

PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298



September 15, 2016

Advice Letters 3735-G/4870-E and 3735-G-A/4870-E-A

Erik Jacobson
Director, Regulatory Relations
Pacific Gas and Electric Company
77 Beale Street, Mail Code B10C
P.O. Box 770000
San Francisco, California 94177

SUBJECT: Program Implementation Plan Submission for Pacific Gas and Electric Company's Approved AMI Water Pilot

Dear Mr. Jacobson:

Advice Letter 3735-G/4870-E, as modified by 3735-G-A/4870-E-A, is effective as of September 12, 2016.

Sincerely,

A handwritten signature in cursive script that reads "Edward Randolph".

Edward Randolph
Director, Energy Division

July 11, 2016

Advice 3735-G/4870-E

(Pacific Gas and Electric Company ID U 39 M)

Public Utilities Commission of the State of California

Subject: Program Implementation Plan Submission for Pacific Gas and Electric Company's Approved AMI Water Pilot

Purpose

Pursuant to Ordering Paragraph (OP) 6 of Decision (D.) 16-06-010, Pacific Gas and Electric Company (PG&E) hereby submits its Program Implementation Plan for its approved advanced metering infrastructure (AMI) pilot.

This Tier 2 Advice Letter is filed in compliance with OP 6 in California Public Utilities Commission (Commission or CPUC) D.16-06-010, ordering that "within 30 days of the effective date of [the decision (June 9, 2016), PG&E shall] file and serve, by Tier 2 Advice Letter, a Program Implementation Plan, adapted to meet the pilot criteria set forth in the Energy Efficiency Policy Manual v.5., for [its] approved pilot that includes, but is not limited to, detailed schedules for implementation, proposed budgets, projected savings and cost effectiveness using the water-energy calculator as applicable, marketing, education, and outreach guidelines, data requirements, measurement and evaluation plan, and control group size."¹

Attachment A is the Project Implementation Plan and adheres to D.09-09-047, which requires investor-owned utilities (IOUs) to file an Advice Letter for implementation of all pilot projects approved for funding using the format set forth in the Energy Efficiency Policy Manual, v.5.²

The filing would not increase any current rate or charge, cause the withdrawal of service, or conflict with any rate schedule or rule.

¹ D.16-06-010, Ordering Paragraph 6, p. 26-27.

² D.09-09-047, p. 49; see also Energy Efficiency Policy Manual, Version 5, July 2013, Section XII.12, pp. 8-9, and Note 3 on p. 65,
http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/EEPPolicyManualV5forPDF.pdf

Background

The Water-Energy Nexus Proceeding explores avenues for ensuring that direct and indirect savings are taken into consideration when making investment decisions in both energy and water resources. In this context, the water-energy calculator was developed to quantify the associated indirect energy savings with water savings. In D.15-09-023, the California Water Association (CWA) suggested introducing AMI installations into the Water-Energy Nexus Proceeding. Overall, smart water meter data may offer significant water (and therefore direct and indirect energy) savings by – among other things – providing real-time feedback on water use, and can also under certain circumstances detect leaks on a customer’s premise. D.15-09-023 directed that workshops be held on AMI integration pilots with the goal of identifying technical issues with a water corporation using the existing electric and/or gas corporation’s AMI infrastructure to transmit water usage data. In preparation for a relevant workshop, IOUs filed draft pilot proposals on January 13, 2016. Subsequently, the workshop was held on January 19, IOUs submitted final pilot proposals on February 16, and D.16-06-010 approved the IOU pilots on June 9, 2016.

Program Implementation Plan

PG&E hereby submits the attached Program Implementation Plan as Attachment A.

The parameters of PG&E’s approved pilot proposal are summarized in the below excerpt from pp. 7-8 of D.16-06-010:

PG&E’s proposed pilot evaluates the potential to achieve water-energy savings by delivering high-resolution data to end-use customers using advanced analytics and reporting platforms. To provide customers with real-time granular water-use reporting, PG&E will collaborate with both a water utility and a third-party water-energy data analytics provider. Execution requires recruitment of participating customers, as well as agreement between PG&E and the participating water utility on protections for customer privacy and information security.

Evaluation of water-energy savings will be carried out by studying the water, electric, and gas usage of roughly 10,000 residential sector overlapping customers in PG&E’s and East Bay Municipal Utility District’s (EBMUD) service territories. Among the 10,000 target households to be studied, up to 5,000 households will receive smart water meters that communicate granular usage data via EBMUD’s existing and expanded AMI network. The selection of customers that will receive smart meters will be based on EBMUD’s anticipated meter replacements, which represent a diverse population and climate across its 330 square-mile service territory. Based on the size of the treatment group, up to 5,000 similar customers in the same geographic area will be selected as a control group with AMI-connected smart gas and electric meters, but with standard water meters that are read bi-monthly.

The initial budget estimate for the project includes \$350,000–\$400,000 from PG&E and up to \$1,725,000 of in-kind contributions from EBMUD. The final budget will depend on the selected participants, as well as the AMI equipment and meter installations required. PG&E funding will be provided via its Energy Efficiency Emerging Technologies Program. The projected pilot duration is between 27 and 30 months, inclusive of the time required to select AMI locations, install the hardware, conduct a 12-month-long observation, analyze the data, and publish the final report for broad dissemination.

PG&E and its research partner, the Center for Water Energy Efficiency at the University of California, Davis will focus on collecting primary data on water, electricity, and gas usage in the residential sector, aspiring to determine where a measurable positive correlation exists between behavior-based water conservation and energy conservation. The presence of such a correlation will justify PG&E's wider engagement with EBMUD and other water utilities and the scaling of this initiative going forward.

Protests

Anyone wishing to protest this filing may do so by letter sent via U.S. mail, facsimile, or E-mail, no later than August 1, 2016, which is 21 days³ after the date of this filing. Protests must be submitted to:

CPUC Energy Division
ED Tariff Unit
505 Van Ness Avenue, 4th Floor
San Francisco, California 94102

Facsimile: (415) 703-2200
E-mail: EDTariffUnit@cpuc.ca.gov

Copies of protests also should be mailed to the attention of the Director, Energy Division, Room 4004, at the address shown above.

The protest shall also be sent to PG&E either via E-mail or U.S. mail (and by facsimile, if possible) at the address shown below on the same date it is mailed or delivered to the Commission:

Erik Jacobson
Director, Regulatory Relations
c/o Megan Lawson
Pacific Gas and Electric Company
77 Beale Street, Mail Code B10C

³ The protest period ends on a weekend, therefore, PG&E is moving this date to the following business day.

P.O. Box 770000
San Francisco, California 94177

Facsimile: (415) 973-7226
E-mail: PGETariffs@pge.com

Any person (including individuals, groups, or organizations) may protest or respond to an advice letter (General Order 96-B, Section 7.4). The protest shall contain the following information: specification of the advice letter protested; grounds for the protest; supporting factual information or legal argument; name, telephone number, postal address, and (where appropriate) e-mail address of the protestant; and statement that the protest was sent to the utility no later than the day on which the protest was submitted to the reviewing Industry Division (General Order 96-B, Section 3.11).

