

DEPARTMENT OF WATER RESOURCES

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NOV 29 2011

TO: Distribution List

The attached report provides context and information about the effort that the Department of Water Resources (DWR) has undertaken to reduce its annual Green House Gas (GHG) emissions and fossil fuel dependency. The approach is undertaken by applying the DWR 1990 carbon footprint as its benchmark, consistent with California's compilation of statewide GHG emissions and sinks.

If you have any questions, please contact me at (916) 653-7007 or your staff may contact Carl A. Torgersen, Acting Deputy Director, at (916) 653-8043.

Sincerely,

A handwritten signature in blue ink, appearing to read "Mark W. Cowin".

Mark W. Cowin
Director

Attachments

Distribution List

Electronic copy of transmittal letter and one-page Executive Summary distributed to members of the Legislature.

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**Executive Summary****Report to the Legislature****The California Department of Water Resources Report on
Reducing the State Water Project's Dependency on Fossil Fuels and
Changes to the State Water Project's Power Contracts Portfolio**

The Department of Water Resources (DWR) shares California's goals for mitigating climate change impacts and effective management of carbon, and makes use of a diverse energy portfolio to meet California's water needs. DWR is reducing its annual GHG emissions and fossil fuel dependency through applying the Department's 1990 carbon footprint as its benchmark, consistent with California's compilation of statewide GHG emissions and sinks. Based on its 1990 emissions, DWR will exceed California's emission reductions targets for 2020.

Since 1983, DWR has received up to 235 megawatts (MW) annually from Unit 4 of the coal-fired Reid Gardner Power Plant in Nevada. DWR will not extend or renew the agreement when it expires in July 2013. DWR is refining and expanding its programs to quantify and accurately report the State Water Project's (SWP) operational impact on California's emissions reductions goals, and implementing environmentally sustainable energy strategies that are responsive to hydrology, water delivery, facilities requirements, and energy market events. By identifying and investing in technologies that increase the SWP's percentage mix of cleaner, more efficient resources, DWR will enhance the ability to provide clean hydroelectric generation to the electric grid during critical peak hours. However, the ability to pump off-peak is being adversely impacted by staffing issues which have resulted in decreased operational availability.

DWR is improving the water to energy conversion ratio at key SWP hydroelectric facilities, and by the end of 2011 annual GHG emissions savings from DWR's hydroelectric energy efficiency projects will reach 48,000 metric tons of carbon dioxide (CO₂) avoided. DWR's strategy and evolving policies to meet California's emissions reductions goals are reflected in this and other reports by DWR to the Governor and the Legislature.



The California Department of Water Resources Report on Reducing the State Water Project's Dependency on Fossil Fuels and Changes to the State Water Project's Power Contracts Portfolio

Executive Summary

DWR shares California's goals for mitigating climate change impacts and effective management of carbon. DWR makes use of a diverse energy portfolio to meet California's water needs. DWR is reducing its annual GHG emissions and fossil fuel dependency through:

- Applying the DWR 1990 carbon footprint as its benchmark, consistent with California's compilation of statewide GHG emissions and sinks; Based on its 1990 emissions, DWR will exceed California's emission reductions targets for 2020;
- Maintaining an optimal balance between loads and resources on the State Water Project (SWP) water conveyance system.
- Refining and expanding its programs to quantify and accurately report the SWP's operational impact on California's emissions reductions goals.
- Implementing environmentally sustainable energy strategies that are responsive to hydrology, water delivery, facilities requirements, and energy market events.
- Identifying and investing in technologies that increase the SWP's percentage mix of cleaner, more efficient resources.
- Providing clean hydroelectric generation to the electric grid during critical peak hours.
- Improving the water to energy conversion ratios at key SWP hydroelectric facilities; by 2011, annual GHG emissions savings from DWR's hydroelectric energy efficiency projects will reach 48,000 metric tons of carbon dioxide (CO₂) avoided.
- Since 1983, DWR has received up to 235 megawatts (MW) annually from Unit 4 of the coal-fired Reid Gardner Power Plant in Nevada. DWR will not extend or renew the agreement when it expires in July 2013.

DWR's strategy and evolving policies to meet California's emissions reductions goals are reflected in this and other reports by DWR to the Governor and the Legislature.



Introduction

The Department of Water Resources (DWR) is pleased to submit to the Legislature and to the Governor its 2011 report on the status of DWR's efforts to reduce its dependency on fossil fuels. Senate Bill 85 added Section (§) 142 to the California Water Code, to address reductions in greenhouse gas (GHG) emissions associated with water conveyance and its energy requirements. Specifically, §142(a) requires that by March 1, 2008, and at least annually through 2015, DWR will report:

- (1) The status of any contracts it has for fossil fuel generated electricity, and its efforts to reduce its dependency on fossil fuels; and
- (2) Changes to the existing energy portfolio that alters the contracts' costs, term, quantity, or composition of resources that deliver power under the contracts.

