STATE OF CALIFORNIA Edmund G. Brown Jr., *Governor*

PUBLIC UTILITIES COMMISSION
505 VAN NESS AVENUE
SAN FRANCISCO, CA 94102-3298

September 28, 2016

Advice Letter 4992-G-A

Ronald van der Leeden
Director, Regulatory Affairs
Southern California Gas
555 W. Fifth Street, GT14D6
Los Angeles, CA 90013-1011

SUBJECT: SoCalGas Program Implementation Plan Filing for Water Energy Nexus Advanced Meter Infrastructure (AMI) Pilot with San Gabriel Valley Water Company

Dear Mr. van der Leeden:

Advice Letter 4992-G-A is effective as of August 19, 2016.

Sincerely,

Edward Randolph

Edward Randolph
Director, Energy Division

Ronald van der Leeden
Director
Regulatory Affairs

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September 16, 2016

Advice No. 4992-A
(U 904 G)

Public Utilities Commission of the State of California

Subject: Supplemental - SoCalGas Program Implementation Plan Filing for Water Energy Nexus Advanced Meter Infrastructure (AMI) Pilot with San Gabriel Valley Water Company

Southern California Gas Company (SoCalGas) hereby submits for approval by the California Public Utilities Commission (Commission) the Program Implementation Plan (PIP) for SoCalGas' approved Water Energy Nexus AMI Pilot with San Gabriel Valley Water Company (SGVWC), as shown in Attachment A.

Purpose

This supplemental filing replaces in its entirety Advice No. (AL) 4992, filed on July 20, 2016. SoCalGas inadvertently excluded details regarding general overhead costs in its budget details. SoCalGas herein includes updated information on general overhead costs and updates the AMI Pilot budget costs. Additionally, SoCalGas includes further details on the Water Energy Nexus AMI Pilot, as shown in Attachment B.

In compliance with Decision (D.) 16-06-010 Ordering Paragraph (OP) 7, this filing provides, for review by Energy Division, the PIP for SoCalGas' approved Water Energy Nexus AMI Pilot.

Background

On June 9, 2016, the Commission issued D.16-06-010, which approved the Investor-Owned Utilities' (IOUs) AMI Pilot proposals to "test the impact of joint delivery of energy and water data to customers on energy and water savings behaviors."[1] Further, D.16-06-010 directed the IOUs to file and serve, by Tier 2 Advice Letter, PIPs for their

[1] D.16-06-010, p. 2.

approved pilots, and Energy Division to review the Advice Letters for consistency with standard energy efficiency review protocols.[2]

On August 26, 2016, Energy Division provided SoCalGas with a list of clarifying questions developed by Energy Division and an evaluation, verification & measurement consultant, DNV GL, to be answered in form of a supplemental Advice Letter.

SoCalGas' Water Energy Nexus AMI Pilot

D.16-06-010 authorized SoCalGas to implement a pilot by partnering with SGVWC and Valor Water Analytics to gather data from water meters, transmit that data over SoCalGas' existing AMI network, and transport that data to the participating water agency. The pilot also includes an analytics component for: 1) the identification and evaluation of potential hot water leaks based on analysis of both gas and combined gas and water usage data; 2) joint water-gas analytics for hot water leak detection and quantification of water, embedded energy, and greenhouse gas (GHG) benefits associated with hot water leak detection and resolution; and 3) trend analytics to identify where water loss reduction has resulted in a change in gas consumption.

As required in D.16-06-010,[3] the PIP herein contains details of the following for SoCalGas' Water Energy Nexus AMI Pilot with SGVWC: 1) detailed schedules for implementation; 2) proposed budgets; 3) projected savings and cost-effectiveness using the Water Energy calculator as applicable; 4) marketing, education, and outreach guidelines; 5) data requirements; 6) measurement and evaluation plan; 7) control group size; and 8) the Pilot criteria set forth in Energy Efficiency Manual v.5.

Protests

In accordance with General Order (GO) 96-B, Section 7.5.1 and at the direction of Commission Staff, SoCalGas hereby requests that the protest period be waived, as the updates included in this Advice Letter were done at the direction of Energy Division.

Effective Date

This Advice Letter is subject to Commission staff disposition and is classified as Tier 2 (effective after staff approval) pursuant to GO 96-B and OP 7 of D.16-06-010. Therefore, SoCalGas respectfully requests that this Advice Letter become effective on August 19, 2016, which is coincident with the original effective date of Advice No. 4992.

[2] D.16-06-010, p. 19.
[3] D.16-06-010, p. 27.

Notice

A copy of this Advice Letter is being sent to SoCalGas' GO 96-B service list and the Commission's service list in R.13-12-011. Address change requests to the GO 96-B should be directed by electronic mail to tariffs@socalgas.com or call 213-244-3387. For changes to all other service lists, please contact the Commission's Process Office at 415-703-2021 or by electronic mail at Process_Office@cpuc.ca.gov.

_____

Ronald van der Leeden
Director – Regulatory Affairs

Attachments

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. **SOUTHERN CALIFORNIA GAS COMPANY (U 9O4G)**

Utility type:	Contact Person: Sid Newsom
☐ ELC ☒ GAS	Phone #: (213) 244-2846
☐ PLC ☐ HEAT ☐ WATER	E-mail: SNewsom@semprautilities.com

EXPLANATION OF UTILITY TYPE

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

(Date Filed/ Received Stamp by CPUC)

Advice Letter (AL) #: 4992-A

Subject of AL: Supplemental - SoCalGas Program Implementation Plan Filing for Water Energy Nexus Advanced Meter Infrastructure (AMI) Pilot with San Gabriel Valley Water Company

Keywords (choose from CPUC listing): Energy Efficiency

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[1]: N/A

Does AL request confidential treatment? If so, provide explanation: No

Resolution Required? ☐ Yes ☒ No Tier Designation: ☐ 1 ☒ 2 ☐ 3

Requested effective date: 8/19/16 No. of tariff sheets: 0

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).

Tariff schedules affected: N/A

Service affected and changes proposed[1]: N/A

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

Protests and all other correspondence regarding this AL are due no later than 20 days after the date of this filing, unless otherwise authorized by the Commission, and shall be sent to:

CPUC, Energy Division
Attention: Tariff Unit
505 Van Ness Ave.,
San Francisco, CA 94102
mas@cpuc.ca.gov and jnj@cpuc.ca.gov

Southern California Gas Company
Attention: Sid Newsom
555 West 5th Street, GT14D6
Los Angeles, CA 90013-1011
SNewsom@semprautilities.com

[1] Discuss in AL if more space is needed.

ATTACHMENT A

Advice No. 4992-A

Update to the Program Implementation Plan (PIP) for SoCalGas' Approved Water Energy Nexus AMI Pilot with San Gabriel Valley Water Company

Program Implementation Plan Template

Program Overview Template

1) Program Name

SoCalGas Water-Energy Nexus Shared Network AMI Pilot

2) Program Description (general)

This is a Commission approved pilot program for which Southern California Gas Company (SoCalGas) has partnered with San Gabriel Valley Water Company (SGVWC) and Valor Water Analytics. The Pilot will leverage the existing SoCalGas Advanced Meter Infrastructure (AMI) network to allow for the water utility meters to 'piggyback' on the SoCalGas AMI network and includes an analytics component for identification and evaluation of potential hot water leaks based on analysis of both gas and combined gas and water usage data.

SoCalGas has a limited analytics process to identify anomalous gas consumption patterns for Core Residential customers. As reported in the Southern California Gas Company Advanced Meter Semiannual Report[1] as of December 31, 2015, SoCalGas had confirmed 286 hot water leaks out of the 953 field visits conducted as follow up to identification of unusual gas consumption patterns at customer facilities.

This Pilot will help develop our understanding of the widespread problem with hot water leaks in our SoCalGas service territory. Data gathered during the Pilot will be used to evaluate potential benefits, such as refining our capability to identify and report on potential hot water leaks by analyzing natural gas usage in comparison to actual water usage. In addition, refining our capability to identify and report on potential hot water leaks based on validation of analytics results gathered during field visits.

Valor Water Analytics will perform joint water-gas analytics for hot water leak detection, and quantification of water, embedded energy, and greenhouse gas (GHG) benefits associated with hot water leak detection and resolution. Valor will also conduct trend analytics, to identify where water loss reduction has resulted in a change in gas consumption. Analysis will be performed on AMI (treatment) vs. control; pre and post.

Valor Water Analytics engineers and analysts have experience working with water, electricity and gas data since 2007. Valor Water is a technology transfer company from the University of North Carolina at Chapel Hill, where multiple staff worked with over 10 water and power utilities on analysis projects for advanced meter data analytics. These analytics include AMI, AMR and appliance analytics. Additional

[1] https://www.socalgas.com/regulatory/documents/a-08-09-023/SoCalGas_Advanced_Meter_Semi_Annual_Report_FEB2016.pdf.

information and references can be found in the footnotes.[2]

In cooperation with SoCalGas, SGVWC will conduct its own investigation into the value and benefits of advanced metering. SGVWC's pilot program will evaluate the benefits, costs, and value of deploying AMI technology throughout its entire service area. Features of the pilot program will compare AMI metering with existing manual read metering based on the following measures: 1) meter and billing accuracy; 2) leak detection analytics; 3) impacts on physical operations; and 4) consumer engagement and acceptance; and 5) reduced energy usage.