Effective Date

PG&E requests that this Tier 2 advice filing become effective on regular notice, August 10, 2016, which is 30 calendar days after the date of filing.

Notice

In accordance with General Order 96-B, Section IV, a copy of this advice letter is being sent electronically and via U.S. mail to parties shown on the attached list and the parties on the service list for R.13-12-011. Address changes to the General Order 96-B service list should be directed to PG&E at email address PGETariffs@pge.com. For changes to any other service list, please contact the Commission's Process Office at (415) 703-2021 or at Process_Office@cpuc.ca.gov. Send all electronic approvals to PGETariffs@pge.com. Advice letter filings can also be accessed electronically at: <http://www.pge.com/tariffs/>.

/s/

Erik Jacobson
Director, Regulatory Relations

Attachments

cc: Service List R.13-12-011

CALIFORNIA PUBLIC UTILITIES COMMISSION

ADVICE LETTER FILING SUMMARY ENERGY UTILITY

MUST BE COMPLETED BY UTILITY (Attach additional pages as needed)

Company name/CPUC Utility No. **Pacific Gas and Electric Company (ID U39 M)**

Utility type:

ELC GAS
 PLC HEAT WATER

Contact Person: Jennifer Estridge

Phone #: (415) 973-1419

E-mail: J6WS@pge.com and PGETariffs@pge.com

EXPLANATION OF UTILITY TYPE

ELC = Electric GAS = Gas
PLC = Pipeline HEAT = Heat WATER = Water

(Date Filed/ Received Stamp by CPUC)

Advice Letter (AL) #: **3735-G/4870-E**

Tier: **2**

Subject of AL: **Program Implementation Plan Submission for Pacific Gas and Electric Company's Approved AMI Water Pilot**

Keywords (choose from CPUC listing): Compliance, Metering

AL filing type: Monthly Quarterly Annual One-Time Other _____

If AL filed in compliance with a Commission order, indicate relevant Decision/Resolution #: D.16-06-010

Does AL replace a withdrawn or rejected AL? If so, identify the prior AL: No

Summarize differences between the AL and the prior withdrawn or rejected AL: _____

Is AL requesting confidential treatment? If so, what information is the utility seeking confidential treatment for: No

Confidential information will be made available to those who have executed a nondisclosure agreement: No

Name(s) and contact information of the person(s) who will provide the nondisclosure agreement and access to the confidential information: _____

Resolution Required? Yes No

Requested effective date: **August 10, 2016**

No. of tariff sheets: N/A

Estimated system annual revenue effect (%): N/A

Estimated system average rate effect (%): N/A

When rates are affected by AL, include attachment in AL showing average rate effects on customer classes (residential, small commercial, large C/I, agricultural, lighting). N/A

Tariff schedules affected: N/A

Service affected and changes proposed: N/A

Pending advice letters that revise the same tariff sheets: N/A

Protests, dispositions, and all other correspondence regarding this AL are due no later than 21 days¹ after the date of this filing, unless otherwise authorized by the Commission, and shall be sent to:

California Public Utilities Commission

Energy Division

EDTariffUnit

505 Van Ness Ave., 4th Flr.

San Francisco, CA 94102

E-mail: EDTariffUnit@cpuc.ca.gov

Pacific Gas and Electric Company

Attn: Erik Jacobson

Director, Regulatory Relations

c/o Megan Lawson

77 Beale Street, Mail Code B10C

P.O. Box 770000

San Francisco, CA 94177

E-mail: PGETariffs@pge.com

¹ The protest period ends on a weekend, therefore, PG&E is moving this date to the following business day.

July 11, 2016

Attachment A

Program Implementation Plan for Pacific Gas and Electric Company's

Approved AMI Water Pilot

Date of first submission: February 16, 2016	PA: Pacific Gas and Electric Company
Project Name: Water AMI Integration Pilot	
Project Number: (IOU- 4 digit year- 3 digit unique ID; ex: SCE-2015-000) TBD	
<p>Brief Description:</p> <p>This proposal seeks to assess the value of providing customers with near real-time granular water use reporting as a means of determining how behavior and technology-based water interventions can reduce water usage, peak energy usage, and total energy usage. For the purpose of this study, PG&E and its partners intend to use customer meter data (at the highest resolution available) for residential electricity, gas, and water consumption, as well as targeted water and energy conservation messaging.</p>	
<p>Proposed Budget:</p> <p>\$2,175,000 (encompassing cash and in-kind funding from all project partners)</p>	<p>Budget Source(s):</p> <p>PG&E's Energy Efficiency Emerging Technologies Program;</p> <p>East Bay Municipal Utility District (EBMUD)</p>
<p>Lead PA/Partnership PA(s):</p> <p>Pacific Gas and Electric</p>	<p>Implementer Lead (if applicable):</p> <p>N/A</p>
<p>Sector(s):</p> <p>Residential</p>	<p>SW Program(s) the Findings Will Contribute to:</p> <p>Statewide Residential Program</p>
<p>Lead Contact(s) [PM/Implementer/EM&V, if applicable]:</p> <p>Mangesh Basarkar, Gina Melekh, Cait Pollock, Priscilla Johnson</p>	<p>Energy Division Contact(s):</p> <p>Peter Franzese, Rory Cox</p>
<p>Is the Project Claiming Savings?</p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No Collecting Data for Possible Savings</p> <p><input type="checkbox"/> Claim [same project ex-post, additional project]</p>	<p>Workpaper ID(s) [if existing]:</p> <p>N/A</p>
<p>Attachments (check applicable ones):</p> <p><input type="checkbox"/> Ex-Ante Data Collection Form</p> <p><input checked="" type="checkbox"/> EM&V Plan</p> <p><input type="checkbox"/> Proposed PRG</p> <p><input checked="" type="checkbox"/> Other, list: CWEE Draft Work Plan, Draft Customer Implementation Plan; Draft Customer Outreach Plan</p>	

Project Amendment History

Date	Amendment
January 13, 2016	Initial draft submitted to CPUC
February 16, 2016	Final proposal filed at CPUC
July 11, 2016	More details added to the proposal per Ordering Paragraph 6, D.16-06-010

PACIFIC GAS AND ELECTRIC COMPANY
Water AMI Integration Pilot Project Proposal

July 11, 2016

Summary of Updates per Decision (D.) 16-06-010

In response to D.16-06-010, the following points have been addressed:

1. PG&E's portion of the project budget is confirmed not to exceed \$400,000.
2. The filing of this document satisfies Ordering Paragraph 6 of the Decision.
3. The Implementation Schedule has been enhanced with more details (see Section 7 of this document).
4. The proposed budget can be found in Section 5 of this document.
5. The Marketing, Education, and Outreach guidelines have been edited in Appendices B and C.
6. Data requirements have been provided in more detail in Section 8 and Appendix A.
7. The Measurement and Evaluation Plan has been enhanced – see Appendix A.
8. The proposed control group remains the same as in the initial filing; information can be found in Section 3.
9. As an external vendor, the Center for Water Energy Efficiency (CWEE) is subject to the standard Third-Party Security Review process per PG&E procedures.