The first section of this report focuses upon the status of the contracts and the changes to the power portfolio for the State Water Project (SWP), with an emphasis on calendar year 2009 data.¹ The second portion shows the status of DWR's California Energy Resources Scheduling (CERS) Division's long-term power contract portfolio.

The California State Water Project

DWR is classified in the North American Industry Classification System under the Public Administration of Environmental Quality Program Sector. This industry includes government establishments primarily engaged in the administration, regulation, and enforcement of water resource programs, flood control programs, drainage development and water resource consumption programs, and coordination of these activities at intergovernmental levels. DWR's mission is to manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.

Consistent with its mission, DWR is charged with management of the State Water Project, the largest state-built, multi-purpose water project in the country. The SWP was designed and built to deliver water, control floods, generate power, provide recreational opportunities, and enhance habitats for fish and wildlife. DWR has contracts with 29 local water agencies for delivery of up to 4.2 million acre-feet of water per year. Water deliveries serve 24 million people and provide irrigation for 750,000 acres of farmland.

DWR operates the SWP pumping and generating facilities to (in order of importance) (1) provide for safety and flood control needs; (2) comply with environmental regulations (3) meet water supply and delivery needs; (4) minimize cost of water deliveries; and (5)

¹ Calendar year 2010 data is currently being collected and analyzed. Draft statistical and summary data will be available in June 2011.



provide support for the electricity grid for the California Independent System Operator during periods of stress. All of DWR’s power activities are dedicated to making water deliveries and supporting California’s electricity grid. Since water deliveries are subject to increasingly stringent environmental constraints, they are given priority over grid support. These water deliveries, combined with the variability of water supply required for its hydrogeneration plants, render DWR’s energy demand and supply highly variable and difficult to predict from year to year.

The SWP is the third largest generator of clean hydropower in California.² The SWP’s hydrogeneration capacity exceeds 1,900 MW, accounting for 2 percent of California’s total generating capacity. The California Energy Commission classifies the SWP as a publicly owned utility. Compared with all California publicly owned utilities, the SWP ranks as the third largest publicly owned utility, and is roughly half the size of SMUD.³

Table 1 summarizes SWP generation capacity by plant facility, as well as the capacity associated with the energy share from Reid Gardner Power Plant Unit 4.

Table 1. SWP Generation Capacity

Power Plant	Capacity (MW)
Hyatt	819
Thermalito	113
Pine Flat	210
Gianelli	424
William Warne	76
Castaic	120
Alamo	16
Mojave Siphon	14
Devil Canyon	235
Reid Gardner Unit No. 4	250
Total Capacity	2,277

In 2010, SWP owned and operated hydroelectric generation resources and pumpload demand increased by 25 percent and 32 percent respectively from 2009 levels, after a three year decline of 40 percent in both generation and pumpload from 2007 through 2009.

The SWP’s pumping capacity equals 2,600 MW. In 2010, the SWP consumed 7.2 million MWh to deliver 2.1 million acre-feet of water, representing 2 percent of total electricity usage in California. For calendar year 2010, the energy required to deliver

² http://www.energyalmanac.ca.gov/powerplants/POWER_PLANTS.XLS

³ <http://www.ecdms.energy.ca.gov/elecbyutil.aspx>



water was derived from SWP and off-Aqueduct hydrogeneration resources (49 percent), purchases from bilateral counterparties (41 percent), and from DWR's contract to receive electricity from the Reid Gardner coal-fueled power plant in Nevada (10 percent).

The State Water Project Power Portfolio Overview

DWR develops and administers a comprehensive power resources program for the strategic timing of generation and pumping schedules, acquisition of power resources and transmission services, short-term sales of energy surpluses, and forecasts of resources in the future. The SWP's energy portfolio is made up of the SWP's own hydropower resources, including the Hyatt-Thermalito Pumping-Generating complex, the SWP aqueduct's recovery plants (Gianelli, Alamo, Devil Canyon, and Warne), and the Mojave Siphon generation plant.⁴

The SWP receives additional hydroelectric energy and capacity through long term agreements with the Kings River Conservation District (KRCD), the Los Angeles Department of Water and Power (LADWP), and the Metropolitan Water District (MWD). With respect to non-hydroelectric energy resources used by the SWP, under the *Reid Gardner Unit 4 Participation Agreement*, DWR receives up to 90.40 percent energy output from Reid Gardner Power Plant Unit 4. DWR's market purchases make up the rest of the SWP's energy portfolio, which includes two medium-term market contracts for off-peak energy.

