

Executive Summary: Draft PA No. 1 – Additional Water Conservation Activities

Description

Additional or accelerated water conservation programs that focus on the energy efficiency of water consuming appliances would directly save energy and promote reduction of potable water use. The reduction of GHG emissions associated with this project would primarily be from the direct energy savings of using a more energy efficient washer and the indirect energy savings of using less potable water. SCWD and SqCWD already have robust overall water conservation programs. This project would accelerate the existing washing machine replacement program by increasing the number of rebates for residential washers and more aggressively targeting commercial high efficiency washing machines.

Amount of GHG Reduction

The estimated GHG reductions rely on participation in the program and may be less than estimated if actual participation is less than assumed by this project assessment. Assuming 750 additional customers per year install high efficiency front loading washing machines, this program could reduce water and energy consumption and could potentially provide an annualized GHG reduction of approximately 240 MT CO₂e per year for SCWD and 213 MT CO₂e per year for SqCWD. The majority of these savings are direct energy reduction from the more efficient machine (80 to 90%); a smaller portion is indirect savings from lower water use. This project could reduce approximately 35 to 55% of the potential GHG reduction goals for SCWD, and 12 to 15% of the potential GHG reduction goals for SqCWD.

Project Life and Sustainability

Due to the criteria of additionality, only new or accelerated programs, beyond the existing programs described above, can be counted as a GHG reduction project for the **scwd**² Desalination Program. For SCWD and SqCWD, the additional GHG reduction credit from these accelerated programs is estimated to have a 12 year lifetime, since it is assumed that in 12 years, or less, customers would have signed up through the existing programs offered by SCWD and SqCWD. Also, a washing machine replaced through this program is expected to last approximately 12 years.

Project Cost

For SCWD, this project is estimated to have an average annual net cost of approximately \$167,000 per year, or approximately \$600 per MT CO₂e. For SqCWD, this project is estimated to have an average annual net cost of approximately \$110,000 per year, or approximately \$460 per MT CO₂e.

Table ES-1: Additional Water Conservation Project Summary

Agency	Life (yr)	Avg Annual GHG Reduction (MT CO ₂ e/yr)	Capital Cost (\$ mil)	Average Annual Net Cost (\$/yr)	Lifecycle Energy Cost (\$/kWh)	Lifecycle GHG Reduction Cost (\$/MT)
SCWD	12	240	\$2.6	\$167,000	\$0.19/kWh	\$600
SqCWD	12	213	\$1.9	\$110,000	\$0.15/kWh	\$460

Draft Project Assessment No. 1 – Additional Water Conservation Activities

Description

This assessment estimates the energy savings and GHG reduction potential from the development of an additional or accelerated water conservation program.

Background

SCWD and SqCWD have robust water conservation programs designed to maximize water savings and incorporate latest technologies and practices. Programs are developed to ensure compliance with state requirements, most recently the SBx7-7 demand reduction goals. The proposed program would build on existing activity and reduce energy consumption and indirect GHG emissions from washing machine use throughout the SCWD and SqCWD areas by providing customers with incentives to purchase high efficiency machines.

High-efficiency clothes washers (HEW) deliver high level wash performance while saving both water and energy. Resource efficient models use 35 to 50% less water and approximately 50% less energy to heat the water.

Existing SCWD Program

SCWD has offered a clothes washer rebate program to its residential and commercial customers since 2000, primarily as a water conservation measure. The program currently provides a \$100 rebate as an incentive to choose HEWs. As a signatory to the CUWCC's Memorandum of Understanding Regarding Urban Water Conservation in California, the program is one of several Best Management Practices (BMPs) SCWD has committed to implement. Since 2000, SCWD has issued between 500 and 700 rebates per year, which has generated an estimated cumulative total water savings of 44.3 million gallons of water per year through 2010. The current program provides rebates to any machine that has an ENERGY STAR label.

Existing SqCWD Program

SqCWD has been offering rebates for high-efficiency clothes washing machines since 1999. It first offered a \$100 credit to residential customers who purchased and installed approved HEWs. The program has since expanded to include a \$200 rebate to commercial customers who install ENERGY STAR HEWs.

