWh), a unit of electricity commonly used in home electric bills.

A **carbon footprint** is a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of **carbon dioxide (CO<sub>2</sub>)**. The international standard unit for measuring CO<sub>2</sub> is the **metric ton**: 1,000 kilograms or 2,205 pounds.

facility. Although the plant employs ozonation (an energy-intensive activity) as one of its primary treatment processes, the plant typically produces surplus power, which is utilized at ACWD's other water treatment facility.

- The City of San Diego installed a 1.135 MW photovoltaic solar system at the water department's Alvarado Water Treatment Plant in March 2007.

The panels produce about 20% of the plant's power, 778,274 kWh in the first nine months. Over the next few years, the City of San Diego plans to add additional solar capacity to eventually produce 5 MW of renewable energy. The park space on top of the water tank is a feature used by San Diego to maintain neighborhood aesthetics throughout the city.

- CCWD is building a solar array at its Ygnacio Pump Station. This array is capable of generating enough energy to offset 34% of the energy demand at the station, mostly during peak energy use times. CCWD also is developing a 1,000 kW power generation station along the Los Vaqueros pipeline to generate power that can either offset demand at a nearby water treatment plant, or be sold back to the power grid.
- SDCWA began commercial operation of an in-line hydroelectric generation facility in December 2006. The power is generated using a single horizontal turbine with an annual net energy production of 20 million kWh of renewable energy. The generating unit is controlled from SDCWA's central control facility and will operate year-round.

The power generated is sold to San Diego Gas & Electric and delivered to the grid.

- LADWP is committed to a renewable energy policy that seeks to boost the amount of renewable energy the utility provides its customers to 20% of retail electric sales by 2010. The long-term goal, as identified in the Los Angeles Mayor's Climate Action Plan, is to

achieve 35% renewables by 2020. These goals, which are part of the LADWP's Renewable Portfolio Standard (RPS), are aimed at expanding the City's supply of renewable resources, such as wind, solar, geothermal, biomass, and small hydroelectric power. The benefits of increasing renewable power supply include:

- reducing greenhouse gas emissions;
- improving air quality;
- providing a sustainable energy resource;
- providing a hedge against market fluctuations of fuel costs;
- reducing dependence on foreign sources of fuel.

LADWP plans to develop over 9 billion kWh of renewable energy to support this long-term goal.

### Developing water facilities and systems energy conservation

- The City of Sacramento has developed an internal operations climate action plan designed to reduce CO<sub>2</sub> emissions by 41,000 metric tons per year by 2030, as well as an energy conservation program based around more efficient operation of storm and sewer pumps. In addition, the City of Sacramento is committed to sustainable building design:
  - The City has seven buildings registered (or soon to be registered) under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) benchmarking program.
  - All new city-owned buildings are to be designed with energy efficiency in mind and certified as sustainably designed, built, and operated through the LEED benchmarking program.
  - The City owns and operates the Cal EPA building, a unique city/state partnership. This building was the first building in the world to achieve the LEED existing building Platinum status, and it



LADWP's "Ra" solar photovoltaic installation produces 135,000 kWh per year. LADWP has promoted the installation of similar systems throughout Los Angeles through its solar energy program.



is estimated that the energy efficient operation of this building is resulting in a 300 metric tons per year reduction in CO<sub>2</sub> emissions.

- ACWD leverages time-of-day billing into most facilities' electrical power rate schedules, and operates those facilities to minimize power consumption during highest-rate periods. ACWD is participating in an automated critical peak pricing demand reduction response program (Auto-CPP) for its headquarters building. The Demand Response Research Center and PG&E presented ACWD with an Early Innovator Adaptor Award for its participation in Auto-CPP.
- SCVWD has incorporated reduction in greenhouse gas emissions as a significant environmental aspect in its ISO (International Organization of Standards) 14001 Environmental Management System. ISO 14001 allows organizations to demonstrate sound environmental performance by controlling the impacts of their activities, products, and services on the environment.
- The City of San Diego established an energy optimization implementation team to meet its optimization strategy and ISO 14001 program requirements. The team's purpose is to develop strategies for reducing energy costs. By analyzing pressures, flows, and storage requirements, San Diego's water department has already seen a 10-15% reduction in energy consumption.
- SFPUC is a clean power generator; its water supply is almost completely gravity fed. As a result, baseline operations have a relatively small carbon footprint. SFPUC's Power Enterprise manages a number of programs that develop renewable energy facilities and energy efficiency programs for the City and County of San Francisco.