DWR typically schedules its pumpload for off-peak hours, which substantially benefits California's electricity grid. During off-peak hours, fewer generators cycle up and down in response to peak energy demand requirements. Off-peak operations receive energy from the generators that normally run at higher levels of efficiency (e.g., during periods of lower electricity demand). DWR's on-peak hydroelectric generating plants displace less efficient alternative thermal power resources that operate on the margin during hours where electricity demand is at its peak.

Due to the variability of electricity scheduling and water deliveries, DWR may have surplus power. The surplus power results from scheduled power in excess of actual load, and constitutes 19 percent of DWR's total generation resources. Aside from the incidental sales of surplus power, all electricity consumed by the SWP is used to pump water throughout California. DWR makes no retail sales of this surplus electricity to retail energy providers or for end-use electricity consumption.

SWP power costs have ranged from \$350 million to \$600 million annually in recent years. Approximately 96 percent of the costs of the entire SWP, including power costs, are paid by the 29 local agencies holding long-term water supply contracts with the

⁴ Gianelli Pumping-Generating Plant is a joint DWR and U.S. Bureau of Reclamation (USBR) facility; DWR's share is 222 MW; USBR's share is 202 MW.



Department. Increased costs for power and transmission, coupled with reduced water availability have raised the unit cost of water.

DWR Emissions Reductions Programs and Strategies

The development of reliable, clean and renewable energy sources and effective management of carbon are critical for national and global security, and environmental health. To mitigate climate change impacts, California shares the national and international goal of reducing GHG emissions, expanding energy efficiency programs and renewable energy resources, and implementing low-carbon fuel standards. With its diverse energy portfolio to meet California's water and energy needs, DWR is reducing its GHG emissions and fossil fuel dependency by:

- Maintaining a continuous balance between resources and demand on the SWP's system through: self-generation of clean hydroelectric power, load management, exchange agreements, and specified and unspecified market purchase and sales transactions. DWR analyzes SWP transactions data for trends in energy usage and GHG emissions that impact its legislatively mandated responsibilities.
- Coinciding with the Governor's Executive Order S-3-05 (*The Impacts of Climate Change*) and Assembly Bill 32 (AB 32 -- *The Global Warming Solutions Act of 2006*), DWR is continually refining its programs to quantify and accurately report the SWP's operational impact on California's emissions reduction goals. DWR communicates extensively with government and private entities to ensure that its efforts align with national and State legislation and policy directives.
- AB 32 mandates the reduction of California's GHG emissions to 1990 levels by 2020. DWR defines its 1990 carbon footprint consistent with California's GHG inventory, a compilation of statewide GHG emissions and sinks.⁵ DWR applies calendar years 1990 and 2007 as reference years to quantify the SWP's carbon footprint. Under either scenario, DWR meets or exceeds California's 2010 and 2020 emission reduction goals.
- DWR's environmentally sustainable energy strategies are dependent upon hydrology, water deliveries, SWP hydroelectric equipment and facilities requirements, and energy market events.
- DWR is investigating and investing in technologies such as highly efficient combined-cycle, combined heat and power generation, solar, and wind energy to increase the SWP's percentage mix of cleaner, more efficient resources.

⁵ See http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_by_ipcc_2007-11-19.xls. The California Air Resources Board (ARB) inventory draws upon data from the Intergovernmental Panel on Climate Change Second Assessment Report.



- The SWP lowers the wholesale power grid emissions by offering clean hydroelectric generation to the market on peak hours. Consequently, the SWP's hydrogeneration resources displace energy from carbon producing generators that would otherwise be called upon to meet California's peak electricity demand.
- In 2007 and 2008, DWR participated in the California Demand Response Program through contracting to drop up to 200 MW of the SWP's pump load from May through September during peak demand hours. The program reduces GHG emissions by decreasing the amount of peak generation met by inefficient, high carbon emitting resources.⁶ In 2007, DWR pumpload drop equaled 7,600 megawatt hours (MWh) during California's peak demand period. In 2008, DWR dropped 2,200 MWh of its pumpload during peak demand hours.
- DWR invests substantial resources in engineering feasibility and design studies to implement programs to optimize water to energy conversion ratios at SWP hydroelectric facilities. DWR's energy efficiency programs include pump and turbine replacements and refurbishments to increase the SWP's overall system performance. The programs substantively reduce overall GHG emissions since the SWP hydroelectric units are using less energy to move more water, and generating more energy with less water. DWR's energy efficiency improvements at the Hyatt Generation Plant are complete. Replacement of three Edmonston hydroelectric pumps, and refurbishment of all Hyatt generators reduced SWP pumpload and increased hydroelectric generation capacity saved 42,000 tonnes of CO2 emissions in 2009. The Edmonston Pumping Plant project will continue through 2011.
- AB 32 mandated the California Air Resources Board (CARB) to adopt compulsory regulations for reporting of statewide GHG emissions by January 1, 2008, incorporating the standards and protocols developed by the California Climate Action Registry (CCAR). DWR submitted its second annual Mandatory Greenhouse Gas Reports to the CARB in June 2010. The report includes energy data for SWP hydroelectric facilities, plant capacities, and the SWP power portfolio.
- DWR's membership in California's Climate Registry and its participation in California's mandatory reporting requirements under AB32 serve as consistent and transparent mechanisms to report, update, track and verify DWR's carbon footprint. DWR's strategy and future policies to meet California's emissions reductions goals are demonstrated in these reports. DWR's third and final emissions report to the CCAR was submitted in June 2010. Independent verification for DWR's 2009 report to the CCAR was successfully completed in October 2010.