Executive Summary

Pacific Gas and Electric Company's (PG&E's) proposed Water Advanced Metering Infrastructure (AMI) Pilot builds upon PG&E's existing efforts to "piggyback" water smart meter data on its gas AMI. PG&E's proposed pilot seeks to analyze behavior-based water conservation interventions and their impact on reducing water usage, peak energy usage, and total energy usage. The project aims to accomplish this by providing customers with real-time granular water-use reporting, which will necessitate PG&E's close collaboration with both a water utility and a third-party water-energy data analytics provider. Execution of the project will require recruitment of participating customers, as well as agreement between PG&E and the participating water utility on protections for customer privacy and information security.

Evaluation of water-energy savings will be carried out by studying the water, electric, and gas usage of roughly 10,000 residential sector overlapping customers in PG&E's and East Bay Municipal Utility District's (EBMUD's) service territories. The project will use a Randomized Control Trial (RCT) approach; random assignment of households into various groups will allow for the attribution of differences in behavior to the interventions. Among the target households to be studied, up to 5,000 households will receive smart water meters that communicate granular usage data via EBMUD's existing and expanded AMI network. The selection of customers that will receive smart meters will be based on EBMUD's anticipated meter replacements, which represent a diverse population and climate across its 330 square-mile service territory. Based on the size of the treatment group, up to 5,000 similar customers in the same geographic area will be selected as a control group with AMI-connected smart gas and electric meters, but with standard water meters that are read bi-monthly. The project will use a treatment and control group approach. Quasi-random assignment of households into various groups (pure randomization is limited by reliance on the existing list of planned meter replacements) will allow for the attribution of differences in behavior to the interventions.

The initial budget estimate for the project includes up to \$400,000 from PG&E and up to \$1,725,000 of in-kind contributions from EBMUD. The final budget will depend on the AMI equipment and meter installations required. The projected pilot duration is between 27 and 30 months, inclusive of the time required to select AMI locations, install the hardware, conduct a 12 month-long observation, analyze the data, and publish the final report for broad dissemination.

1- A specific statement of the concern, gap, or problem that the pilot seeks to address and the likelihood that the issue can be addressed cost-effectively through utility programs. This statement should include any market research done to support the statement of gap and the solution proposed.

As part of its Water-Energy Nexus Proceeding, the California Public Utilities Commission (CPUC) adopted Decision 15-09-023 that provides tools to better quantify the benefits of water savings. These new calculators should enable the CPUC, Investor-Owned Utilities (IOUs), and other stakeholders to more accurately quantify and capture ‘embedded energy’ savings stemming from water conservation programs.

Having the ability to better quantify related energy savings lends support to the premise of testing smart water meters that can provide near real-time feedback on water use for the purpose of water and energy conservation; such timely feedback could be used to explore the value of behavioral water-energy conservation programs.

PG&E and its research partner, the Center for Water Energy Efficiency (CWEE) at the University of California, Davis (UC Davis), recently teamed up with the East Bay Municipal Utility District (EBMUD) to explore the viability of a new approach to characterize energy flows through water infrastructure in high-resolution (PG&E ET Study ET12PGE5411). This collaboration led to the conceptualization of leveraging behavior-based water conservation as a tool to achieve substantial energy savings.

The CPUC subsequently issued a Ruling on November 20, 2015 requiring IOUs to propose pilot projects that explore the technical challenges of water agencies “piggybacking” on the IOU electric/gas infrastructure to obtain water smart meter data for advancing water conservation programs.^[1] In response to this ruling, PG&E proposes to leverage its existing PG&E/CWEE/EBMUD partnership as a framework for studying behavior-based water-energy conservation in the residential sector.

In this proposed project (the “Project”), PG&E seeks to assess the value of providing customers with near real-time water use reporting as a means of determining how behavior-based water interventions can reduce water usage, peak energy usage, and total energy usage. To glean this insight, PG&E intends to use customer meter data (at the highest resolution available) for residential electricity, gas, and water consumption collected and aggregated from both PG&E and its water utility partner.

The Project will leverage relevant insights and address new questions that are not being addressed within the scope of an existing pilot initiative already underway at PG&E. Since November 2014, PG&E has actively collaborated with a water utility to pilot up to 200 water meters “piggybacking” on PG&E’s gas AMI network. This ongoing pilot has provided PG&E with an opportunity not only to test the performance of its AMI network as a platform for offering services such as data collection and validation, but also to explore avenues for expanding this platform to accommodate multiple water utilities. Consistent with the goals identified in Decision 15-09-023, PG&E has successfully identified and overcome relevant technical challenges associated with water utilities “piggybacking” on PG&E’s AMI. More specifically, through its pilot work to date, PG&E has resolved issues with data separation, transformation, and transmittal.

Consistent with the direction in the Assigned Commissioner’s Ruling, this proposed pilot project will not repeat the scope of the previous effort; it will instead evaluate the potential to achieve water-energy savings by delivering high-resolution data to end-use customers via conservation programs using advanced analytics and reporting platforms.

^[1] <http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M155/K978/155978762.PDF>

EBMUD's previous AMI deployments have identified significant indoor and outdoor plumbing leaks, as well as other opportunities in the specific project areas. In addition, a large number of customers were found to be over irrigating even during the rainy seasons. Demonstrated water savings from EBMUD pilots where customers were provided with on-line AMI water consumption data without conservation assistance averaged 7%; however, savings more than doubled when targeted conservation services were provided with the AMI data. Approximately 25% of customers in the AMI pilots had identified leaks– and, in some cases, very large leaks were identified and repaired as a result of EBMUD's outreach.

2- Whether and how the project will address a Strategic Plan goal or strategy and market transformation.

While the proposed Project is designed to quantify potential peak and total energy savings through reduced water use, the Project does not directly address any California Energy Efficiency Strategic Plan goals, given that water-energy has not been addressed in the current Strategic Plan.¹ However, PG&E's new pilot aligns with Governor Brown's Executive Orders B-29-15 and its goal to achieve a statewide 25% reduction in potable urban water usage through February 28, 2016,² as well as Executive Order B-36-15 "calling for an extension of urban water use restrictions until October 31, 2016, should drought conditions persist."³ On May 9, 2016, Governor Brown issued an Executive Order directing actions aimed at using water wisely, reducing water waste, and improving water use efficiency for the years and decades ahead. The Executive Order, in part, directed state agencies to extend the emergency regulations for urban water conservation through the end of January 2017 and to define and establish water efficiency standards for the state to ensure a more reliable water supply and to make state water users more resilient and prepared over the long term. The Executive Order also directed the California Energy Commission to certify innovative water conservation and water loss control technologies that also increase energy efficiency.

The proposed Project will gather primary data seeking specific actionable insights that integrate water and energy efficiency. Such resulting insights may help customers to justify the cost of energy efficiency upgrades and practices that save water and energy. Furthermore, the information gained can be applied to other areas within EBMUD territory and beyond. Future phases of this effort may be able to leverage these insights to build scalable programs and drive market transformation in the water-energy realm.

3- Specific goals, objectives and end points for the project (end points should clearly state how this project is expected to be scaled up in the portfolio or modify an existing offering in the portfolio).