Water AMI participants will continue to receive their water bills, as they always have, from SGVWC's manual read meters and legacy billing system. However, AMI participants will have access to a secure web portal and consumer engagement program with personalized hourly water usage information to help customers find leaks and manage their daily water use data. Customer participation levels and satisfaction with using this customer service application will be tracked and recorded during the 1-year pilot program.

After registering online, customers gain access to their current usage, past usage, and other useful comparisons. Customers can see the estimated cost of the water they've already used (any time during the billing cycle), as well as a projected end-of-period bill. Customers can also establish a billing or usage threshold ($ or gallons) and be notified when their bill amount/consumption exceeds, or is projected to exceed, that value.

SGVWC will also deploy specialized software to analyze, identify and locate apparent water loss[3] from customers' hourly AMI data and pro-actively notify customers via automated call, text, or e-mail when potential leaks have occurred.

Reduced energy usage is assessed in two ways 1) the embedded energy per gallon and associated savings from proactive alerting and water loss reduction (i.e. water pumping, conveyance, etc., see CPUC Water Energy Nexus Calculator) and 2) gas savings associated with proactive alerting on this gas powered appliance and timely resolution of the hot water leak.

[2] Background on Dr. Boyle, the CEO and research lead on this project: http://www.efc.sog.unc.edu/efcstaff/dr-christine-boyle.

[3] Apparent Losses, as defined in American Water Works Association Manual of Practice M36, Water Audits and Loss Control Programs, 2009, are the non-physical losses that occur in utility operations due to customer meter inaccuracies, systematic data handling errors in customer billing systems an unauthorized consumption. This water is consumed but is not properly measured, accounted or paid for.

3) Total Projected Program Budget and Savings

SoCalGas' estimated costs incurred to conduct its pilot with SGVWC using Valor Water Analytics as the collaborative analytics vendor is $165,000. SoCalGas has received approval for a budget of up to $175,000 per water utility participant, with a not to exceed budget of $300,000 across all water utility participants.[4] SGVWC has established a Water-Energy Memorandum Account authorized by the Commission in D.15-09-023 to record the costs incurred in connection with projects undertaken pursuant to decisions issued in Rulemaking (R.)13-12-011, including the AMI Pilot Program. The estimated cost to conduct its one-year pilot program is $224,000, as detailed in Section 11c.

Projected savings are not applicable for this pilot, as this is new development and there is no basis for estimation of savings. SoCalGas will not be claiming any savings as part of this pilot.

4) Table 1: Total Projected Program Budget & Savings by Subprogram

Subprogram	SCG ($)	Total ($)	Kwh	KW	Therms
A – SoCalGas WEN AMI Pilot with SGVWC	$165,000	$165,000	-	-	-
Total	$165,000	$165,000			

5) Table 2: Total Projected Program Savings by IOU

The pilot program is non-resource. No savings will be claimed.

Subprogram	SCG Therms	Total
SoCalGas WEN AMI Pilot with SGVWC	0	N/A
Total	0	N/A

6) Short description of each subprogram (suggested word limit- 50 words/subprogram).

SoCalGas has partnered with SGVWC and Valor Water Analytics. The Pilot will leverage the existing SoCalGas AMI network to allow for the water utility meters to 'piggyback' on the SoCalGas AMI network and includes an analytics component for identification and evaluation of potential hot water leaks based on analysis of both gas and combined gas and water usage data. Valor Water Analytics will perform joint water-gas analytics for hot water leak detection, and quantification of

[4] Decision (D.) 16-06-010.

water, embedded energy, and GHG benefits associated with hot water leak detection and resolution. Valor will also conduct trend analytics, to identify where water loss reduction has resulted in a change in gas consumption. Analysis will be performed on AMI (treatment) vs. control; pre and post.

SGVWC's Pilot, which is described in Section 2 above, will consist of 500 water AMI customers (who also have gas AMI equipment), divided equally between the Los Angeles County and Fontana Water Company divisions. In addition, 500 Control Group participants who are not water AMI customers (but have gas AMI equipment) will be selected from these divisions.

Sub-Program
Program Implementation Plan Template

1) Sub-Program Name:

SoCalGas Water-Energy Nexus Shared Network AMI Pilot

2) Sub-Program ID number: SCG3806

3) Type of Sub-Program: _X_ Core __ Third Party __ Partnership

4) Market sector or segment that this sub-program is designed to serve:
This is a limited pilot that will be conducted within SGVWC's Los Angeles County and Fontana Water Company divisions.
   a. _X_ Residential
      i. Including Low Income? _X_ Yes __ No;
      ii. Including Moderate Income? _ X _ Yes __No.
      iii. Including or specifically Multifamily buildings _ X _ Yes __ No.
      iv. Including or specifically Rental units? _ X _ Yes __ No.
   b. _X_ Commercial (List applicable NAIC codes: _various__)
   c. __ Industrial (List applicable NAIC codes: ___)
   d. __ Agricultural (List applicable NAIC codes: _____)

5) Is this sub-program primarily a:
   a. Non-resource program _X_ Yes__ No
   b. Resource acquisition program ___ Yes __ X _ No
   c. Market Transformation Program ___ Yes __ X _ No

6) Indicate the primary intervention strategies:

   a. Upstream ___ Yes _ X __ No
   b. Midstream ___ Yes __ X _ No
   c. Downstream ___ Yes _ X __ No
   d. Direct Install __ Yes _ X _ No.
   e. Non Resource _ X _ Yes __ No.

7) Projected Sub-program Total Resource Cost (TRC) and Program Administrator Cost (PAC) TRC _N/A__ PAC _N/A__

8) Projected Sub-Program Budget

The SoCalGas projected budget for this pilot with SGVWC is $165,000.

The Administrative cost includes Project Management, split between 2016 and 2017 as the pilot term is one year starting mid-2016.

General Overhead includes projected IT costs, which will take place in 2016, including but not limited to accounting support, energy efficiency reporting, and pilot oversight.

Direct Implementation non-incentives include our fee to the analytics vendor, as well as the projected cost of SoCalGas field visits, split between 2016 and 2017.

SGVWC's projected budget for its pilot project is $224,000, described in Attachment B (p.1) to Exhibit SG-5 (Direct Testimony of Robert J. DiPrimio, in Application 16-01-002 (San Gabriel Valley Water Company General Rate Case).

Table 1: Projected Sub-Program Budget, by Calendar Year

	Program Year		
SoCalGas WEN AMI Pilot with SGVWC	2016	2017	Total
Admin ($)	$20,000	$20,000	$40,000
General overhead ($)	$50,000	$10,000	$60,000
Incentives ($)	N/A	N/A	N/A
Direct Implementation Non-Incentives ($)	$32,500	$32,500	$65,000
Marketing & Outreach ($)	N/A	N/A	N/A
Education & Training	N/A	N/A	N/A
Total Budget	$ 102,500	$62,500	$165,000

9) Sub-Program Description, Objectives and Theory

a) Sub-Program Description and Theory: Clearly describe the goals of the sub-program and the sub-program theory. As part of this, describe the market barriers, specific areas of concern and/or gaps that the sub-program is designed to address. Then describe the way the sub-program will seek to address each barrier, area of concern or gap (suggested work limit: 600 words per subprogram).

Advanced Metering is a technology that allows utilities to gather data automatically and wirelessly from their meters. This technology is used by all major energy utilities in California, and the benefits are being recognized as being effective for water utilities as well. The focus on Advanced Metering for water has increased in recent years due to the widespread drought conditions our state is currently facing.

There are several objectives for this pilot program, which leverage AMI technology.

Goal 1: Network Piggybacking

Advanced Metering can be deployed in several ways, however one of the most common has been a "fixed network" deployment, where a utility will install data collectors throughout their service area in order to receive radio frequency data transmissions from the meter measurement devices. Given the deployment cost, length of time to deploy, and maintenance requirements of implementing a fixed network AMI solution, such solutions may not always feasible for water utilities. This pilot program seeks to address this by allowing water utilities to share in the network infrastructure already deployed for SoCalGas Advanced Metering, hence removing the burden of deploying and maintaining a network infrastructure for the water utilities. Bringing separately owned and operated utilities together under the same AMI infrastructure is a novel solution not yet readily available in the AMI industry.

The objective for Goal 1 of this Pilot is to demonstrate the feasibility of a water utility "piggybacking" meter data on the SoCalGas AMI Network. SoCalGas already has several non-commission regulated water utilities utilizing the SoCalGas network to transmit their water data as part of a separate pilot effort.

Goal 2: Combined utility data analytics for water leak detection

SoCalGas has identified that approximately 30% of the anomalous gas consumption investigations based on exploratory enhanced data analytics performed in 2015 were the result of a hot water leak at the customer premise.[5]

This pilot will use hourly water data for the identification and evaluation of potential water leaks, and hourly gas data for the identification and evaluation of potential hot water leaks. Leveraging joint water and gas utility data for the detection of hot water leaks is a novel concept in the analytics industry and the ability to identify a water leak specifically as a hot water leak is expected to help utility providers as well as customers to better understand and identify the source of the leak, which may lead to reduced time to correct the issue and increased water and energy savings.

Goal 3: Determine the embedded energy savings from reduced water loss

Hot water leaks that are identified by leveraging joint water and gas utility data and verified by field technicians are expected to be resolved by the treatment group in a timelier manner than the control group. Integrated

[5] Reply Comments of SoCalGas on Final AMI Pilot Proposals, Page 9.

water and gas analysis will be used to measure the water savings due to timely determination of hot water leaks, gas savings due to timely determination of hot water leaks, and the embedded energy in the water saved. An aggregation of the water, gas, and electricity savings will provide a measure of associated GHG emissions reductions.