⁶ Inefficient, high emitting "peaker" plants are generally brought on line when power demand is high, and there are no other alternatives.



- In February 2011, DWR issued a Request for Offer (RFO) for CARB accredited Verification Services for reporting year 2010. DWR will issue an RFO for its 2010 voluntary greenhouse gas emissions report to The Climate Registry (TCR) in March 2011.⁷

Under Water Code Section 142, DWR must comply with the same greenhouse gas emissions performance standards adopted pursuant to Section 8341 of the Public Utilities Code for a local publicly owned electric utility for new electricity contracts. DWR entered into a contract with Northern California Power Agency for a generation share in the new Lodi Power Plant, which meets and exceeds the performance standards required under Section 142 and Section 8341. Since 1983, DWR has received up to 235 megawatts (MW) annually from Unit 4 of the coal-fired Reid Gardner Power Plant in Nevada. DWR will not extend or renew the agreement for up to 235 MW of energy from Unit 4 of the Reid Gardner Power Plant, a coal-fired facility in Nevada upon its expiration in 2013.

Specified Energy Resources to Convey State Water Project Water

The SWP's electric power requirements are met with DWR's own and jointly developed hydroelectric facilities, and long-term and short-term purchase agreements. DWR enters into agreements so that the SWP can sell, buy, and exchange capacity or energy to promote the most efficient use of its generating resources and the scheduling of water deliveries. The SWP's energy portfolio includes:

Hydroelectric Generation: Hydropower is renewable energy, since it is "energy drawn from a source that is infinite or is replenished through natural processes. Such sources include the sun, wind, thermal energy, biomass, and moving water."⁸ Clean, hydroelectric generation typically makes up almost half of SWP power resources.

Joint Development Agreements: In 1966, DWR contracted with the Los Angeles Department of Water and Power (LADWP) for the joint development of the Castaic Power Plant. Although part of the SWP system, the Castaic Power Plant is operated by LADWP, and electrically connected to their system at the Sylmar Substation. SWP receives capacity and energy based upon LADWP's weekly water schedules.

Contractual Arrangements: DWR takes delivery within California for energy through long-, medium-, and short-term agreements with marketers and utilities, including:

- All hydroelectric output from the run-of-river 210 MW Pine Flat Power Plant, owned and operated by the Kings River Conservation District (KRCD).

⁷ CCAR accepted 2009 GHG emission reports, and converted its database to "read only." TCR was formed to continue voluntary reporting throughout North America. DWR's 2010 and future annual emission report are to be submitted through TCR.

⁸ Refer to <http://www.energy.ca.gov/2005publications/CEC-300-2005-010/CEC-300-2005-010-FS.PDF>



- 30 MW from five small hydroelectric plants owned and operated by MWD.⁹
- A 1988 Coordination Agreement, which allows DWR to purchase surplus energy from MWD's Colorado River Aqueduct system.
- 100 MW of off-peak energy through 2010, and 200 MW of off-peak energy through 2015 from two market contracts sourced primarily from natural gas.
- DWR receives energy from the Reid Gardner coal-fired generation facility in Moapa, Nevada. DWR receives up to 235 MW from Reid Gardner Unit No. 4. This contract will expire in July 2013 and will not be renewed.
- The SWP relies upon market contracts and exchange agreements with energy from unspecified sources. The emissions from these contracts and agreements are derived from emissions assigned to California's mix of energy resources.