In partnership with EBMUD and CWEE, this Project will address the following three core research questions:

1. Does collecting and conveying high-resolution water consumption data (from AMI systems) lead to measurable water consumption savings and higher uptake of conservation services and measures offered by EBMUD relative to the current baseline of customer communication?
2. Does this intervention in the water sector lead to measurable spillover energy savings in household gas and electricity use?
3. If measurable electricity savings occur, how are the savings distributed between peak and off-peak hours?

More broadly, the pilot objectives include:

¹ California Energy Efficiency Long Term Strategic Plan; Section 1, p. 7.

² https://www.gov.ca.gov/docs/4.1.15_Executive_Order.pdf

³ https://www.gov.ca.gov/docs/11.13.15_EO_B-36-15.pdf

- Facilitating customers’ immediate water and energy conservation by identifying leaks, excess irrigation, high water and energy consumption devices, and hot and cold water usage patterns
- Providing data to assist customers in evaluating longer-term energy and water conservation strategies such as identifying total energy and water use of existing appliances, fixtures and irrigation systems, and the opportunity for long-term retrofit savings
- Improving customer understanding of their individual water and energy consumption patterns and peak uses
- Improving utility understanding of water and energy consumption patterns and peak uses
- Offering timely and cost-effective customer notifications of leaks and high consumption end uses, which may have both water and energy consumption consequences
- Providing indications and findings of supply-side water and energy savings through use of EBMUD water loss control measures, including pipeline leak detection and District Metered Areas
- Analyzing the direct water savings, as well as direct and embedded energy savings; utilizing both field-collected data and data gleaned using the Water-Energy Calculator
- Collecting primary data and conducting analysis to support cost-effectiveness estimates

Potential for Scaling Up

This Project focuses on collecting primary data on water, electricity, and gas usage in the residential sector, aspiring to determine where a measurable positive correlation exists between behavior and technology adoption-based water and energy use and conservation. The presence of such a correlation will justify PG&E’s wider engagement with EBMUD and other water utilities and the scaling of this initiative and related AMI deployments going forward.

Evaluation of water-energy savings will be carried out by studying the water and energy usage of roughly 10,000 residential customers and supply-side water loss reduction within the combined EBMUD and PG&E service territory. Among the households studied, up to 5,000 households will receive smart water meters that communicate near real-time usage data via EBMUD’S AMI network. The Project will use various forms of (stratified) random assignments to treatment groups required for the identified sampling methodology; this will enable a more robust analysis and more reliable attribution of any behavioral differences of the two treatment groups to the treatment interventions. The following section outlines the proposed size of the Project and the classification of households for the purpose of this study.

Pilot Project Size and Details

Pilot Group Type	Treatment Received	Data Readings by Interval	Group Size
Hourly/daily/monthly data feedback	Installation of smart water meters; access to web portal and/or mobile apps and customized water conservation audits, landscape water budgets, leak detection using on-line consumption data	Hourly water consumption	Up to 5,000 meters
Control group	Standard bi-monthly water bill and general conservation services available to the public	Bi-monthly water consumption	Up to 5,000 meters
Total Pilot Size			Up to 10,000 meters

4- New and innovative design, partnerships, concepts, or measure mixes that have not yet been tested or employed.

Innovative concepts: The proposed pilot aims to connect indoor and outdoor household consumption of all three major end uses (water, electric, and gas), and state of the art water loss detection and reduction methods to estimate water-energy savings correlation at the highest available resolution level.

Innovative partnerships: The success of the pilot is predicated on close collaboration between PG&E, EBMUD, and CWEE.

5- A clear budget and explanation of funding source.

This pilot requires a significant financial and time commitment by all participating parties. The below high-level budget estimate covers most key Project tasks; whereas, a more precise, detailed budget will be determined once the Project is approved and all relevant agreements are in place.

Task	Unit Cost	Unit Installs	Budget Estimate*	Funding Source
Radio Network Water meters, end-points, meter box lids, ancillary equipment	\$250	Up to 5,000	\$1,250,000	\$1,250,000 EBMUD
Collector install	\$10k/sq mi	40 sq mi	\$400,000	\$250,000 PG&E** \$150,000 EBMUD
Server/headend	\$50,000	1	\$50,000	\$50,000 EBMUD
Total			\$1,700,000	
Customer outreach and conservation services			\$275,000	EBMUD
Data analysis and reporting			\$125,000	PG&E**
Project management			\$25,000	PG&E**
Total estimate			\$2,125,000	

Notes:

*Denotes budget estimates from all project partners and includes in-kind services and capital outlay for customer services, and equipment and software purchase, installation, and operation. PG&E funding will be provided via its Energy Efficiency Emerging Technologies Program.

**Total funding from PG&E budget is not to exceed \$400,000

6- Program performance metrics or non-resource objectives and success criteria.

High-level objectives for the pilot project are outlined under question #3. Answering the three main pilot research questions in the projected amount of time and within the planned budget will be considered as a successful completion of the project.

The project outcomes will inform the specific metrics and success criteria of potential program(s) that might be offered in the future in the water/energy nexus.

7- Timeframe to complete the project and obtain results within a portfolio cycle (subject to R.13-11-005 Phase 2 determination) - projects should not be continuations of programs from previous PAs' portfolios.

Project Phase	Duration	Implementation Calendar*
Project plan and agreements	1 month	July-August 2016
Project initiation, treatment and control group selection	3 months	August-October 2016
Water meter and AMI network equipment procurement and installation	9-12 months	August 2016-July 2017
Program roll-out to the customers	3 months	August 2016-October 2017
Observation period*	24 months	August 2016 to July 2018
Data analysis and ETCC report development**	3 months	October-December 2018
Total duration	27-30 months	August 2016-December 2018

Notes:

*Equipment procurement and roll-out will take place in phases resulting in longer observation periods so that data is captured for the full 12 months of treatment for all households.

**ETCC denotes Emerging Technologies Coordinating Council of California.

8- Information on relevant baselines metrics or a plan to develop baseline information against which the project outcomes can be measured.

The Project seeks to compare consumption patterns (water, gas, and electric) as a randomized control trial (RCT) between 1) a treatment group, and, 2) a control group of households that receive no feedback on their water consumption beyond standard bi-monthly water bills. This latter control group will provide a baseline against which observations of the treatment group can be contrasted.

To execute the RCT, up to 10,000 participating households will be randomly assigned into a treatment group and control group. The treatment group will receive AMI meters and a set of notifications that are uniquely enabled by AMI-based data collection for one full year. These communications will be defined explicitly in the early phase of project deployment, but will likely include ongoing access to a web-based water use portal, leak identification and high water use notification, water rate tier transition, and advisories on methods to save water based on the on-line water use data. The control group will not receive any AMI information, and its usage will be tracked via the water meters with AMI or bimonthly reads for comparison with the treatment group.

The study team aims to acquire customer water, gas, and electricity consumption data of the highest granularity available from the existing and deployed AMI meters. The team realizes that there may not be full coverage of high-resolution AMI for all three utility meters (most notably, the PG&E gas meters); however, whenever more granular data is available, the team will leverage this information to enhance its ability to detect water, gas, and electricity savings in the treatment group relative to the control group.