This pilot and the three goals targeted represent industry leading efforts in identifying the benefits of combined water and gas analytics - to a greater extent than can be done with data analytics from just one AMI utility source.

b) Sub-Program Energy and Demand Objectives- If this sub-program has energy and demand objective, please complete Table 2.

Not applicable since no savings will be claimed.

Table 2: Projected Sub-Program Net Energy and Demand Impacts, by Calendar Year

	Program Years		
	2016	2017	Total
SoCalGas WEN AMI Pilot with SGVWC			
GWh	-	-	N/A
Peak MW	-	-	N/A
Therms (millions)	-	-	N/A

c) Program Non-Energy Objectives:

The pilot is informational and will seek to establish baselines for future program performance metrics.

Objective of this Pilot is to determine the viability of performing joint energy-water analytics and measure the scope of the associated benefits.

- Determining how leveraging both water and gas data for the detection of hot water leaks can help utility providers understand and identify the source of the leak more quickly and measure the energy savings associated with identification and subsequent customer correction of the hot water leak.
- Quantifying the benefits of using combined water and gas AMI data to identify and calculate the embedded energy savings based on water loss reductions, and subsequent reductions in GHG emissions.

Quantitative metric targets for this pilot are as follows:

- 500 participants in the pilot treatment group with both water and gas AMI meters.
- 500 participants in the pilot control group with only gas AMI meters (no water AMI).

It is estimated 1% of participants will have leaks identified based on anomalous gas consumption.[6]

Metrics will be measured based on the one year pilot duration.

Table 3: Quantitative Program Targets (PPMs)

Target	2016	2017
500 participants in the Pilot treatment group with both water and gas advanced meters	-	-
500 participants in the Pilot Control Group with only gas advanced meters	-	-

d) Cost Effectiveness/Market Need: What methods will be or have been used to determine whether this program is cost-effective? If this is a non-resource program, describe the literature, market assessments or other sources that indicate a need for this program.

This pilot is classified as a non-resource program.

"The use of water and the use of energy are intricately intertwined. The extraction, treatment, distribution, and use of water followed by the collection and treatment of wastewater require a lot of energy; likewise, the production of energy—particularly hydroelectric and thermometric power generation— requires a lot of water.[4] For the past decade, this Commission and other state and federal agencies have been exploring how to ensure that both the direct[5] and indirect[6] impacts of this interdependency are taken into consideration when making investment decisions in both energy and water resources."[7]

"In its comments on the proposed decision that ultimately became D.15-09-023, California Water Association (CWA) asked that the commission add approval of advanced meter infrastructure (AMI) installations to the scope of the water-energy nexus proceeding,"[8] and that there is "an immediate need to provide customers with real-time information on their water consumption, which in turn created an accompanying potential for

[6] SoCalGas Final Advanced Meter Infrastructure Pilot Proposal, page 10.
[7] D16-06-010, Page 3.
[8] D.16-06-010, Pages 3-4.

water and related energy savings."[9] 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. A smart meter can, under some circumstances, indicate immediately if there is a leak at a customer premises.[10]

To this end, the Commission has directed Energy Utilities to propose pilot programs, with the goal of identifying "technical issues with a water corporation utilizing the existing electric corporation and/or gas corporation AMI infrastructure to transmit water usage data."[11] "Each utility filed a unique pilot proposal designed to probe the technical issues associated with shared use of existing energy utility advanced metering infrastructure to obtain water smart meter data and advance water conservation programs that complements existing efforts to test shared infrastructure options."[12] Pilot proposals were approved by the Commission in D.16-06-010.

e) Measure Savings/ Work Papers:

a. Indicate data source for savings estimates for program measures (DEER, custom measures, etc.).

Not applicable because no savings will be claimed by the pilot. Savings may be identified to inform future programs.

b. Indicate work paper status for program measures:

Not applicable.

Table 4: Work paper Status

#	Work paper Number/Measure Name	Approved	Pending Approval	Submitted but Awaiting Review
1	N/A			

10) Program Implementation Details

a) Timelines: List the key program milestones and dates. An example is included below.

[9] D.16-06-010 Page 4.
[10] D.16-06-010, Pages 6-7.
[11] D.16-06-010, Page 7.
[12] Id, Page 7.

Table 5: Sub-Program Milestones and Timeline

Milestone	Expected Date
AMI Pilot Workshop	1/19/16
CPUC Decision Issued	6/09/16
Final pilot selection set	July 2016
SGVWC Installations	July – August 2016
SoCalGas –> Valor: Interface	August 2016
Start of Analytics Period	September 2016
Monthly Progress Reports	September 2016 – September

	2017
Conclude Pilot Program	October 2017
SoCalGas 2017 EE Annual Report	May 2017
Valor Final Report (to SoCalGas)	December 2017
SoCalGas WEN AMI Pilot Final Report	March 2018
SoCalGas 2018 EE Annual Report	May 2018

b) Geographic Scope: List the geographic regions (e.g., CEC weather zones) where the program will operate.

This program will be conducted in the SGVWC's Los Angeles County and Fontana Water Company divisions.

Table 6: Geographic Regions Where the Program Will Operate

The two service areas that will be targeted for this pilot are shown in the images below:

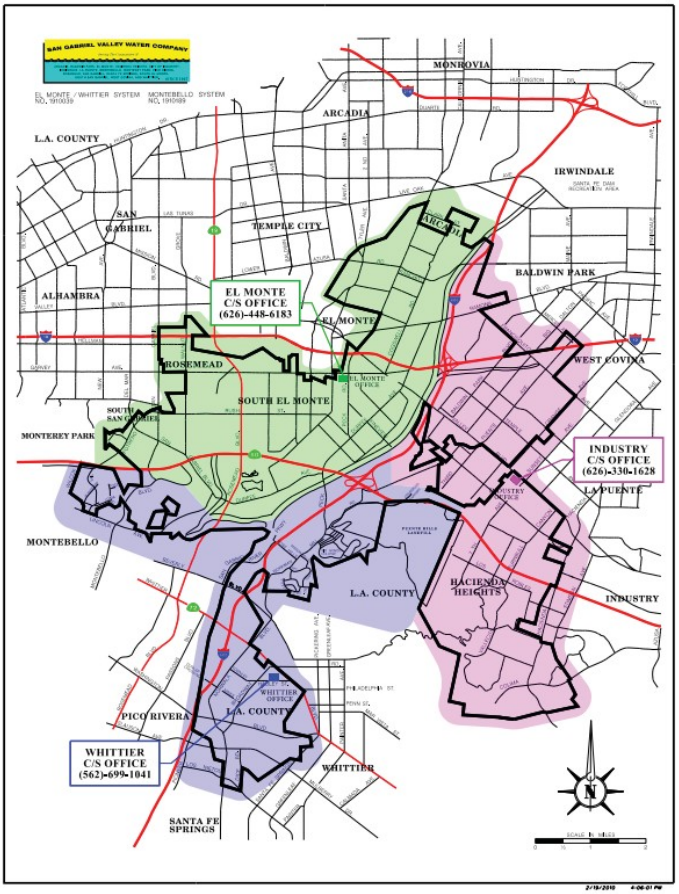

Image 1 – Certified service area of San Gabriel Valley Water Company's Los Angeles County Water Company Division.

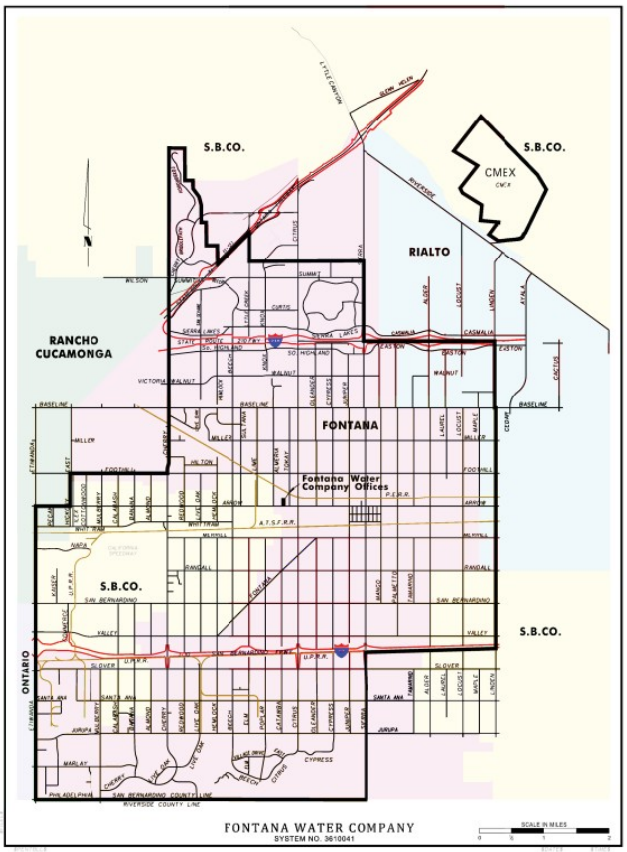

Image 2 – Certified service area of San Gabriel Valley Water Company's Fontana Water Company Division.