## Other mitigation measures underway

### Hybrid fleet

Most CUWA agencies have, or are developing, programs to phase in hybrid or alternative fuel vehicles as the older fleet vehicles are replaced. Following are some programs in place:

- CCWD has a strategic initiative to reduce petroleum fuel use by 5% each year over the next three years. One of the many tactics employed to meet this challenge is to apply a rigorous analysis to determine whether to replace a vehicle currently in use with a hybrid or alternative fuel vehicle.
- The City of Sacramento has a goal to have all new fleet vehicles be hybrid or alternative fuel (hydrogen or fuel cell) and to "right size" vehicles. Currently, electric vehicles are used at the corporation yards and water treatment plants.
- In 2001 EBMUD started a pilot program to test day-to-day use of gas-electric hybrids for the sedan fleet. The pilot program was successful; now all 59 of EBMUD's sedans are gas-electric hybrid Toyota Prius. The hybrid vehicles save around 12,000 gallons of gasoline per year, and reduce carbon dioxide emissions by approximately 102 metric tons per year.
- MWDSC eliminated SUVs from its fleet five years ago (except for necessary field use) and in 2004 added hybrids to its fleet. It currently has 27 hybrids. MWDSC also has replaced a large number of gasoline vehicles with electric carts. MWDSC is replacing three pieces of construction equipment with new pieces that meet Tier 3 fuel efficiency standards.
- LADWP continues efforts to make Los Angeles an "electric vehicle ready" city through the development and support of an advanced electric transportation industry. As an alternative transporta-



ACWD, like most CUWA agencies, is replacing vehicles in its fleet with hybrid or alternative fuel vehicles.

ACWD



EBMUD's biodiesel pilot project turned waste grease into clean-burning fuel for its trucks.

EBMUD



tion fuel provider, LADWP must increasingly incorporate alternative fuel vehicles (such as EVs) into its fleet under the provisions of the 1992 National Energy Policy Act. To this end, LADWP currently utilizes more than 300 EVs for carpools, meter reading, and other field applications.

### **Methane offsets**

- For over two decades, EBMUD has captured the biogas that is produced by the solids digestion process at the main wastewater treatment plant to power the plant's operations. EBMUD's resource recovery program, which brings in trucked organic waste, has increased the amount of organic-rich waste trucked to the wastewater treatment plant digestion process to generate additional biogas. Today, EBMUD generates 90% of the electricity needed to run the plant. Plans to increase power generation by 2009 will net power sales to the electrical grid, turning the wastewater plant into an energy provider, further minimizing EBMUD's reliance on fossil fuels and creating additional opportunities to offset greenhouse gas emissions.
- SFPUC also uses methane gas produced in the anaerobic digesters at both of its wastewater treatment plants (Southeast and Oceanside). It is used to fuel the engine generators and boilers to produce energy which is used in the operation of the plants. The engine generators produce electrical power. Both the engine generators and boilers produce hot water to heat the digesters and provide the heat required by the plant's heating, ventilation, and air conditioning system.

### **Employee incentives**

Most CUWA agencies have adopted energy-saving measures for their employees. These include programs to promote mass transit use, incentives for employee carpooling, off-peak work schedules to avoid traffic, and others. For example, City and County of San Francisco employees have the following alternative transportation programs available to them:

- A pre-tax commuter benefits program that allows employees to save up to 40% on their transit costs. Approximately 200 SFPUC employees are currently enrolled in this program.
- A City College of San Francisco Bicycle Fleet program that focuses on replacing the on-job vehicle trips with bicycles. Over 300 bicycles have been procured for various city departments.
- A free bicycle room at City Hall, with a shower facility and lockers, available to all City employees.

### **Taking a leadership role**

SCVWD is part of Sustainable Silicon Valley (SSV), a collaboration of businesses, governments, and non-governmental organizations spearheading an effort to reduce regional carbon dioxide (CO<sub>2</sub>) emissions 20% below 1990 levels by 2010. The SSV approach to reaching this goal is to facilitate strategies to reduce CO<sub>2</sub> emissions through increased energy and fuel efficiency and through the use of renewable sources of energy.