The project also attempts to better understand and quantify the potential (supply-side) water and energy savings through real and apparent water loss reduction. The effort will include numerous EBMUD water loss control measures including pipeline leak detection and dynamic District Metered Areas (DMAs) within select areas of the EBMUD water distribution system. A DMA is created by dividing the water distribution system into smaller areas with defined and permanent boundaries to address real losses. Valves and flow meters are installed within the DMA to measure water deliveries in and out of the DMA. To provide needed granular data to better measure water and energy usage, the leak detection equipment and meters within the DMA study areas will have AMI connections.

9- A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California utilities and to transfer those practices to resource programs, as well as a schedule and plan to expand the pilot to utility and hopefully statewide usage including expected funding source for the planned new program or program modification if known.

As detailed under question #3, the Project aims to collect primary data, aspiring to demonstrate a statistically-significant correlation between water conservation and energy conservation on a household level, and within utility water distribution system. If such a correlation is shown to be present in EBMUD/PG&E territory, the results can support similar efforts across other California regions.

Effectively measuring the impact of water usage on residential and utility energy and gas usage stands to provide both water and electric utilities (and the CPUC) with much-needed data points on the cost effectiveness of future water-energy nexus programs.

Because the Project is only examining water use behavior, independent of the technical AMI-“piggybacking” questions, there are no implications for scalability resulting from the differing AMI networks used by IOUs.

Statewide IOU Coordination: PG&E will share insights, milestones, best practices, and developments regarding this pilot through monthly or bi-monthly IOU check-in calls.

Commission Staff Coordination: PG&E will share status updates with Commission Staff through standard calls and meetings.

Public Review: PG&E will post the final Evaluation, Measurement, and Verification (EM&V) report on the Emerging Technology Coordinating Council (ETCC) website for external review, as well as distribute it to IOUs, Commission Staff, EBMUD, and other impacted stakeholders. EBMUD will share findings among the water utility community as appropriate opportunities arise.

Appendix A
High-Resolution Water Consumption Data and Customer Behavior:
Understanding the Value of Water AMI Systems and the Residential Water-Energy Nexus
Proposed EM&V Plan

Introduction

CWEE will play a key role in the evaluation of this Project, assuming responsibility for ensuring that evaluability is a central consideration in its design. Notably, CWEE will be responsible for designing the sampling approach, collecting the data, and reporting on that methodology, analysis, and findings. The study team at CWEE has significant experience in analyzing customer utility data, and also has the necessary agreements in place with PG&E and EBMUD for appropriate data privacy and cybersecurity measures.

BACKGROUND/ PROJECT SUMMARY

Water and energy resource systems are inextricably linked. Thus, water conservation can generate energy savings, and energy efficiency measures can save water. Despite this linked relationship, water and energy conservation measures are usually designed and deployed in isolation of one another, and unfortunately, without a complete understanding of the opportunity to optimize joint resource savings.

Meanwhile, in recent years, behavior-based messaging has been shown to be an effective mechanism to secure both energy (Allcott 2011, Allcott and Mullainathan 2010) and water (Ferraro and Price 2013) savings in the residential sector. Advanced metering infrastructure (AMI) provides an additional opportunity to message consumers by taking advantage of the timeliness of information for decision-making. For example, with water AMI technologies, the water agency gains the ability to identify and alert customers about water leaks in near-real time; to communicate transitions in rate tiers based on volumetric consumption; and, to advise consumers about their use relative to local policy (e.g. compliance with outdoor watering restrictions).

The purpose of this project is to measure the value of communicating this type of AMI-dependent (e.g. information collected and conveyed at an hourly temporal resolution at a minimum) information to consumers in terms of household water, electricity, and gas consumption. In addition, the project will help to identify and quantify the water-energy relationship in reducing system water losses using AMI equipped supply and demand metered areas. Research questions to be explored include:

1. Does collecting and conveying high-resolution consumption data (from AMI systems) lead to measurable water consumption savings relative to the current baseline of customer communication?
2. Does this intervention in the water sector lead to measurable spillover savings in household gas and electricity savings?
3. If measurable electricity savings occur, how are the savings distributed between peak and off-peak hours?
4. Does collecting and conveying high-resolution consumption and pipeline leak detection data (from AMI systems) lead to potential supply-side water and energy savings?

CWEE researchers will provide technical expertise and research integrity of the highest caliber, ensuring that the project's deliverables meet the highest standards as set by the CPUC, academics, EBMUD, and PG&E. CWEE, EBMUD, and PG&E already have a standing relationship as research partners with PG&E formally supporting CWEE as a Founding Affiliate Member and serving as a Leadership Sponsor of the UC Davis Energy Efficiency Center (EEC).

PROJECT SCOPE

Evaluation of water-energy savings will be carried out by studying the water, electric, and gas usage of roughly up to 10,000 residential sector customers in PG&E's and EBMUD's service territory. The up to 10,000 households included in the study will be selected to represent the general characteristics of the broader EBMUD customer population. Of the up to 10,000 total households in the study, up to 5,000 households will receive smart water meters that communicate usage data via an AMI infrastructure. Where possible, EBMUD will leverage households that have recently received AMI-compatible water meters as part of EBMUD's ongoing meter replacement program. The remaining households will have meters installed that may be but are not necessarily connected to the AMI network.

Evaluating the impact of AMI-based information using a Randomized Control Trial (RCT)

The project is designed to be deployed as a randomized control trial (RCT). An RCT represents a 'gold standard' methodology for measuring the impact of a program intervention by providing the ability to isolate the effect of the intervention in the context of other potentially confounding factors, such as weather or economic conditions.

To execute the RCT, the up to 10,000 participating households will be assigned into a treatment group and control group, depending on whether they have AMI compatible meters. Given that the project aims to leverage EBMUD's existing meter replacement program, there will be some limits to the pure randomization of assignment to treatment and control groups; as such, the implementation will technically be a quasi-random experiment. However, the research team will work to maximize the extent of the randomness in the household selection, as well as to clearly define the limitations of the quasi-random approach.

The treatment group will receive AMI meters and a set of notifications that are uniquely enabled by AMI-based data collection for one full year. These communications will be defined explicitly in the early phase of project deployment, but will likely include ongoing access to a web-based water use portal, leak identification and notification, water rate tier transition, and advisories on water restriction compliance. The control group will have meters that may be connected to the AMI, but will not receive any of this information and their usage will be tracked with bimonthly reads for comparison with the treatment group.

Leveraging high-resolution data

The study team aims to acquire customer water, gas, and electricity consumption data of the highest granularity available from the existing and deployed AMI meters. The team realizes that there will not be full coverage of high resolution AMI for all three utility meters (most notably, the PGE gas meters), but whenever more granular data are available the team will leverage the information to enhance its ability to detect water, gas, and electricity savings in the treatment group relative to the control group.

Estimating the impact

Using this billing data on both water and electricity usage, the team will estimate the effect of the intervention on water and energy usage. To make the empirical approach of this project more concrete, we discuss the empirical strategy that will be used to evaluate the effect of near real-time water use customer notification on water, electricity, and gas usage. We begin this regression analysis by comparing mean water and energy usage across treatment and control, estimating the equation:

$$y_{it} = \beta_0 + \beta_1 T_i + u_{it}$$

The dependent variable (y) is the level of usage (water, electricity, or gas) for household i for time period t . Assignment to the AMI-based information treatment group is denoted by the indicator variable T_i . Standard

errors are clustered at the household. We will refine the regression by incorporating additional information, such as time controls, as necessary to maximize the precision of our estimation.