The State Water Project Water Energy Portfolio – Calendar Years 2007 through 2010

Averaged over the past four years (2007 through 2010), hydroelectric generation comprised 44 percent of SWP power resources. Market based purchases and exchanges, and Reid Gardner Unit No. 4 equaled 43 percent and 14 percent of the SWP power purchase portfolio, respectively. In the same timeframe, hydrogeneration decreased by 35 percent; portfolio purchases and Reid Gardner Unit No. 4 decreased by 40 percent and 15 percent, respectively. The SWP's generation portfolio for calendar years 2007-2010 is summarized below.¹⁰

⁹ Located at Lake Mathews, Foothill Feeder, San Dimas, Yorba Linda, and Greg Avenue in the Los Angeles area

¹⁰ SWP energy data is subject to change, based upon the financial settlements process, as well as the validation necessary for publication in Bulletin 132. This verification process may continue for one or more years, until final publication in the Bulletin.



Table 2. SWP 2007-2010 Energy Portfolio¹¹

SWP Generation Resources (GWh) Source	Year			
	2007	2008	2009	2010
Alamo Powerplant	58	66	56	80
Castaic Power Plant*	859	582	585	447
Devil Canyon Powerplant	1,166	686	561	1,002
Mojave Siphon Powerplant	75	42	32	62
Pine Flat*	195	246	270	514
Gianelli Pumping-Generating Plant	246	140	56	87
Hyatt - Thermalito Powerplant Complex	2,072	990	1,451	1,546
Warne Powerplant	465	316	284	269
Small Hydro*	<u>145</u>	<u>147</u>	<u>102</u>	<u>100</u>
Hydrogeneration	5,281	3,215	3,397	4,107
Purchases (Unspecified Energy)	4,956	3,715	2,983	3,369
Reid Gardner Unit No.4 Imports	<u>1,387</u>	<u>1,134</u>	<u>1,175</u>	<u>819</u>
Fossil Fuel Generation	6,343	4,849	4,158	4,188
Total Resources	11,624	8,064	7,555	8,295
Sales (Surplus Energy)	2,258	2,335	1,476	1,784
Total (Net) Resources	9,366	5,729	6,079	6,511

*Off Aqueduct

¹¹ Minor variances in subtotals or totals are to the result of rounding. GWh totals include line loss factors and station service.



Table 3 illustrates the marked change in SWP pumpload demand and generation resources over the past four years. In 2010, following three consecutive drought years, 2010's persistent spring storms showed increases in SWP hydroelectric generation and pumpload demand. In 2010, SWP owned and operated hydroelectric generation resources and pumpload demand increased by 25 percent and 32 percent respectively from 2009 levels, after a three year decline of 40 percent in generation, pumpload, and unspecified energy purchases from 2007 through 2009.

Table 3. SWP Owned & Operated Hydroelectric Plant Profile

SWP Owned & Operated Hydroelectric Plant Supply and Demand				
Project Gigawatt Hours	2007	2008	2009	2010
SWP Pumping Plant Load	9,293	5,709	5,445	7,191
SWP Power Plant Generation	4,081	2,240	2,441	3,046

CO₂ Emissions Summary and Accounting Methodology

DWR reported CO₂ emissions for the SWP power purchase portfolio to the CCAR for years 2007 through 2009 and to The Climate Registry (TCR) for 2010, as summarized below.

Table 4. SWP Annual Energy Portfolio CO₂ Emissions

State Water Project CO₂ Emissions (Million Metric Tonnes Carbon Dioxide)				
Source	2007	2008	2009	2010
Reid Gardner Unit 4	1.4	1.0	1.0	0.8
Purchases (Unspecified Energy)	1.7	1.4	1	1.1
Gross Emissions	3.1	2.4	2.0	1.9
Surplus Sales	0.7	0.8	0.4	0.4
Net Emissions	2.3	1.6	1.6	1.5

Through reporting year 2009, DWR applied emissions factors and guidelines consistent with the CCAR General Reporting Protocol and the Power/Utility Protocol. These protocols integrate data sources and methodology from the Environmental Protection



Agency (EPA), the Energy Information Administration (EIA), and the Federal Energy Regulatory Commission. DWR transitioned to the new, nationally based registry by joining TCR in February 2010. For the 2010 reporting year, DWR will report to The Climate Registry, applying methodology and emissions factors consistent with TCR's General Reporting Protocol and the Electric Power Sector (EPS) Protocol. DWR's Request for Offer for independent verification services for its 2010 report to TCR was issued in early 2011.