Geographic Region	SoCalGas Water Energy Nexus AMI Pilot
CEC Climate Zone 1	
CEC Climate Zone 2	
CEC Climate Zone 3	
CEC Climate Zone 4	
CEC Climate Zone 5	
CEC Climate Zone 6	
CEC Climate Zone 7	
CEC Climate Zone 8	
CEC Climate Zone 9	X - El Monte, Hacienda Heights, Whittier

CEC Climate Zone 10	X - Fontana, Rialto
CEC Climate Zone 11	
CEC Climate Zone 12	
CEC Climate Zone 13	
CEC Climate Zone 14	
CEC Climate Zone 15	
CEC Climate Zone 16	

Table 6 Geographic Regions- CEC Climate Zones

c) Program Administration

Table 7: Program Administration of Program Components

Program Name	Program Component	Implemented by [energy] IOU Staff ?	Implemented by contractors to be selected by competitive bid process	Implemented by contractors NOT selected by competitive bid process	Implemented by local government or other entity (X = Yes)
SoCalGas Water Energy Nexus AMI Pilot with SGVWC	Network Infrastructure Provider, Gas Analytics & field validation of potential hot water leaks	X			
	Joint water/gas hot water leak and integrated trend analytics, WEN Calculator Results, Reports, Whitepapers			Valor Water Analytics	
	Water AMI deployment,				SGVWC
	AMI technology			Aclara	

	provider & support				

d) Program Eligibility Requirements:

i. Customers: List any customer eligibility requirements (e.g., annual energy use, peak kW demand):

Approximately 500 customers split between each of the two SGVWC divisions will be selected by Valor Water Analytics to receive water Meter Transmission Units (MTUs). Customer selection is randomized and based on the Region (either Los Angeles County or Fontana), Classification (Single-Family Residential, Multi-Family Residential, and Commercial), MeterSize (BillSize), and water usage characteristics. In sampling, Valor have used the distribution of the characteristics described above for the year 2013, since this year is often considered to be the "last good year" of water representative of typical customer behavior before the onset of the California drought.

In addition, customer selection shall also include the requirement of having an advanced gas meter installed and fully operational.
The water utility may choose to monitor additional customers using AM technology outside the pilot test and control group; these customers will not be included in program results.

Table 8: Customer Eligibility Requirements (Joint Utility Table)

Customer Eligibility Requirement (list of requirements)	SCG
Must have gas MTU installed and fully operational	X

ii. Contractors/Participants: List any contractor (and/or developer, manufacturer, retailer or other "participant") eligibility requirements (e.g., specific IOU required trainings; specific contractor accreditations; and/or, specific technician certifications required).

Contractors/Participants included in this Pilot were not subject to eligibility requirements.

Aclara is the AMI vendor for this pilot, as they provide the AMI solution for SoCalGas. In order to utilize the SoCalGas AMI network infrastructure, the water utility must also use Aclara technology for their AMI solution.

Valor Water Analytics was already selected by SGVWC as an analytics partner and as such SoCalGas utilized them for the joint analytics components of this pilot.

All contractors must comply with all applicable federal, state and local governmental statutes, acts, ordinances, regulations, and codes and standards.

Table 9: Contractor/Participant Eligibility Requirements (Joint Utility Table)

Contractor Eligibility Requirement (list of requirements)	SCG
N/A	N/A

e) Program Partners:

a. Manufacturer/Retailer/Distributor partners: For upstream or midstream incentive and/or buy down programs indicate:

Not applicable

Table 10: Manufacturer/Retailer/Distributor Partners

Manufacturer/Retailer/Distributor Partner Information	SCG
Manufacturers enrolled in program	N/A
Manufacturers targeted for enrollment in program	N/A
Retailers enrolled in program	N/A
Retailers targeted for enrollment in program	N/A
Distributors enrolled in program	N/A
Distributors targeted for enrollment in program	N/A

b. Other key program partners: Indicate any research or other key program partners:

SGVWC is the Water Utility partner for this pilot. SGVWC will deploy water MTUs to 500 of their customers, split between their Los Angeles County and Fontana Water Company divisions. The SGVWC MTUs will communicate over the SoCalGas Advanced Meter network. In addition to activities related to the SGVWC's own goals and objectives for conducting and Advanced Meter pilot, SGVWC will provide hourly water data from the 500 customers to Valor Water

Analytics for use in joint water/gas hot water leak and integrated trend analytics.

Aclara is the AMI technology provider for this pilot. Aclara will be responsible for providing the following to SGVWC: MTUs and associated equipment; a hosted HeadEnd; associated training; integration to interfacing systems; professional services; and technical support.

Valor Water Analytics – In addition to activities performed specifically for SGVWC, Valor will be responsible for conducting joint water/gas hot water leak detection for the customers they select for the pilot, updating dashboards for SoCalGas, and performing the evaluation, water and energy savings calculations, reports, and whitepapers on the results of joint analytics.

f) Measures and incentive levels: E3 calculators will provide the list of measures and incentive levels to be provided via the program. In this section the utilities should provide a summary table of measures and incentive levels.

This is not applicable in a non-resource program.

Table 11: Summary Table of Measures, Incentive Levels and Verification Rates

Measure Group	Market Actor Receiving Incentive or Rebate	SCG	
		Incentive Level	Installation Sampling Rate
N/A	N/A	N/A	N/A

g) Additional Services: List additional services that the sub-program will provide, to which market actors.

a. For each service provided, indicate any expected charges to market actors of the services, and/or the level at which any such services will be incented or funded.

Not applicable.

Table 12: Additional Services

Additional Services that the Sub-Program Will Provide	To Which Market Actors	SCG
N/A	N/A	N/A

h) Sub-Program Specific Marketing and Outreach: Please describe, providing timelines (suggested word limit: 300 words)

SoCalGas will not be marketing this program.

SoCalGas will perform a field visit in the event that hot water leak flags (from joint water and gas data) and/or anomalous gas usage is detected at the customer premise. The purpose of this visit would be to validate the source of the gas consumption and inform the customer accordingly. This would take place on an as-needed basis.

i) Sub-Program Specific Training: Please describe, providing timelines (suggested word limit: 300 words)

Not applicable – no customer training will be conducted for this pilot.

j) Sub-Program Software and/or Additional Tools:

a. List all eligible software or similar tools required for sub-program participation.

SoCalGas is not providing any software to customers as part of this pilot.

b. Indicate if pre and/or post implementation audits will be required for the sub-program.

Not required.

Pre-implementation audit required ___ Yes __X_ No
Post-implementation audit required ___ Yes __X_ No

c. As applicable, indicate levels at which such audits shall be rebated or funded, and to whom such rebates/funding will be provided (i.e. to customer or contractor).

Table 13: Post-implementation Audits

Levels at Which Program Related Audits Are Rebated or Funded	Who Receives the Rebate/Funding (Customer or Contractor)
N/A	N/A

k) Sub-Program Quality Assurance Provisions: Please list quality assurance, quality control, including accreditations/certification or other credentials

A SoCalGas field technician will perform a field visit to the customer premise for any customers participating in the pilot for whom hot water leak flags (from joint water and gas data) and anomalous gas usage is identified. The field visit is intended to identify the source of anomalous gas consumption. In the event that the source is considered to be a hot water heater (as can occur when a hot water leak causes the hot water heater to be in constant demand), the information will be passed to the water utility and analytics vendor. Negative results will also be shared with the analytics vendor. Feedback from these field validations will help to improve the quality and accuracy of the analytics performed.

Table 14: Quality Assurance Provisions

QA Requirements	QA Sampling Rate (Indicate Pre/Post Sample)	QA Personnel Certification Requirements
N/A	N/A	N/A

l) Sub-program Delivery Method and Measure Installation /Marketing or Training: Briefly describe any additional sub-program delivery and measure installation and/or marketing & outreach, training and/or other services provided, if not yet described above.

Not applicable.

m) Sub-program Process Flow Chart: Provide a sub-program process flow chart that describes the administrative and procedural components of the sub-program. For example, the flow chart might describe a customer's submittal of an application, the screening of the application, the approval/disapproval of an application, verification of purchase or

installation, the processing and payment of incentives, and any quality control activities.

Please refer to Appendix D for the Process Flow Chart.

n) Cross-cutting Sub-program and Non-IOU Partner Coordination: Indicate other IOU EE, DR or DG sub-programs with which this sub-program will regularly coordinate. Indicate also key non-IOU coordination partners. Indicate expected coordination mechanisms and frequency:

Regular coordination will take place between SoCalGas, SGVWC, Aclara, and Valor Water Analytics throughout the pilot. This will be in the form of conference calls on a monthly basis unless greater frequency is warranted.

Table 15: Cross-cutting Sub-program and Non-IOU Partner Coordination

SoCalGas Water Energy Nexus AMI Pilot		
Pilot Program Partner	Coordination Mechanism	Expected Frequency
San Gabriel Valley Water Company	Teleconference	Monthly or greater
Aclara	Teleconference	Monthly or greater
Valor Water Analytics	Teleconference	Monthly or greater

o) Logic Model: Please append the logic model for this sub-program to the end of this PIP. Describe here any additional underlying theory supporting the sub-program intervention approach, referring as needed to the relevant literature (e.g., past evaluations, best practices documents, journal articles, books, etc.).

See Appendix E for the Logic Model.

11) Additional Sub-Program Information

a) Advancing Strategic Plan Goals and Objectives: Describe how sub-program advances the goals, strategies and objectives of the California Long Term Energy Efficiency Strategic Plan (word limit: 150 words).

While the Strategic Plan does not specifically address water-energy "nexus" efforts, this pilot may help inform potential future energy efficiency activities in the residential and commercial sectors.

b) Integration

i. Integrated/coordinated Demand Side Management: As applicable, describe how sub-program will promote customer education and sub-program participation across all DSM options. Provide budget information of non-EE sub-programs where applicable.

Not applicable.