Anticipated outcomes

More broadly, this project will offer insight for utilities and policy makers on the estimated water-energy benefits of leveraging higher resolution water consumption data for more timely communication within utility operations and between the water utility and the customer. It is uncertain how customers will behave when presented with this time-sensitive information relative to the existing utility-customer communication pathways, so this project provides a setting in which to evaluate this impact in relative isolation using an RCT. Gaining well-identified estimates of the effect of AMI-based behavior change information will provide both water and electric utilities and the CPUC with much-needed data points on the cost effectiveness of such programs.

PROJECT TASKS

Task 1 – Project Initiation and Meetings

- Project initiation and coordination meetings and finalization of institutional agreements
- General project coordination efforts between PG&E, EBMUD, and CWEE including conference calls as needed

Task 2 – Data Agreements, Initial Data Collection, Database, & Treatment Randomization

- Develop, review, and finalize data sharing agreements between CWEE and EBMUD, and between CWEE and PG&E to enable transfer of customer data for project analysis
- Establish and operationalize secure data transfer system and project database
- Collect initial water consumption data (and other relevant and readily-available geographical and socioeconomic data) for the up to 10,000 households included in the study
- Use a partial (stratified) randomized selection of up to 5,000 households (from up to 10,000 planned EBMUD AMI deployments) into the treatment group that will receive AMI meters and the information services enabled by the AMI devices. The remaining up to 5,000 households will form a (matched pair) control group for the study from recent or planned meter replacements.

Task 3 – Ongoing Monitoring and Analysis

- Establish system for secure transfer and ingestion of data from EBMUD and PG&E to CWEE for ongoing project monitoring analysis throughout the 12-month program implementation period.
- Aim to transfer data after every billing cycle for all three utility services (water, electricity, and natural gas)
- Develop an application of computational code for ongoing statistical analysis of AMI information impact on treatment group vs. control group
- Quarterly reporting to project partners of observational effects of AMI treatment

Task 4 – Final Evaluation and Report

- Final evaluation of AMI information impact on treatment group vs. control group at close of project
- Elaboration of final project report to be shared with and reviewed by all project partners
- Final project meeting and results discussion, as well as presentation(s) to applicable stakeholders

Appendix B

Customer Implementation Plan

A crucial part of the proposed Project is successful identification of the treatment and control groups, installation of the required smart water meter hardware, and two-way communication with the customers, and installation where necessary of new meters for the control group. The plan below lays out the high-level approach to accomplishing these tasks.

Introduction: This Project will use Advanced Meter Infrastructure (AMI) to collect near real-time demand data from customer meters. This project will involve installing customer meters with electronic registers and transmitters such that they can collect, record, and transmit hourly consumption. This project will use fixed network AMI technology where the meter-reading transmissions will be picked up by collector towers located within the vicinity of the meters, which in turn will transmit the meter reads to a centrally-located computer server. The water usage data collected from the meter reads can then be accessed in graphical format via an Intranet connection where it will be shared with customers for their use in identifying water conservation opportunities. EBMUD water conservation staff will then work with these customers to identify water conservation strategies such as fixing leaks, alternative irrigation techniques, and replacing older appliances with new higher efficiency appliances. EBMUD staff has experienced that this faster, more immediately-available data will be more customer-friendly and facilitate water conservation activities.

Pre-Project Conditions: Conditions will be reviewed and summarized for the estimated 10,000 households in the study population. EBMUD has conducted bi-monthly meter reads for almost a century and maintains a record of meter reads within its database back to 1974. Therefore, the pre-project and project conditions will be well documented. EBMUD has successfully deployed AMI and a customer web interface in the Blackhawk area of Danville within its service area and has experience working with customers and on-line usage data.

Customer Selection: Where possible EBMUD will leverage existing or planned smart meter and AMI radio network installations to minimize costs to itself and PG&E. This enables this project to be as large and statistically significant as possible while minimizing total cost and labor. EBMUD will not include customers that already have access to their water consumption online. Effort will be made to sequence the smart meter installations to fulfill the strongest stratified random distribution. In order to do this, residential customers to be equipped with smart meters will be selected according to the following criteria:

1. Residential customers that already have or are scheduled to have smart meters that are within EBMUD's existing AMI network
2. Residential customers that have smart meters (mobile type) but are not within an existing EBMUD-owned AMI network but can be added onto the fixed network should EBMUD's AMI network be expanded
3. Residential customers that are scheduled for a meter repair and may be upgraded to a smart meter that are within an existing EBMUD-owned AMI network
4. Residential customers that are not scheduled for a meter repair but are within an existing EBMUD-owned AMI network
5. Residential customers that are not scheduled for a meter repair but are within an existing PG&E-owned AMI network

Below is a map of EBMUD's planned and existing smart meter deployments and its existing collectors. Because customers in the Blackhawk AMI area already have access to their on-line information, they are not considered as part of this Project; however, additional customers could be added to these areas.