Under existing protocols, hydroelectric, nuclear, and renewable energy are reported as having zero carbon emissions. SWP's purchases and exchanges from unspecified sources reflect emissions rates reported to the CCAR, TCR, the US EPA, and directly to DWR.¹²

The Reid Gardner Unit 4 CO₂ emissions rate is calculated by retrieving data from the EPA Clean Air Markets Division database.¹³ The rate is calculated based upon the daily energy DWR imports into California to serve SWP pumpload demand. In 2010, DWR imported less energy as a result of a Force Majeure event in January 2010, as well as economic disincentives to import energy from Unit 4 into California. Over the past four years, emissions from RG4 have declined by 43 percent.

Phasing Out Carbon-Intensive Energy Resources

The electric power needed to operate the SWP comes from its own and jointly developed hydroelectric facilities, long-term and short-term purchase and exchange agreements, and a 30-year agreement with NV Energy (formerly known as Nevada Power Company). Since July 25, 1983, DWR has received up to 235 MW from Unit 4, one of four units at the Reid Gardner coal-fired generation facility located in Moapa, Nevada. Upon contract expiration, DWR will replace this energy with a combination of cleaner, more efficient resources, and through continuing improvements to the SWP system resources and strategies (some of which are described below).

Investment in Low Emissions Technologies - The Lodi Energy Center

CO₂ emissions from electric power generation are tied to efficiency factors associated with converting fossil fuels into electricity, and the type of fuel used. In a typical power plant, only 30 percent of the energy is actually converted into electricity. Improvements in generation efficiency by replacing traditional power generators with more efficient technologies can result in lower CO₂ emissions. For example, emissions factors associated with coal-fired generation are almost twice that of natural gas powered generation.

¹² With the exception of one counterparty whose emission rate was only available for 2005.

¹³ NV Energy reports emissions to the EPA CAMD on a quarterly basis, based upon direct measurements acquired through its continuous emissions monitoring (CEM) system. The EPA publishes its CAMD emissions data three months after the fact.



In 2009, DWR finalized its participation in the construction of a new, state-of-the-art combined-cycle natural gas plant. The new facility will employ advanced emission control technology, be highly efficient and replace a portion of the SWP power needs now served by coal fired generation. The Lodi Energy Center (LEC) will be a 280 MW gas-fired power plant located near Lodi, California, and has one of the lowest greenhouse gas emissions rates in the state, and possibly the nation. As currently planned, SWP has contract rights approximately one third of output from LEC (the SWP will receive approximately 90 MW of the plant’s output). Groundbreaking for construction of the plant occurred in July 2010.

SWP Operational Flexibility and Energy Efficiency Programs

Hydroelectric power plants avoid increased releases of GHGs. Consistent with AB 32, achieving high levels of efficiency of pumps and generators is one of many strategies DWR engages in to help California meet the GHG emission reduction goals and stabilize the costs of delivering water, and provide energy alternatives to fossil fuel based energy resources.

The Edmonston Pumping Plant and Edward Hyatt Power Plant are SWP-owned hydroelectric facilities where major energy efficiency projects have been undertaken. DWR anticipates that upon completion in 2011, the two energy efficiency projects will reduce GHG emissions by 48,000 metric tons of CO₂ annually. DWR is evaluating the feasibility of additional energy efficiency upgrades at Edmonston, which would start in 2013 and extend through 2020.

Table 5 illustrates the cumulative energy savings and fossil fuel emissions equivalents associated with the energy efficiency improvements from 2003 through 2020. This table reflects the weighted average of the emissions rates from the SWP’s energy portfolio from 2007 through 2010.

**Table 5. SWP Energy Efficiency and Emissions Reductions
Years 2003 – 2020**

Energy Efficiency Program	Cumulative Energy Savings (MWH)		Emissions Reductions (Metric Tons CO ₂)		Emissions Avoided
	Hyatt Generation	Edmonston Pumping	Hyatt Generation	Edmonston Pumping	
Years					Automobile Equivalents
2003-2007	306,949	5,951	84,108	1,631	15,703
2008-2020	1,721,443	773,202	471,698	211,867	125,195
Total (2003-2020)	2,028,392	779,153	555,806	213,498	140,898
CUMULATIVE TOTAL	2,807 gigawatt hours		0.77 million metric tonnes CO₂		140,898 automobiles



The Tehachapi East Afterbay Project

In 2006, DWR completed the construction of a new reservoir east of the East Branch and West Branch bifurcation of the California Aqueduct in southern Kern County. The Tehachapi East Afterbay Project provides additional storage to the existing Tehachapi Afterbay. The additional water storage capacity allows downstream facilities to operate for short periods without relying on the pumping operations of the Valley String Pumping Plants,¹⁴ thereby reducing pumpload demand during peak electrical demand periods,¹⁵ and increasing operational flexibility. Pumping shifted from expensive, peak periods of power demand to off-peak periods when power rates are lower, results in cost savings and more efficient and stable energy consumption.¹⁶ The reservoir also provides ancillary services to California's energy grid.