Table 16: Non-EE Sub-Program Information

SoCalGas Water Energy Nexus AMI Pilot		
Non-EE Sub-Program	Budget	Rationale and General Approach for Integrating Across Resource Types
N/A	N/A	N/A

ii. Integration across resource types (energy, water, air quality, etc.): If sub-program aims to integrate across resources types, please provide rationale and general approach.

Not applicable.

c) Leveraging of Resources: Please describe if the subprogram will leverage additional investments by market actors or other state, local or federal agencies.

The overall cost for the Pilots between SoCalGas and SGVWC is estimated to be $388,462, as shown in Figure 1 below.

Deliverable/Material	SoCalGas Cost	SGVWC Cost[13]
AMI Hardware and Software, associated training, installation hardware, integration, services and contingency	-	$189,692
Network use fee to SoCalGas	-	$5,000
Analytics services and reporting	$60,000	$25,000
Consumer engagement software	-	$3,500
Hot water leak field visits	$5,000	-
SoCalGas IT interface	$40,000	-
Project Management	$40,000	-
General Overheads	$20,000	
Total	$165,000	$223,462

Figure 1: SoCalGas and SGVWC Pilot costs

d) Trials/ Pilots: Please describe any trials or pilot projects planned for this sub-program.

This is a Pilot which will serve to determine viability of potential future programs of this kind.

e) Knowledge Transfer: Describe the strategy that will be used to identify and disseminate best practices and lessons learned from this sub-program.

Valor Water Analytics will develop a whitepaper presenting the methodologies used for the pilot program assessment, results from the pilot randomized control experiment (customer data will be de-identified and aggregated), integrated trend analytics and water-energy nexus insights gained, innovations or new thinking developed, future work necessary, and recommendations for future programs. This whitepaper will be incorporated into the SoCalGas WEN AMI Pilot Final Report.

12) Market Transformation Information: For programs identified as market transformation programs, include the following (suggested page limit- five pages):

i. A summary of the market transformation objectives of the program.
ii. A description of the market, including identification of the relevant market actors and the relationships among them;
iii. A market characterization and assessment of the relationships/dynamics among market actors, including identification of the key barriers and opportunities to advance demand side management technologies and strategies;

[13] Attachment B (p. 1) to Exhibit SG-5 (Direct Testimony of Robert J. DiPrimio), in Application 16-01-002 (San Gabriel Valley Water Company General Rate Case).

iv. A description of the proposed intervention(s) and its/their intended results, and specify which barriers the intervention is intended to address;

v. A coherent program, or "market," logic model that ensures a solid causal relationship between the proposed intervention(s) and its/their intended results; and

vi. Appropriate evaluation plans and corresponding Market Transformation indicators and Program Performance Metrics based on the program logic model.

Not applicable.

13) Additional information as required by Commission decision or ruling or as needed: Include here additional information as required by Commission decision or ruling (As applicable. Indicate decision or ruling and page numbers):

Per D.16-06-010, Ordering Paragraph 7, SoCalGas 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 their approved pilot that includes, but is not limited to:

- Detailed schedules for implementation (See Section 10 / Table 5)
- Proposed budgets (See Section 11c)
- Projected savings and cost-effectiveness using the Water Energy calculator as applicable (Not Applicable)
- Marketing, education, and outreach guidelines (See Section 10h)
- Data requirements (See Appendix A)
- Measurement and evaluation plan (See Appendix B)
- Control group size (See Appendix A)

The Pilot criteria set forth in Energy Efficiency Manual v.5 referenced in the decision regarding WEN AMI Pilots are detailed in Appendix C.

Appendix Guide:
Appendix A – Data Requirements & Control Group Size
Appendix B – Measurement and Evaluation Plan
Appendix C – Pilot Criteria based on Energy Efficiency Manual v.5
Appendix D – Pilot Program Process Flow Chart
Appendix E – Pilot Program Logic Model

Appendix A - Data Requirements & Control Group Size

Data requirements for this pilot are that both SGVWC and SoCalGas shall send to Valor Water Analytics hourly consumption data for the 500 pilot treatment group accounts, monthly reads for the 500 control group from SGVWC, and hourly reads for the control group from SoCalGas. SoCalGas shall also send to Valor conformation of any validated hot water leaks based on field visits, as well as any negative results.

- Valor is requesting gas meter consumption data for approximately 1,000 customers every hour (AMI) for a historic period between January 1, 2015 and present date.
- Test and control group customers will be common customers between SGVWC and SoCalGas.
- Valor requests historic gas usage data for a small subset of accounts (at least five meters) with validated hot water leaks and, if available, corresponding detail on when the leak occurred, when and how the outreach occurred, and when the leak was fixed.

Data requested by Valor from SoCalGas includes:

- Data Identifiers
  - A unique meter number.
  - A unique ID number per customer such as “Address”, “Location ID” or “Premise ID.”
- Meter Data
  - Timestamp. Month, day, year and hour interval for the meter read.
  - Consumption amount per meter - usage in consumption unit for the associated interval timestamp.
  - Unit of measurement for consumption - e.g., therms.
  - Hot Water Leak Alert Identifier, when applicable – Was a hot water leak detected during this interval?

Appendix B - Measurement and Evaluation Plan

The Measurement and Evaluation plan is included in Attachment 2 and will be undertaken by SoCalGas. Valor Water Analytics will provide inputs to SoCalGas for the EM&V.

Appendix C - Pilot Criteria based on Energy Efficiency Manual v.5

The Energy Efficiency Manual v.5 specifies:

Pilot programs should be designed to create the measures and program delivery mechanisms of the future, enabling IOUs to achieve deeper savings and market transformation. The pilots should be limited in scope and duration so that results are available in a specified time frame and limited in budget so that unsuccessful programs have a limited impact on the overall portfolio. All results of pilot programs must be shared widely with the other IOUs and with the stakeholders in the sector impacted by the pilot. There should be a specific plan and timeframe to move successful pilot programs into statewide use (if applicable). Each proposed pilot should contain the following elements:

a. 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;

   The statement of concern, gap or problem that the Pilot seeks to address is detailed in Section 9a.

b. Whether and how the pilot will address a Strategic Plan goal or strategy and market transformation;

   While the strategic plan does not specifically address water-energy nexus efforts, this pilot may help inform potential future energy efficiency activities in the residential and commercial sectors.

c. Specific goals, objectives and end points for the project;

   The goals and objectives for this Pilot are detailed in Section 9a. Details regarding the end points for this Pilot are provided in Appendix B.

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

   Bringing separately owned and operated utilities together under the same AMI is a novel solution not yet readily available in the AMI industry.

   Leveraging joint water and gas utility data for the detection of hot water leaks is a novel concept in the analytics industry and the ability to identify a water leak specifically as a hot water leak is expected to help utility providers as well as customers to better understand and

identify the source of the leak, which may lead to reduced time to correct the issue and increased water and energy savings.

Quantifying the benefits of using combined water and gas AMI data to identify and calculate the embedded energy savings based on reduced water loss, and subsequent reductions in GHG emissions is not prevalent in the industry today.

This pilot and the goals targeted represent industry leading efforts in identifying the benefits of combined water and gas analytics - to a greater extent than can be done with data analytics from just one AMI utility source.

e. A clear budget and timeframe to complete the project and obtain results within a portfolio cycle - pilot projects should not be continuations of programs from previous portfolios;

SoCalGas' estimated costs incurred to conduct its pilot with SGVWC using Valor Water Analytics as the collaborative analytics vendor is $165,000. SoCalGas has been approved by the Commission in D.16-06-010 for a budget of up to $175,000 per water utility participant, with a not to exceed budget of $300,000 across all water utility participants.

Additional details regarding the components of this budget are provided in Section 11c.

Targeted timeframe for this pilot is to begin water MTU installations in July 2016, begin joint utility analytics in September 2016, and continue analytics for a one year period through September of 2017 with reporting of results by March 2018. Additional timeline details are provided in section 10a.

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

Baseline metrics are not yet available, and this pilot may aid in developing such baseline metrics.

g. Program performance metrics;

In D.15-10-028, the California EE Program Administrators were relieved from their reporting requirements for PPMs.[14]

[14] See D.15-10-028, pg. 54.

h. Methodologies to test the cost-effectiveness of the project;

Valor will provide SoCalGas with an "Integrated Water Energy Calculator", based on the CPUC Water Energy Calculator. SoCalGas will use this calculator for reporting requirement measuring the pre-post energy savings for this piggybacking pilot and across joint customers in SGVWC's Los Angeles County and Fontana Water Company divisions over the pilot's 12-month time frame. Valor will calculate embedded energy savings of hot water leak savings, per the analytical results captured in the Side-by-Side Leak Detection Dashboard.

i. A proposed EM&V plan;

Proposed EM&V plan is included in Appendix B, Attachment 2.

j. A concrete strategy to identify and disseminate best practices and lessons learned from the pilot to all California IOUs 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.

SoCalGas will submit a final report at the end of the Pilot program, a copy of which will be made available to all California IOUs detailing the result of the objectives of this pilot described in Section 9a.