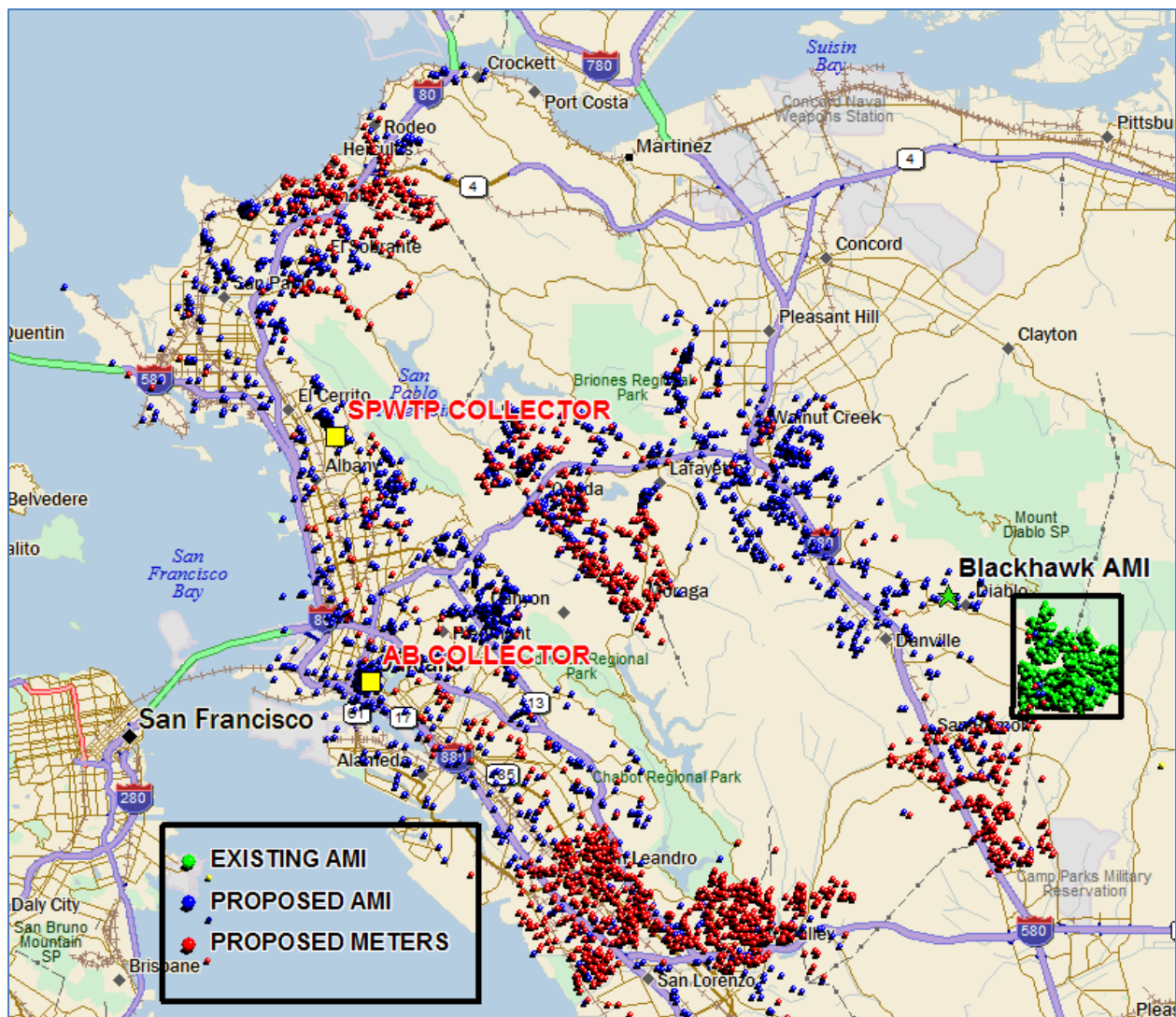


Figure 1 (above) depicts a map of EBMUD’s existing AMI network, proposed AMI, and planned meter upgrades.

Draft Work Plan and Approach

Customers will have access to their data on-line so that they can track their own water usage and ensure that they are being as efficient as possible. The system will have the potential to notify customers that they have leaks and also notify them if they exceed a pre-set consumption limit (water budget).

Task 1: Administrative Management: This task will include finalizing the list of up to 10,000 residential customers for the treatment and control groups using GIS and database queries. It will also include preparation of the purchasing documentation to solicit the implementing AMI vendor(s) that can provide the most cost-effective approach for this Project. This task also includes developing work plans and procedures for the program management, and data collection and analysis.

Task 2: Installation: This task will encompass the installation of the AMI equipment meters with electronic registers and associated meter equipment, and meter interface units, collector towers, and software. It will then include the testing and debugging of the system. Data collection will begin as soon as the first equipment is placed in the field. Where necessary, this task will also involve installation of new, non-AMI meters for the control group.

- Task 3: Customer Interventions: This task will include communicating with customers to invite them to log on to the AMI portal. Additional communications will explain how customers can access their personal water use and identify conservation opportunities. Part of this Project will cross over into the pre-existing EBMUD residential conservation programs. The interventions will begin approximately 3-6 months after AMI installation and will continue throughout the expected life of the projects.
- Task 4: Maintenance: Task will include meter repair and maintenance, electronic equipment repair and maintenance, and software maintenance and updates. This task is expected to be ongoing throughout the expected life of the Project.

Appendix C

Customer Outreach Plan

In previous pilot projects, on-line water consumption information has been very successful in helping customers identify both short-term immediate conservation savings and long-term water (and energy) management. The on-line access made it easy to quantify the savings because the website portal allows for easy comparison of pre- and post- water usage and the setting of a water budget and leak notifications. Similar AMI gas and electric meters can show pre- and post- energy usage.

EBMUD has documented the water conservation savings from presenting customers with on-line water consumption information and by working with them to identify ways to save water. During these conservation efforts, EBMUD has also identified energy savings; however, limited access to energy usage profiles has not allowed quantification of these energy savings. Examples of energy savings identified include residents taking shorter showers and saving hot and cold water; identifying plumbing leaks (e.g. hot water heaters), which may include both hot and cold water; and encouraging customers to upgrade appliances that are both energy and water efficient by identifying total savings in both water and energy from these devices.

Public Outreach Approach

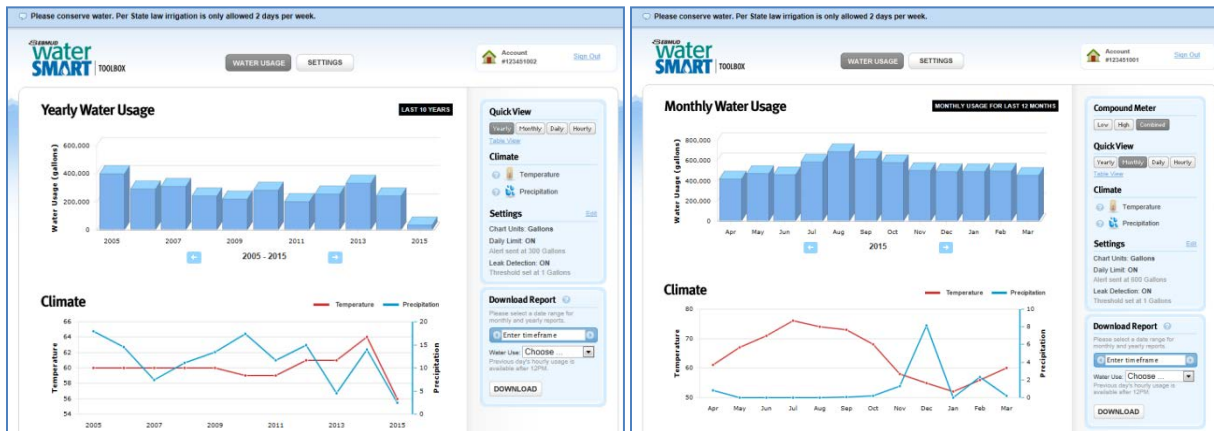
The treatment and control groups will receive the same level of water conservation public outreach provided to all EBMUD customers, with a few exceptions. EBMUD's conservation public outreach includes: (a) information on EBMUD's website; b) bill inserts discussing ways to save water in the home; c) EBMUD information booths at various public forums; and, d) EBMUD Home Water Reports (HWRs), which are available for all EBMUD single-family residential customers. Currently, approximately 70,000 households receive HWRs. These reports compare customers' water use to similar-sized households with similar lot size, household square footage, residents, microclimate, and irrigated landscape. Recipients are also provided with conservation tips via the HWRs and a web portal based on their water use and response to surveys.

The exceptions to the normal practice will include treatment customers being invited to view their water use in an on-line AMI portal that provides numerous more granular water consumption and management features such as hourly water use, leak notification, daily water budget thresholds, climate data, and additional conservation tips and services.