Since 1999, 3,467 residential and 46 commercial HEW rebates have been issued by SqCWD; this is an average of approximately 293 rebates per year. SqCWD has been considering modifications to the commercial washer rebate program in an effort to increase participation, particularly among coin-operated laundries that are using multi-load washers. The multi-load commercial washers are significantly more expensive than single-load washers used in most residences, and an increase in the current rebate amount of \$200 may entice commercial laundry owners to retrofit these units.

Although there currently is not an estimate of local market saturation at this time, according to the 2007 California Single Family Water Use Efficiency Study, only about one-third of homes were using HEWs of 30 gallons per load or less. It is expected that there is still a strong

potential for energy and water conservation in improving the efficiency of clothes washers. SCWD currently is performing a market penetration analysis to determine the fixture efficiency and saturation in its service area. The results of this analysis will better inform the savings estimates developed in the proposed program and will be incorporated as soon as they are available.

Proposed Additional Program

The proposed program would offer a rebate of \$400 as an incentive to residential customers and \$800 for commercial customers who purchase clothes washers meeting the California Energy Commission's (CEC) most efficient, Tier 3 specifications. The goal in offering this rebate is to make the net cost of HEWs less than the cost of conventional clothes washers for the consumer, in order to accelerate the number of customers who participate in adopting this technology. Compared to a standard top loading machine with a water factor of 13, a Tier 3 machine would save an estimated 28 gallons of water per day or almost 10,000 gallons per year and a high-efficiency commercial washer retrofit saves about 15,586 gallons per year per unit. The HEWs are also more energy efficient than standard top loading machines, therefore the rebate program could provide energy savings from both the machines themselves, and from the associated energy to provide potable water.

Based on discussions with the SCWD and SQCWD Water Conservation Directors, the project assessment estimates an increase in current participation rates to provide rebates for an additional 375 residential top loading HEWs and 63 commercial HEWs per year for SCWD. This would be an approximately 60% increase in current participation rates. The project assessment estimates an increase in current participation rates to provide rebates for an additional 250 residential top loading HEWs and 62 commercial HEWs per year for SqCWD. This would approximately double the current participation rates.

Table 1 estimates the number of additional rebates and water savings that could be achieved over the life of this program.

Table 1: Estimated Water Savings from Washing Machine Rebate Conservation Program

Year	SCWD			SqCWD		
	Total Additional Rebates		Total Water Savings (MGY)	Total Additional Rebates		Total Water Savings (MGY)
	Residential	Commercial		Residential	Commercial	
1	375	63	5	250	62	4
2	750	126	10	500	124	7
3	1,125	189	14	750	186	11
4	1,500	252	19	1,000	248	14
5	1,875	315	24	1,250	310	18
6	2,250	378	29	1,500	372	21
7	2,625	441	34	1,750	434	25
8	3,000	504	39	2,000	496	28
9	3,375	567	43	2,250	558	32
10	3,750	630	48	2,000	620	35
11	4,125	693	53	2,750	682	39
12	4,500	756	58	3,000	744	42
Average Annual Water Savings (MGY)			31	23		

Performance Metrics

In 2004, the CEC adopted tiered water and energy efficiency standards for clothes washers. The CEC high-efficiency clothes washer specifications have two parts: energy consumption (Modified Energy Factor) and water usage (Water Factor).

Modified Energy Factor (MEF) is the energy performance metric for ENERGY STAR qualified clothes washers and all clothes washers as of January 1, 2004. MEF, expressed in ft³/kWh/cycle, is the quotient of the capacity of the clothes container, C, divided by the total clothes washer energy consumption per cycle, with such energy consumption expressed as the sum of the machine electrical energy consumption, M, the hot water energy consumption, E, and the energy required for removal of the remaining moisture in the wash load, D. The higher the value, the more efficient the clothes washer is. The higher the MEF, the more efficient the washer. The equation is shown below:

$$MEF = \frac{C}{M + E + D}$$

Water Factor (WF) is measured by the quantity of water (gallons) used to wash each cubic foot of laundry. WF is the quotient of the total weighted per-cycle water consumption, Q, divided by the capacity of the clothes washer, C.. The lower the water factor rating, the more water efficient the clothes washer. A clothes washer with a water factor rating of 6 uses half the amount of water compared to a washer with a rating of 12, to clean the same amount of clothes. A typical clothes washer has a water factor rating of 12 to 13. Water efficient clothes washers have water factor ratings of 9.5 or less. Some super efficient machines have ratings lower than 5. The equation is shown below:

$$WF = \frac{Q}{C}$$

The federal EnergyGuide label on clothes washers shows annual energy consumption and cost. These figures use the energy factor, average cycles per year, and the average cost of energy to estimate energy consumption and cost. The ENERGY STAR criteria for clothes washers changed on January 1, 2011. The new ENERGY STAR criteria require all qualified products to have a Modified Energy Factor (MEF) of 2.0 or greater as well as a Water Factor (WF) of 6.0 or lower