ATTACHMENT 1

Excel Tables

Table 1: Total Projected Program Budget & Savings by Subprogram

Subprogram	PG&E ($)	SCE ($)	SDG&E ($)	SCG ($)	Kwh	KW	Therms
A - SoCalGas WEN AMI Pilot with San Gabriel Valley Water Company	-	-	-	$165,000	-	-	-
Total				$165,000			

Table 2: Total Projected Program Savings by IOU

Subprogram	PG&E Kwh	PG&E KW	PG&E Therms	SCE Kwh	SCE KW	SDG&E Kwh	SDG&E KW	SDG&E Therms	SCG Therms	Total
SoCalGas WEN AMI Pilot with San Gabriel Valley Water Company	-	-	-	-	-	-	-	-	N/A	N/A
Total									N/A	N/A

Table 1. Projected Sub-Program Budget, by Calendar Year

	Program Year		
Sub-Program	2016	2017	Total
Admin ($)	$20,000	$20,000	$40,000
General overhead ($)	$50,000	$10,000	$60,000
Incentives ($)	N/A	N/A	N/A
Direct Install Non-Incentives ($)	$32,500	$32,500	$65,000
Marketing & Outreach ($)	N/A	N/A	N/A
Education & Training	N/A	N/A	N/A
Total Budget	$ 102,500	$62,500	$165,000

Individual utility specific information to be provided in this table

Table 2. Projected Sub-Program Net Energy and Demand Impacts, by Calendar Year

	Program Years		
	2016	2017	Total
SoCalGas WEN AMI Pilot - San Gabriel Valley Water Company			
GWh	-	-	N/A
Peak MW	-	-	N/A
Therms (millions)	-	-	N/A

Individual utility specific information to be provided in this table

Table 3. Quantitative Program Targets (PPMs)

Target	2016	2017
500 participants in the Pilot with both water and gas advanced meters	-	-
500 participants in the Pilot Control Group with only gas advanced meters	-	-

Table 4 – Work paper Status

#	Workpaper Number/Measure Name	Approved	Pending Approval	Submitted but Awaiting Review
1	N/A			

Table 5:. Sub-Program Milestones and Timeline

Milestone	Expected Date
AMI Pilot Workshop	1/19/2016
CPUC Decision Issued	6/9/2016
San Gabriel Valley Installations	July – August 2016
San Gabriel Valley –> Valor : Interface an	Aug-16
SoCalGas –> Valor: Interfaces and Dashb	Aug-16
Start of Analytics Period	Sep-16
Monthly Progress Reports	September 2016 – September 2017
Conclude Pilot Program	Oct-17
SoCalGas 2017 EE Annual Report	May-17
Valor Final Report and Whitepaper (to So	Dec-17
SoCalGas WEN AMI Pilot Final Report	Mar-18
SoCalGas 2018 EE Annual Report	May-18

Table 6 Geographic Regions

Geographic Region	SoCalGas Water Energy Nexus AMI Pilot
CEC Climate Zone 1	
CEC Climate Zone 2	
CEC Climate Zone 3	
CEC Climate Zone 4	
CEC Climate Zone 5	
CEC Climate Zone 6	
CEC Climate Zone 7	
CEC Climate Zone 8	
CEC Climate Zone 9	X - El Monte, Hacienda Heights, Whittier
CEC Climate Zone 10	X - Fontana, Rialto
CEC Climate Zone 11	
CEC Climate Zone 12	
CEC Climate Zone 13	
CEC Climate Zone 14	
CEC Climate Zone 15	
CEC Climate Zone 16	

Table 7: Program Administration of Program Components

Program Name	Program Component	Implemented by [energy] IOU Staff? (X = Yes)	Implemented by contractors to be selected by competitive bid process (if Yes then enter type of contractor/other maket actor possibly used)	Implemented by contractors NOT selected by competitive bid process (list prime contractor and sub-contractor names)	Implemented by local government or other entity (X = Yes)
SoCalGas Water Energy Nexus AMI Pilot - San Gabriel Valley Water Company	Network Infrastructure Provider, Gas Analytics & field validation of potential hot water leaks based on anomalous gas consumption	X			
	Joint water/gas analytics, WEN Calculator Results, Reports, Whitepapers			Valor Water Analytics	
	Water AMI deployment				San Gabriel Valley Water Company
	AMI technology provider & support			Aclara	

Table 8: Customer Eligibility Requirements (Joint Utility Table)

Customer Eligibity Requirement (list of requirements)	PGE	SCE	SDGE	SCG
Must have gas MTU installed and fully operational	-	-	-	X

The utilities must work together and submit this table jointly in their respective applications

Table 9: Contractor Eligibility Requirements (Joint Utility Table)

Contractor Eligibity Requirement (list of requirements)	PGE	SCE	SDGE	SCG
N/A	-	-	-	-

List any contractor (and/or developer, manufacturer, retailer or other "participant") eligibility requirements (e.g. specific IOU required trainings; specific contractor accreditations; and/or, specific technician certifications required).
The utilities must work together and submit this table jointly in their respective applications

Table 10: Manufacturer/Retailer/Distributor Partners

Manufacturer/Retailer/Distributor Parnter Information	PGE	SCE	SDGE	SCG
Manufacturers enrolled in program	-	-	-	N/A
Manufacturers targeted for enrollment in program	-	-	-	N/A
Retailers enrolled in program	-	-	-	N/A
Retailers targeted for enrollment in program	-	-	-	N/A
Distributors enrolled in program	-	-	-	N/A
Distributors targeted for enrollment in program	-	-	-	N/A

Table 11: Summary Table of Measures, Incentive Levels and Verification Rates

Measure Group	Market Actor Receiving Incentive or Rebate	PGE		SCE		SDGE		SCG	
		Incentive Level	Installation Sampling Rate	Incentive Level	Installation Sampling Rate	Incentive Level	Installation Sampling Rate	Incentive Level	Installation Sampling Rate
N/A	N/A	-	-	-	-	-	-	N/A	N/A

a. Use a single excel spreadsheet to indicate the eligible measures for the program across all IOUs. Indicate the expected incentive level by measure or measure grouping for each IOU, making clear where these vary.
b. For each incented or rebated measure, indicate the market actor to whom this will be provided.

Table 12: Additional Services

Additional Services that the Sub-Program Will Provide	To Which Market Actors	PGE	SCE	SDGE	SCG
N/A	N/A	-	-	-	N/A

a. For each service provided, indicate any expected charges to market actors of the services, and/or the level at which any such services will be incented or funded.

Table 13: Program Related Audits

Levels at Which Program Related Audits Are Rebated or Funded	Who Receives the Rebate/Funding (Customer or Contractor)
N/A	N/A

NOTE: If software tools are required sub-program participation, and if there is a program related audit for the sub-program, this table shows the levels at which the audit is rebated or funded and to whom such rebates/funding will be provided (i.e., customer or contractor)

Table 14: Quality Assurance Provisions

QA Requirements	QA Sampling Rate (Indicate Pre/Post Sample)	QA Personnel Certification Requirements
N/A	N/A	N/A

NOTE: Please list quality assurance, quality control, including accreditations/certification or other credentials required.

Table 15: Cross-cutting Sub-program and Non-IOU Partner Coordination

SoCalGas Water Energy Nexus AMI Pilot		
Pilot Program Partner	Coordination Mechanism	Expected Frequency
San Gabriel Valley Water Company	Teleconference	Monthly or greater
Aclara	Teleconference	Monthly or greater
Valor Water Analytics	Teleconference	Monthly or greater

Note: "Mechanisms" refers to communication methods (i.e. quarterly meetings; internal list serves; monthly calls, etc.) and/or any cross-program review methods (i.e., feedback on program plans; sign off on policies, etc). or harmonization techniques (i.e. consistent certification requirements across programs, program participant required cross trainings, etc).

Table 16: Non-EE Sub-Program Information

SoCalGas Water Energy Nexus AMI Pilot		
Non-EE Sub-Program	**Budget**	**Rationale and General Approach for Integrating Across Resource Types**
N/A	N/A	N/A

NOTE: Column C --> Integrated/coordinated Demand Side Management: As applicable, describe how sub-program will promote customer education and sub-program participation across all DSM options. Provide budget information of non-EE sub-programs where applicable. Column D --> Integration across resource types (energy, water, air quality, etc): If sub-program aims to integrate across resources types, please provide rationale and general approach

ATTACHMENT 2

EM&V Plan

Evaluation, Measurement and Verification Plan for the SoCalGas Water- Energy Nexus Shared Network AMI Pilot Program

A. Description of Pilot Program

The Pilot will leverage the existing Southern California Gas Company (SoCalGas) Advanced Meter Infrastructure (AMI) network to allow for San Gabriel Valley Water Company (SGVWC) water meters to "piggyback" on the SoCalGas AMI network and includes an analytics component for identification and evaluation of potential hot water leaks based on analysis of both gas and combined gas and water usage data. Valor Water Analytics will perform joint water-gas analytics for hot water leak detection, and quantification of water, embedded energy, and greenhouse gas (GHG) benefits associated with hot water leak detection and resolution. Valor will also conduct trend analytics, to identify where water loss reduction has resulted in a change in gas consumption. Analysis will be performed on AMI (treatment) vs. control; pre and post.

The pilot will be conducted with 500 SoCalGas and SGVWC customers in two SGVWC divisions: the program will seek approximately 250 customers in the Los Angeles County Water Company division including El Monte, Hacienda Heights, and Whittier in the central Los Angeles basin, and 250 more customers in the Fontana Water Company division including Fontana and Rialto communities to the east. Under the program, SoCalGas will share its AMI network to collect and transmit SGVWC's hourly water data. A control group of 500 additional joint customers will be selected to conduct the randomized pilot program evaluation.

B. Pilot Program Objectives

The program implementation plan identified three objectives for this pilot.