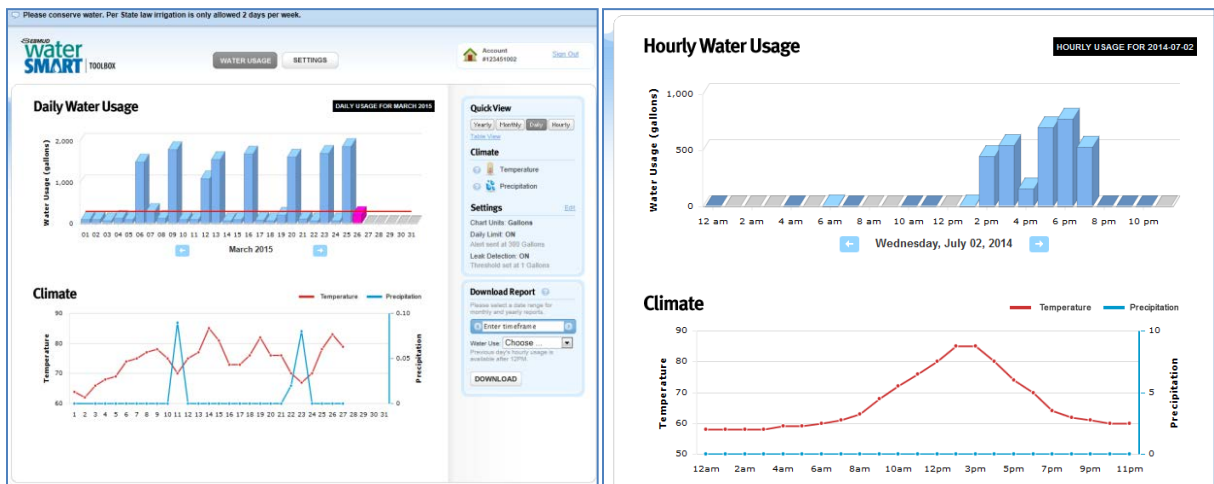
EBMUD will invite the treatment group to access the AMI portal via several print and electronic communications, including postcards, letters, welcome packages (with instruction manual), emails, and telephone outreach. These forms of communication will be repeated as necessary to ensure high participation rates. EBMUD will also contact all non-registering customers that have usage indicating leaks or deemed higher than normal usage.

EBMUD's on-line portal will allow customers to view their water usage by the year, month, day, and even hour. The portal will make it easier for customers to identify periods of high use with the highly granular data. The customers will be able to customize their accounts with leak notification and customized water use budgets. Portal enhancements may also include water cost information, current weather data, and other water account related services. EBMUD's experience with providing customers with their water use via an on-line tool and providing them with leak notification services has led to increased interest and participation in conservation services, technology adoption, and behavioral change.

Below is an example of EBMUD’s customer web interface known as the WaterSmart Toolbox (Toolbox). This site enables customers and EBMUD to view their water usage by the year, month, day, or even hour; it also emails customers if they have a leak or exceed a pre-defined water budget. The site also displays the corresponding climate data during a given period. Planned upgrades will also show customers their billing data, thus better enabling them to estimate financial savings from conservation actions. In the future, this site or a similar one could display gas and electric usage, providing customers with a ‘one-stop shop’.



Figures 2 and 3 (above) depict examples of EBMUD’s online portal resources tracking yearly and monthly water consumption, respectively.



Figures 4 and 5 (above) depict examples of EBMUD’s on-line portal resources tracking daily and hourly water consumption, and water use alert levels, respectively.

AMI technology will allow for remote and near real-time collection and presentation of customers’ total energy and water usage. EBMUD and PG&E staff will use the consumption data to work with their customers to target water and energy conservation through behavioral norming and technology measures.

Initially, customers will be given access to their Toolbox account via a letter, postcard, and/or email outreach (see Figure 6). Although the WaterSmart Toolbox itself is designed to help customers obtain water conservation benefits on their own by better understanding their water use, EBMUD's Water Conservation Department (WCD) will still work with customers to identify practices and plumbing fixtures and devices that may reduce their water usage. WCD anticipates that most interventions can be accomplished via telephone because customers will understand the nature of their own water use, whereas select customers or circumstances will require in-person visits.



Figure 6 (above) depicts a front and back sample AMI Toolbox postcard communication.

Telephone and/or Web Outreach

Most of the water conservation interventions requested by customers will be conducted via telephone. Customers will be provided with an instruction manual on how to use the AMI portal features (see Figure 7). A typical telephone intervention may include discussion of:

1. Water consumption patterns in the household to help identify potential water conservation opportunities (e.g. number of household residents, irrigation area, and water consuming appliances in the home to determine their relative water consumption efficiency).
2. Periodic or continuous leaks such as in toilets, piping, hot water system, irrigation system, service line, pool filler and treatment systems, plumbing fixtures, malfunctioning appliances.
3. Efficient irrigation practices such as watering less frequently but more deeply, replacing lawn or other high-water use plants with plants that require less irrigated water, use of more efficient irrigation equipment, and weather-based irrigation controllers. Depending on the customer, graywater or rainwater catchment for irrigation may also be discussed.
4. Recommended upgrades to appliances and fixtures such as more efficient showerheads, faucets, clothes washers, dishwasher, water treatment systems, and hot water recycling systems. This may include potential hot and cold water savings, as well as electricity savings from more efficient devices and less energy-intensive processes.
5. Behavior patterns that lead to excessive water use such as taking long showers, washing dishes by hand, and using full loads in the dishwasher and washing machine.
6. Toolbox features such as leak detection alerts, landscape irrigation budgets, or daily high usage alerts.

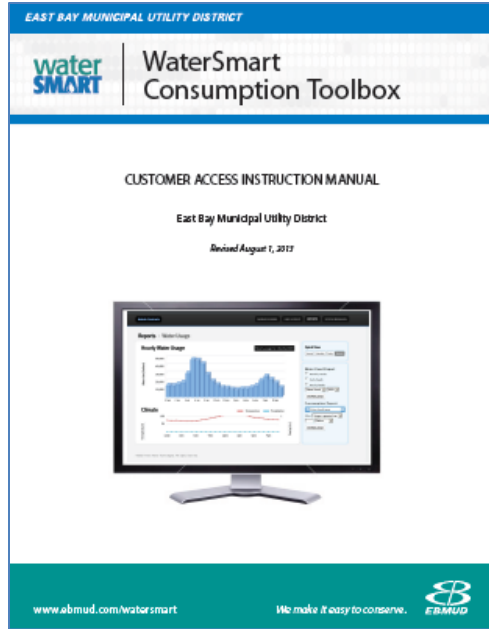


Figure 7. Sample Customer AMI WaterSmart Toolbox Instruction Manual

In-Person Audits

In-person, on-site audits will be performed after a telephone audit has confirmed that the account justifies an in-person appointment or the customer specifically asked for such an appointment. These audits will be conducted in the same manner as a regular in-person audit; however, the staff will utilize a laptop to access customers' WaterSmart Toolbox account and actual data.

**PG&E Gas and Electric
Advice Filing List
General Order 96-B, Section IV**

AT&T	Division of Ratepayer Advocates	Office of Ratepayer Advocates
Albion Power Company	Don Pickett & Associates, Inc.	OnGrid Solar
Alcantar & Kahl LLP	Douglass & Liddell	Pacific Gas and Electric Company
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Dept of General Services	ORA	