The CEC developed high efficiency specifications for residential clothes washers as part of its Super Efficient Home Appliances initiative (Table 2). This program will provide incentive for the most efficient CEC, Tier 3 specification.

Table 2: CEC HEW Specifications

Tier	MEF	WF
Federal Standard	1.26	9.5
ENERGY STAR	2.00	6.0
CEC Tier 1	2.00	6.0
CEC Tier 2	2.20	4.5
CEC Tier 3	2.40	4.0

Vendors

Over 100 models of residential and commercial high-efficiency washers are offered by companies such as Continental, Dexter, GE, Huebsch, Maytag, Speed Queen, Staber, Unimac, Wascomat, and Whirlpool. The proposed program expansion will build on the structure and administration of the current program.

History and Technical Maturity

State and Utility Rebates

Washing machine rebate programs have been implemented by water agencies and energy utilities in California for over a decade and are an element of many statewide programs, such as the California Urban Water Conservation Council's (CUWCC) One Stop Rebate program. The programs have been successful in terms of both customer participation and water and energy savings.

PG&E also offers a rebate for qualifying clothes washer models. Models must be CEE Tier 2 or higher, so using CEE list as qualifying criteria is already being practiced by energy utilities and should not be a problem for customers to use.

Energy and water utilities have been promoting efficient washers and providing rebates for over a decade. In addition, through the Super-Efficient Home Appliances Initiative, CEE promotes the manufacture and sales of energy-efficient clothes washers and has developed a set of specifications and a qualifying products list to define energy efficiency. The CEE works with initiative participants (utilities and energy organizations) to promote qualifying washers through incentive, educational and promotional programs. Tier 3 Machines are widely available at retail locations.

Reliability and Operational Complexity

The reliability of this and other rebate programs to provide GHG reductions will depend on the participation rate in the program. Participation can be increased through public education and advertising campaigns, however, participation is not guaranteed. The actual program participation rates would need to be confirmed on an annual basis and additional efforts made to promote the program if participation is below target.

Since the proposed program is an expansion of a successful long-standing program, operational impacts are expected to be minor. There will potentially be an increase in outreach and rebate processing but the program will not require and new processes to be developed. It is expected that staffing will need to be expanded by about 0.2 FTE to process the increase in rebates. There are no major risks identified with this project. If it is not successful, the rebates would not be issued and the program would be discontinued.

Project Life and Sustainability

Due to the criteria of additionality, only new or accelerated programs, beyond the existing programs described above, can be counted as a GHG reduction project for the **scwd²** Desalination Program. Additional projects have to create “reductions in emissions that are additional to any that would occur in the absence of the certified project activity” (Kyoto Protocol, Article 12.5).

For SCWD and SqCWD, the additional GHG reduction credit from these accelerated programs is estimated to have a 12 year lifetime, since it is assumed that in 12 years, or less, customers would have signed up through the existing programs offered by SCWD and SqCWD. A washing machine replaced through this program is expected to last approximately 12 years. Therefore, the GHG reduction credits for this program are assumed to last only for up to a 12-year period. A customer that signs up in year 4 would only receive credit for $12 - 4 = 8$ years of GHG reductions. At the end of the 12-year project life, an assessment could be made to determine if continuing the program would provide additional GHG reduction credits.

Local Considerations

Economic

This project would have local economic and environmental benefits. Local washing machine suppliers would get an increase in business as more machines are replaced. Although the primary purpose is energy savings, the program would also accelerate long-term water savings and reduce local GHG emissions throughout the water service area and help reduce per capita water use.

Environment

Air: The air quality will be enhanced and GHGs reduced because of the reduction in the consumption of electricity.

Land: no impacts

Water: This program could potentially decrease potable water demand.

Noise: no impacts

Aesthetic/Visual: no impacts

Waste by-product: this project will reduce the amount of wastewater that will need to be processed. The disposal of old washing machine could create waste but much of the old machines can be recycled as scrap materials.