Goal 1: Network Piggybacking

Due to the cost, length of time, and maintenance requirements involved in setting up and running an advanced metering infrastructure within its service territory, it may not be feasible for many water utilities to deploy their own advanced metering network infrastructure. The objective for Goal 1 of this Pilot is to demonstrate the feasibility of a water utility "piggybacking" meter data on the SoCalGas AMI Network.

Goal 2: Combined utility data analytics for water leak detection

SoCalGas has identified that approximately 30% of the anomalous gas consumption investigations based on exploratory enhanced data analytics performed in 2015 were the result of a hot water leak at the customer premise.[1, 2] This pilot will use hourly water data for the identification and evaluation of potential water leaks, and hourly gas data for the identification and evaluation of potential hot water leaks. Leveraging joint water and gas utility data for the detection of hot water leaks is a novel concept in the analytics industry and the ability to identify

[1] SoCalGas Advanced Meter Semi Annual Report February 2016, Pages 12-13.
[2] Reply Comments of SoCalGas on Final AMI Pilot Proposals, Page 9.

a water leak specifically as a hot water leak is expected to help utility providers as well as customers to better understand and identify the source of the leak, which may lead to reduced time to correct the issue and increased water and energy savings.

Goal 3: Determine the embedded energy savings from reduced water loss

Hot water leaks that are identified by leveraging joint water and gas utility data and verified by field technicians are expected to be resolved by customers in the treatment group in a timely manner than those in the control group. Integrated water and gas analysis will be used to measure the water savings due to timely determination of hot water leaks, gas savings due to timely determination of hot water leaks, and the embedded energy in the water saved. An aggregation of the water, gas, and electricity savings will provide a measure of associated GHG emissions reductions.

The treatment (AMI) group receives leak notifications earlier than the control (non-AMI) group. Valor's current AMI water leak detectors (hot and non-hot) require a minimum of 3 days after the onset of a water leak to make a prediction, whereas the non-AMI leaks detector has to wait until the end of the month. This does not necessarily mean that the AMI algorithm can detect the same leak as the non-AMI algorithm 25 days in advance, as this strongly depends on the time of the month that the leak started ("25 days in advance" could happen if the leak started towards the start of the month). Depending on the optimal threshold, the time between the onset of a leak and when the customer is notified could increase/decrease.

"Timeliness" in terms of early notifications can indeed be reasonably determined but only on a case-by-case basis, since this depends on the time of the month that the leak started. The number of days by which an AMI customer can receive a leak notification earlier than a non-AMI customer can range from anywhere from 0-30 days, though statistically we would expect an average of somewhere mid-way in that range, say 15 days.

C. Evaluation Objectives

The objectives of this evaluation plan are to:

1. Determine the gross water, gas, and embedded energy savings
2. Verify hot water leaks detected by analytics with on-site inspections
3. Develop and track program metrics and costs

D. Evaluation Objective 1: Gross Water, Gas, and Embedded Energy Savings Methodology

Analytical Methodology

Valor has a set of leak algorithms for both water and gas that have been validated by a third party and found to have a high rate of precision. This is done by using anomaly detection methods to analyze and locate the digital signature of a leak. The digital signature of a leak, in both water and gas data, shows up despite normal variation in water or gas use. By accounting for this variation, the leak signature can be singled out in a precise manner, and in doing so, a fairly accurate measure of the amount leaked can be determined. Integrated machine learning is leveraged to "train" the mathematical models to learn as larger numbers of leaks are identified and modeled. Machine learning allows for constant improvement of the algorithms and even greater precision to be achieved over time.

Valor began the customer selection process with a full set of SGVWC 76,348 water accounts, and used these to stratify and randomly select the sample pilot test treatment and control sets

groups for a total sample size of 1,000 customers. A randomly selected a sample of 500 treatment accounts was collected, roughly 250 each for Los Angeles and Fontana, that are also representative of the underlying population (as described below). A matching stratification approach was then used to randomly select the 500 control group customers. In sampling, the distribution of the characteristics described below for the year 2013 was used. This year was chosen as it is often considered to be the "last good year" of water use, representative of typical customer behavior before the onset of the California drought.

Since some of the percentages for the various segments (Region, Classification, Meter/Bill Size, Use/Peak-quadrant) were fairly low, in drawing samples for a total sample size of 250 for each of Los Angeles and Fontana, there were some segments that should not be drawn samples for, for the simple reason that the number of samples to be picked out of that segment was rounding off to zero.

Regression analysis will be used to evaluate the impact of AMI-related interventions on water and gas usage, while controlling for weather and water prices. A difference-in-difference modeling approach will be employed to measure the changes in two groups over time, a treatment and a control group, to ascertain a treatment effect equivalent, in this case, to the reduction in water and gas consumption that is attributed to AMI-related interventions (customer portal and leak alerts).

Difference-in-difference methods are commonly used to assess treatment effects in non-randomized experiments. Forty-eight months of pre-intervention data is available to serve as an additional basis for comparison. Similar to difference-in-averages methods, difference-in-differences also relies on the changes in the treatment group relative to the control group, although it has several advantages for this analysis: 1) explicit inclusion of control variables; 2) tests of statistical significance; and 3) allowing the treatment period to vary between premises. To estimate a treatment effect for the difference-in-difference model, two types of regression models will used under varying control scenarios: ordinary least squares and panel data models with fixed effects.

The regression model takes the form:

$$\ln(Q_{wgit}) = b_1 AMI_{wgit} + b_2 post_{wgit} + b_3 weather_{wgit} + b_4 price_{wit} + b_5 q_t + u_i + e_{wgit}$$

where:

$\ln(Q_{wgit})$ = the natural log of monthly water (*w*) or gas (*g*) consumption for premise *i* at time *t*.

AMI_{wgit} = whether premise *i* had an AMI meter at time *t* (i.e., 0 or 1)

$post_{wgit}$ = whether the time period of the observation is after AMI meters were installed

$weather_{wgit}$ = a weather variable indicating maximum monthly temperature (*F)

$price_{wit}$ = the average price a customer faced for monthly consumption ($/gal)

q_t = a time variable indicating the month (i.e., 0, 1, 2, … , 12)

u_i = premise fixed effects

e_{wgit} = error term

A logarithmic dependent variable is used for two reasons: 1) it mitigates the effect of extremely high consumption on the parameters of interest and 2) it allows for a simple "percent reduction" interpretation of coefficients.

SGVWC Sample Size Significance

Given budget constraints driving number of AMI meters installed, the goal was to determine a sample size that will allow for establishing statistically significant results for an hourly AMI vs. monthly manual reads effectiveness environmental benefits comparison. In general, Valor recommends as large a sample size as possible within a practical resource budget. RTC framework is used in this Pilot, which is described as being appropriate for technical program evaluation by highly regarded experimental design researchers (see Shadish Cook and Campbell, 2002).

In summary, it is expected that with a test sample size of 1,000 customers, statistically plausible inferences can be made about results of the study across the SGVWC service areas.

In order to draw a sample that best represents the attributes of the underlying population, we segment customers according to the Region (either Los Angeles or Fontana), Classification, Meter Size, and then further based on each customers' usage characteristics.

Valor Water has models to identify leaks for monthly and hourly data. For the control group (monthly data), volumetric thresholds have been set for the monthly non-AMI leak detection algorithm using data from over million water customers. On a monthly basis a number of aspects can be measured: 1) validate the water leak flag with the gas hot water leak flag; 2) measure the associated water loss; 3) confirm the leak resolution; and 4) measure the associated water loss rate for entry into the monthly water loss comparison (to AMI). Given that a delta is being measured, a reference group is necessary to conduct the pre/post – treatment/control analysis.

Hot water leaks are distinguished from other water leaks by the joint analysis of gas and water data. Valor has validated hot water leak data from both water and gas customers. The parallel stream of both data flows (on test customers) is used to identify this appliance level leak, which looks different from typical non-hot water leaks (a garden hose leak, a leaky toilet, a leaky pipe, etc.).

Data & Duration

Data inputs for this study are:

Hourly gas meter read data for 1,000 study customers -

1 year of historic data provided to establish baseline.

Daily Batch feeds for duration of the study period.

Hourly Water meter read data for 500 Test Group Customers -

4 years of historic data (manual reads) provided to establish baseline.

Daily Batch feeds for duration of the study period.

Monthly Water manual meter read data for 500 Control Group customers -

4 years of historic data (manual reads) provided to establish baseline.

Monthly Batch feeds for duration of the study period.

Daily weather data for SGVWC service areas -

Identify the nearest weather station associated with each premise in the analysis.

Obtain daily temperature data from each weather station for a period that matches the consumption data.

Alert and Validation Inputs from SoCalGas -

Sample validated hot water leaks to be provided in advance.

Positive and negative validated hot water leaks be sent as available (at least monthly) for the study period.

Duration:

This study will occur over a 12-month pilot period (referred to as the analytical period) beginning in September 2016.

Measurement Methodology

Embedded Energy of Reduced Water Loss

Valor Water Energy Nexus calculator is based on the CPUC Water Energy Calculator, as specified in the September 2015 proceedings (CPUC Rulemaking 13-12-011). SoCal Gas will use this calculator for reporting requirement measuring the pre-post energy savings for this piggybacking pilot and across joint customers in the SGVWC service area over the pilot's 12-month time frame. Valor will calculate embedded energy savings of hot water leak savings, and estimate the gas savings incurred via timely hot water leak resolution.