In 2010, DWR completed a study on the feasibility of adding a second hydrogeneration unit, rated at 14 MW at the Alamo Powerplant in Southern California in lieu of the upstream storage capacity from the Tehachapi East Afterbay. The study addressed climate change impacts on runoff and impacts from pumping restrictions for the Delta smelt and salmon. There are clear, emissions reductions benefits, in adding a qualifying renewable (small hydroelectric) generation resource to the SWP's energy portfolio.

Sites Reservoir Storage Projects

DWR is researching how to provide water supplies in average and dry years for urban, agricultural and environmental purposes using clean hydroelectric resources to enhance the inherent flexibility of the SWP.¹⁷ Pump-back operations use water in excess of what is necessary to meet downstream flow requirements. The water is pumped back into a reservoir during off-peak hours, and then released during on-peak hours when power is in demand. A classic example of these types of operations is the SWP Oroville Facilities power operations, whose releases are made for several purposes, including entitlements, water quality, and in-stream flow for the Feather River.

¹⁴ Valley String Pumping Plants include Dos Amigos, Buena Vista, Teerink, Chrisman, and A.D. Edmonston Pumping Plants.

¹⁵ The reduction in peak energy demands diminishes reliance on "peaker" plants that provide extra power during periods of peak usage, but generally not as efficient and produce higher GHG emissions.

¹⁶ However, the ability to shift to off-peak pumping is often limited by a lack of regulatory storage and the need to maintain flow rates in the East Branch of the California Aqueduct.

¹⁷ DWR and the CALFED Bay-Delta Program (CALFED) funded five surface storage investigations to study increasing Delta outflows during critical times, improving flood control, enhancing groundwater recharge, contributing to the Environmental Water Account, and, improving the operational flexibility for existing facilities, such as Shasta Reservoir.



Sites reservoir, as an off-stream project with a capacity of 1.9 million acre-feet, would be filled primarily by pumped diversions from the Sacramento River. Water would be diverted into the reservoir during peak flow periods in winter months. To minimize potential impacts of existing diversions on Sacramento River fisheries, sites would release water back into valley conveyance systems in exchange for water that would otherwise have been diverted from the Sacramento River. The undiverted summer water could become available for other downstream uses in the Bay-Delta. By providing additional storage and operational benefits, Sites reservoir would be a critical component of an integrated water management and water development program for the Sacramento Valley.

Reducing Fossil Fuel Use in the CERS Contracts – Replacement with Less Polluting Energy Resources

In response to California's 2000-2001 energy crisis, the Governor and the Legislature directed DWR to purchase electricity for California's investor-owned utilities (IOUs) and to assemble a portfolio of long-term power contracts to provide reliable electric service at the lowest-possible price. DWR created the CERS Division which entered into power contracts to provide more than 20 percent of the electricity used by IOUs' customers. These power contracts provided the guaranteed revenue that allowed for the financing and construction of over 5,000 MW of state-of-the-art natural gas-fired power plants. These cleaner, more fuel efficient natural gas-fired power plants have significantly reduced reliance on older, less-efficient plants in the State and have contributed to a reduction in carbon emissions of approximately 1.51 million metric tonnes annually.

The Legislature required DWR to consider a number of factors when entering into contracts for power, including the intent to achieve an overall portfolio of energy contracts offering reliable service at the lowest possible price and to secure as much power under contract as possible from renewable energy resources.