### **Further Information on Climate Change**

- *Fourth Assessment Report: Climate Change 2007*  
The Intergovernmental Panel on Climate Change Fourth Assessment of Climate Change (November 2007)  
[www.ipcc.ch](http://www.ipcc.ch)
- *California Climate Action Team Report to Governor Schwarzenegger and the Legislature* (March 2006)  
[www.climatechange.ca.gov/climate\\_action\\_team/reports/2006-04-03\\_FINAL\\_CAT\\_REPORT.PDF](http://www.climatechange.ca.gov/climate_action_team/reports/2006-04-03_FINAL_CAT_REPORT.PDF)
- *Our Changing Climate: Assessing the Risks to California*  
California Energy Commission's Public Interest Energy Research (July 2006)  
[www.climatechange.ca.gov/biennial\\_reports/2006report/index.html](http://www.climatechange.ca.gov/biennial_reports/2006report/index.html)
- *Progress on Incorporating Climate Change into Management of California's Water Resources*  
Technical Memorandum Report, California Department of Water Resources (July 2006)  
[www.climatechange.ca.gov/documents/2006-07\\_DWR\\_CLIMATE\\_CHANGE\\_FINAL.PDF](http://www.climatechange.ca.gov/documents/2006-07_DWR_CLIMATE_CHANGE_FINAL.PDF)
- *Climate Change and Water Resources: A Primer for Municipal Water Providers*  
American Water Works Research Foundation; prepared by the National Center for Atmospheric Research (May 2006)  
[www.awwarf.org/research/TopicsAndProjects/projectSnapshot.aspx?pn=2973](http://www.awwarf.org/research/TopicsAndProjects/projectSnapshot.aspx?pn=2973)
- *From Watts to Water: Climate Change Response through Saving Water, Saving Energy, and Reducing Air Pollution*  
Santa Clara Valley Water District (June 2007)  
[www.valleywater.org/conservation/media/Documents/WUE%20Water%20Energy%20Report.pdf](http://www.valleywater.org/conservation/media/Documents/WUE%20Water%20Energy%20Report.pdf)
- Governor's Climate Change Portal  
[www.climatechange.ca.gov](http://www.climatechange.ca.gov)
- *An Inconvenient Future? Assessing the Impacts of Climate Change*  
Western Water Magazine, Water Education Foundation (September/October 2006)  
[www.water-ed.org/septoct06.asp](http://www.water-ed.org/septoct06.asp)
- *In Hot Water: Water Management Strategies to Weather the Effects of Global Warming*  
National Resources Defense Council (July 2007)  
[www.nrdc.org/globalWarming/hotwater/hotwater.pdf](http://www.nrdc.org/globalWarming/hotwater/hotwater.pdf)



# CUWA Agencies Will Continue to Secure Our Water Supply

CUWA TAKES THE THREAT of climate change seriously. Agencies are already seeing the effects of temperature and precipitation changes and understand the long-term implications of sea level rise, reduced snow pack, and more severe storm events. When we look to the future, however, we see big uncertainties about the rate and nature of expected climate change. Scientists tell us that these uncertainties will not be resolved in the near future – our adaptive solutions will need to be robust yet flexible.

The global response to reducing greenhouse gas emissions is directly linked to how dramatically climate will change. California is at the forefront of climate change mitigation and adaptation in the U.S. The Global Warming Solutions Act of 2006 (AB 32) establishes a legislative framework for coordinated statewide action on climate change. Several CUWA agencies have actively supported this and other climate change legislation.

Our agencies are leading the way by inventorying emissions and actively embracing greenhouse gas reduction and mitigation strategies to reduce our carbon footprint. Our water conservation programs not only save water, they save significant amounts of energy and reduce greenhouse gas emissions. We actively generate renewable energy – both hydropower and solar – and are building additional renewable power capacity. We are actively participating in climate change research and the development of guidance documents and protocol so that all water utilities can play their part in reducing emissions. Our member agencies are also working with other organizations to influence water policy and management decisions at the national, state and local levels.

Climate change confronts CUWA agencies with multiple long-term threats that seriously challenge our ability to ensure reliable water supply in our respective urban areas. We are taking a wide range of actions to increase our ability to adapt to expected changes. Many of our agencies have conducted modeling studies to evaluate various climate change scenarios and how our water supplies, infrastructure, and operations will be affected.

Each CUWA agency has invested substantially in diversifying its water supply portfolio, and agencies have worked together to interconnect supplies. Agencies have made impressive strides in reducing demand through water conservation programs. Our public education campaigns help reduce the large percentage of potable water used for landscaping, and many of us provide incentives for, and education about, drought-resistant and native vegetation, and smart and efficient irrigation systems. We are working with our customers, keeping them informed and engaged. In their interests, we are seeking the best, most cost-effective solutions to our climate change challenges. CUWA agencies are in leadership roles in California and the West, engaged at a high policy level to bring about changes necessary to ensure water supply reliability.

California needs to invest in climate change mitigation strategies to meet statewide greenhouse gas emissions goals. California must also invest in long-term, reliable water supply and infrastructure adaptable to a changing climate. CUWA agencies are working with state and federal agencies and other organizations to ensure that these goals are achieved. In addition, CUWA has committed to continue working within the broader research community to support and promote research directed at responding to climate change.

Climate change is one of the most pressing issues of our time, from the global to the local levels. It is a long-term priority for CUWA. We will continue to invest in adaptation and mitigation measures, support continued scientific research regarding water supply impacts, and push for actions at the local, state and national levels.

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*Climate change is a CUWA priority – we all need to work together to secure our water supply future*

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CCWD

*The Delta conveys water from upstream sources to meet both urban and agricultural needs throughout the state, and also supports important environmental resources.*



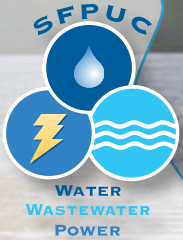




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