Energy Savings and GHG Reductions

This project directly saves energy and reduces GHGs at each residence or commercial location, as well as indirectly by reducing the amount of water used by washing machines. The washing machine energy savings is related to more efficient operation, heating of water, and less drying energy (due to high spin cycles that remove excess water) as compared to standard washing machines. The reduced water use also saves energy associated with the production and delivery of potable water.

The program proposes to increase current participation rates and provide rebates for an additional 375 residential and 63 commercial HEWs per year for SCWD, and an additional 250 residential and 62 commercial HEWs per year for SqCWD. These rebates will supplement the standard ENERGY STAR incentives currently being offered (see discussion in History and Technical Maturity section). Incentives would be available to both residential and commercial customers, and this analysis assumes that about 10% of the rebates will be for commercial uses.

The majority of these savings are direct energy reduction from the more efficient machine (80 to 90%); a smaller portion is indirect savings from lower water use. The direct energy savings are approximately 224 kWh per year for each residential HEW, and approximately 543 kWh per year for each commercial HEW. This averages approximately 768,000 kWh per year for SCWD and 583,000 kWh per year for SqCWD over the life of the program.

The estimated average indirect energy savings from the reduction of potable water demand are shown in Table 3.

Table 3: Estimated Water and Indirect Energy Savings by Agency

Santa Cruz Water Department	
Average water conservation (over 12 year program)	31 MGY
Surface water power factor	1.3 kWh/kgal
Desalination power factor	14.5 kWh/kgal
SCWD drought year blend assumed	86% surface water 14% desalination
Non-drought year net energy savings	40,680 kWh/yr
Drought year net energy savings	100,058 kWh/yr
Average annualized energy savings¹	57,645 kWh/yr
Average annualized GHG reduction	17 MT CO₂e
Soquel Creek Water District	
Average water conservation (over 12 year program)	23 MGY
Groundwater power factor	2.1 kWh/kgal
Desalination power factor	14.5 kWh/kgal
SqCWD non-drought year blend assumed	62% groundwater 38% desalination
SqCWD drought year blend assumed	71% groundwater 29% desalination
Non-drought year net energy savings	156,477 kWh/yr
Drought year net energy savings	131,017 kWh/yr
Average annualized energy savings¹	149,203 kWh/yr
Average annualized GHG reduction	43 MT CO₂e

¹Assumes 5 non-drought and 2 drought years every 7 years.

Table 4 provides a summary of the energy savings and GHG reduction from a washing machine program.

Table 4: Energy Savings and GHG Reductions

Agency	Avg Annual Energy Savings (kWh/yr)	Avg Annual GHG Reduction (MT CO₂e/yr)	Total Project Energy Savings (kWh)	Total GHG Reduction (MT CO₂e)
SCWD	826,000	240	9,900,000	2,900
SqCWD	732,000	213	8,800,000	2,600

This project could reduce approximately 35 to 55% of the potential GHG reduction goals for SCWD, and 12 to 15% of the potential GHG reduction goals for SqCWD.

Cost

At \$400 per residential rebate and \$800 per commercial rebate, the 12-year program is expected to cost approximately \$2.6 million for SCWD and \$1.9 million for SqCWD. It is estimated that staffing will need to be expanded by about 0.2 FTE to process the increase in

rebates. The estimated cost also includes the avoided cost from energy savings. Table 5 lists the estimated cost of the program.

Table 5: Estimated Costs for Washing Machine Rebate Conservation Program

Agency	Life (yr)	Capital Cost (\$)	Average Annual Net Cost (\$/yr)	Lifecycle Energy Cost (\$/kWh)	Lifecycle GHG Reduction Cost (\$/MT)
SCWD	12	\$2.6 million	\$167,000	\$0.19/kWh	\$600
SqCWD	12	\$1.9 million	\$110,000	\$0.15/kWh	\$460

Summary of Advantages and Disadvantages

Advantages:

- Builds on an existing, successful program
- Integrates water and energy programs
- Customers generally like the new machines and appreciate the opportunities to save water and energy
- Water and energy savings are reliable and long term for the customer

Disadvantages:

- There may be a significant number of “free riders”, as with any rebate program, that would have made the purchase without the rebate.
- Lifetime of GHG reductions is limited by additionality criteria.