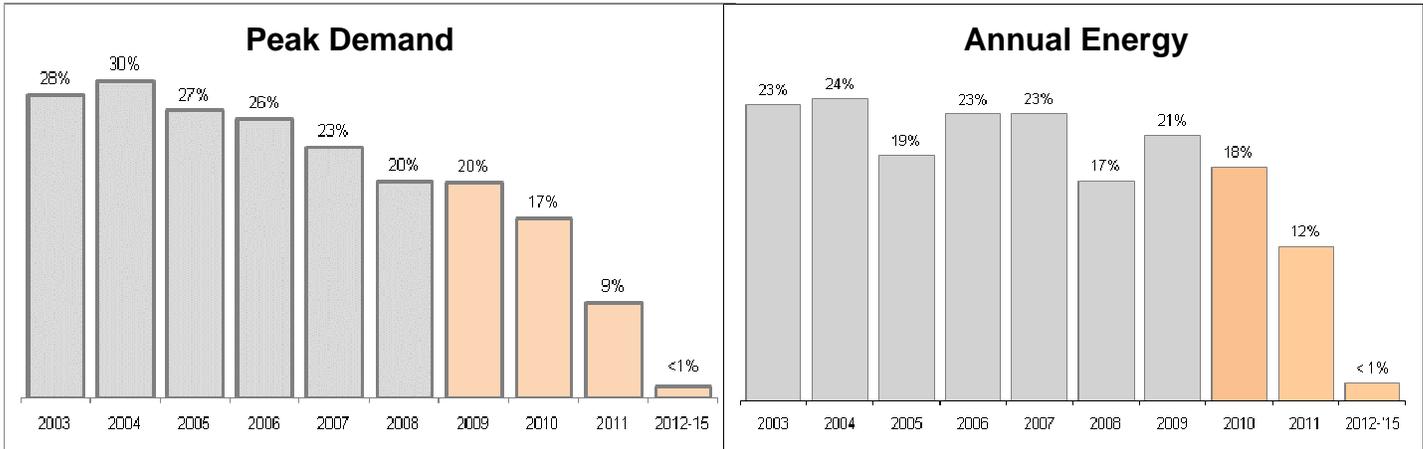
CERS originally entered into contracts with 28 counterparties to provide 56 energy products. Six of the agreements were for renewable power, and included two contracts totaling 31 MW for biomass power, one 25 MW contract for geothermal power, and three contracts for a total of 172 MW of wind power.

As opportunities for contract amendments arise, CERS considers options that could both increase the amount of energy from renewable resources in its portfolio and provide reliable, reasonably-priced electricity.

In 2011, ten years after the energy crisis, the CERS contracts are expected to provide nearly 9 percent of the generating capacity needed to meet the peak electricity demand of IOU customers and 12 percent of the IOU customers' total demand for energy. Effective January 1, 2011, eighteen contracts remain in effect with an estimated cost of \$1.5 billion. By 2012, only five contracts will remain providing less than 1 percent of the IOU's customers' demand. The last contract expires in 2015, as illustrated in Figure 1.



Figure 1. CERS Contracts as a Percent of IOU Peak Capacity & Annual Energy Demand



The Generation Mix of the CERS Portfolio

For 2011, the estimated mix of generation from the CERS portfolio is:

Table 5. CERS Generation Energy Portfolio in 2011

Source	Contract Capacity (MW)	Energy (GWh)
Wind	172	433
Natural Gas	1,054	3,814
Non-Specific	2,995	19,163
TOTAL	4,221	23,410

While most of the energy in the CERS portfolio comes from newly constructed, fuel efficient, natural gas-fired plants, some of the CERS contracts are with power marketers who do not own any generation, or with counterparties that have the option to provide power from market sources when it is cheaper to do so. Roughly, 82 percent of the energy CERS contracts are forecasted to provide in 2011 will come from non-specific market sources, which cannot be traced back to a specific generator. The source of the power could be hydro, nuclear, biomass, wind, solar, natural gas, or coal or some mix of these resources. Electricity from CERS contracts with renewable energy resources will provide 2 percent of the CERS total, while electricity generated from natural gas facilities is estimated to provide 16 percent.

Between now and when the last CERS contracts end in 2015, DWR will have limited



opportunity to re-negotiate the terms of the contracts to increase the amount of electricity derived from renewable energy resources.

Role in Statewide Energy Supply

CERS' authority to enter into new contracts ended in 2002. Its temporary role in providing power limits its ability to renegotiate contracts to bring **new** renewable energy projects on-line. Developers of new renewable energy projects need long-term contracts in order to get financing for the projects.

For CERS to replace fossil generation in the portfolio of contracts with renewable energy, and still limit its involvement in energy markets to no longer than 2015, would require CERS to compete against the California IOUs for power from existing renewable energy projects. This would only exacerbate the problem the IOUs are currently facing in meeting the State's renewable portfolio standard goal.

Conclusion

DWR will continue its role as the State's third largest generator of clean hydropower. DWR is currently investigating ownership interest and contractual agreements to not only replace its coal generating resources, but also to reduce its overall dependency on fossil fuels. This can be accomplished with technologies such as combined-cycle generators and combined heat and power systems to replace the coal-based energy with a combination of cleaner, more efficient resources, improvements to the SWP system, and renewable energy resources. DWR's membership in the CCAR, TCR and participating in AB32 mandated reporting regulations provide the vehicle for DWR to track and report its CO₂ and GHG emissions, evaluate its progress in meeting and exceeding California's GHG emissions reductions goals, and influence the role DWR will play in mitigating the negative effects of climate change in California.

Due to the unique circumstances associated with the CERS contracts and limitations on contract term-renegotiation, it is unlikely that fossil fuel use in the portfolio of CERS will be appreciably reduced between now and when the last CERS contracts end in 2015.