The key embedded energy of water savings measures include but are not limited to:

- Average embedded annual gas energy (therms);
- Avoided gas energy cost (2014$)
- Average embedded annual electricity energy (kwhs);
- Avoided electricity cost (2014$)

Pilot Evaluation

Once the measurements above are determined for each account (test and control groups), the next step is to assess the impact of the pilot program according to these null and alternative hypotheses:

Hypothesis 1

H_0 AMI technology has no impact on water loss and associated energy savings

H_1 AMI technology results in greater water (and associated energy savings) than monthly meter read technology

Hypothesis 2

H_0 Integrated water and gas analytics result in the same number of hot water leak findings than either gas or water data analyzed alone;

H_1 Integrated water and gas analytics result in a greater number of hot water leak findings than either gas or water data analyzed alone

Hypothesis 2 may be revised, if suitable validation data is not available from either the gas utility, or the water utility involved in the pilot.

Both hypotheses will be tested with a number of summary and advanced statistical techniques, including but not limited to the following:

Summary Statistics (compare treated group to control group during treatment period only):

- Leaks / Water Loss Reduction (Hot & Cold Water)
    - gallons, percentage (by month and cumulative)
- Embedded Energy and Emissions
    - Tons CO2, percentage, by month and cumulative
    - Therms, percentage, by month and cumulative
    - Electricity, percentage, by month and cumulative

Advanced level statistical modeling to be conducted, for each of the above measurements, per hypothesis:

- Compare treated group performance to their historical performance
- Compare control group performance to their historical performance
- Weather normalize consumption (emissions and water)
- Regression based difference in difference analysis

E. Evaluation Objective 2: Verification of Hot Water Leaks Detected by Analytics with On-Site Inspections

Water leaks that have been identified by joint AMI data analysis will be displayed on the Side by Side Leak Detection Dashboard provided by Valor to SoCalGas.

SoCalGas will perform a field visit in the event that hot water leak flags (from joint water and gas data) and/or anomalous gas usage is detected at the customer premise. The purpose of this visit would be to validate the source of the gas consumption and inform the customer accordingly.

During the site visit technicians will substantiate evidence of a hot water leakage using a process developed for this program. This process will include physical investigation of the premises, inspection of all gas appliances at the site, and an occupant interview focusing on potential sites for hot water leaks. Technicians will determine the presence of the hot water leakage by evaluation of the hot water heating appliance and a cursory check of the water meter for indication of water flow with all known water usage eliminated. Evaluation of the water heating appliance includes, routine inspection of the burner, controls, and associated piping and hardware as prescribed by SoCalGas policy, observation of the vent, appliance operation,

evidence of water or water flow through the appliance, and any indications of excessive consumption of gas and/or hot water incidental to this inspection.

Field technicians will record a variety of information, if available, about the premise and the hot water appliance(s) observed on site. Collected data may include:

- Age and make/model of the domestic hot water appliance(s)
- Type of leak: Leak at the water heating appliance on a valve, connector, vessel, or apparatus; fixture leak; in wall, underground, or under slab
- Rate of water leakage measured at the leak(s). Commonly at the hot water heater, hot tub, pool, other appliance or hot water line

F. Evaluation Objective 3: Tracking Program Metrics and Costs

Please refer to Appendix 1: Program Metrics for a partial list of important data points which will be used to track program metrics.

Once a hot water leak has been identified, such leaks will continue to be monitored using best resolution gas and water data available. The basic formula for the leak rate will be measured for both water and gas during the time period between when the leak is identified and when it is resolved.

$$Q_{twg} = Q\_baseline\_post_{twg} - Q\_baseline\_pre_{twg}$$

Where Q is the quantity of water or gas, t is the time (hourly) interval, w is water measured in gallons, and g is gas measured in therms. Q will be measured using the data provided by the manual and AMI meters.

Appendix 1: Program Tracking Data

A partial list of program information and data in their respective categories is provided in this section. The list of data points may potentially be modified during the course of the program. Collection of data points listed will be subject to availability.

Customer Information Fields:

- Premise location
- Customer classification
- Climate zone
- Meter numbers (gas and water)
- Gas consumption historical data
- Water consumption historical data

Fields on Leak Detection Dashboard:

- GNN Unique Identifier
- Gas Meter ID
- Water Account ID
- Alert Time Stamp (YY MM DD HH)
- Leak Alert confidence
- Leak Alert Type (hot water)
- Leak outreach timestamp for validated hot water leaks (YY MM DD HH)
- Leak resolution timestamp for validated hot water leaks (YY MM DD HH)
- Estimate of monthly water savings (kgals)
- Estimate of monthly embedded energy savings (therms)

Fields on Monitoring and Evaluation Platforms:

A statistical comparison of treatment and control groups. Base level metrics and savings estimates of the following three categories:

- Leaks/Water Loss Reduction (hot and non-hot water)
    - In gallons, percentage of total use, by month and cumulative
- Embedded energy and emissions
    - Tons CO2, percentage of total use, by month and cumulative
    - Therms, percentage of total use, by month and cumulative
    - kWhs, percentage of total use, by month and cumulative

Advanced metrics, at six month intervals, to estimate energy savings for each of the three categories above will include:

- Results of comparisons of treatment group to historical performance
- Results of comparisons of control group to historical performance
- Weather normalized consumption (emissions and water)
- Results of analysis of regression based differences

Fields from Site Inspection:

- Age and make/model of the domestic hot water appliance(s)
- Type of leak: Leak at the water heating appliance on a valve, connector, vessel, or apparatus; fixture leak; in wall, underground, or under slab
- Rate of water leakage measured at the leak(s). Commonly at the hot water heater, hot tub, pool, other appliance or hot water line

ATTACHMENT B

Advice No. 4992-A

SoCalGas Responses to Energy Division Questions

Attachment B

SoCalGas Responses to Energy Division Questions

1. **Why is this effort important? Can you describe how widespread the problem of hot water leaks is?**

   In the California Public Utilities Commission (CPUC) Decision D.16-06-010, Southern California Gas Company was ordered to participate in Water-Energy Nexus pilots; "*Southern California Gas Company shall implement a pilot to gather data from water meters associated with San Gabriel Valley Water Company and transmit that data over the existing Southern California Gas Company network that includes an analytics component for identification and evaluation of potential hot water leaks based on analysis of anomalous gas consumption patterns, and behavioral analytics on the combined gas and water usage data.*"

   The CPUC also listed many reasons why the pilots are important in Decision D.16-06-010, including:

   - On January 17, 2014, Governor Brown declared a Drought State of Emergency, in which the Governor observed that the magnitude of the severe drought conditions presents threats beyond the control of the services, personnel, equipment and facilities of any single local government. On April 25, 2014, the Governor declared a continued state of emergency, and on April, 1 2015, the Governor issued an Executive Order mandating substantial water reductions throughout the state in light of the ongoing drought emergency.
   - In its comments on the proposed decision that ultimately became D.15-09-023, California Water Association (CWA) asked that the Commission add approval of advanced meter infrastructure (AMI) installations to the scope of the water-energy nexus proceeding. CWA contended that as a result of the Governor's mandate to reduce statewide water consumption by 25 percent and the accompanying State Water Resources Control Board's promulgation of emergency regulations requiring per-utility conservation targets, there is an immediate need to provide customers with real-time information on their water consumption, which in turn creates an accompanying potential for water and energy related savings.
   - 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. A smart meter can, under some circumstances, indicate immediately if there is a leak at a customer's premises.

SoCalGas has partnered with San Gabriel Valley Water Company (San Gabriel) and Valor Water Analytics to develop its pilot. The pilot includes an analytics component for identification and evaluation of potential hot water leaks based on analysis of anomalous gas consumption patterns, and analytics on the combined gas and water usage data. Valor Water Analytics will perform analysis to quantify the benefits of using combined AMI data and assess how data integration will allow the utilities to address apparent water losses, enhance conservation efforts, increase energy savings, and reduce greenhouse gas emissions to a greater extent than can be done using data from one AMI utility. This analysis will also be used to improve the accuracy of water leak modeling for both utilities.

This Pilot will help both utilities to understand how widespread the problem of hot water leaks in the SoCalGas service territory. Data gathered during the Pilot will be used to evaluate our capability to identify and report on potential hot water leaks by analyzing natural gas usage in comparison to actual water usage and our capability to validate those analytics during field visits.

Additional potential benefits from the Pilot include, but are not limited to:

- Provides ability to analyze and determine trends in reductions in gas consumption as a result of water conservation
- Potential for water savings via conservation and leak detection
- Potential for calculating embedded energy in water savings
- Potential for GHG emissions reductions

As reported in the Southern California Gas Company Advanced Meter Semiannual Report 1, as of December 31, 2015 SoCalGas had confirmed 286 hot water leaks out of the 953 field visits conducted as follow up to identification of unusual gas consumption patterns.

2. Does SCG already have gas analytics that identify a potential hot water leak?

SoCalGas is almost finished with their rollout of 5.4M AMI meters and is just beginning to develop and test analytics now possible with the data now available. SoCalGas has begun to develop a process to identify anomalous gas consumption patterns for residential customers. SoCalGas will be able to refine the current process as part of this Pilot.

3. Once a leak is detected, can you explain how the leaking equipment will be repaired, and how the leak rate will be measured?

Customers will be responsible for the correction of any conditions creating water leaks on their property. SoCalGas and SGVWC will inform property owners/customers about water

leaks, but do not have the authority to compel correction and will monitor water usage to determine correction.

The basic formula for the leak rate will be measured for both water and gas during the time period between when the leak is identified and when it is resolved. The basic formula is as follows:

$Q_{iwg}=\Delta t * BASELINE_{iwg}$ Equation 1

Where Q is the quantity of water or gas leaked, measured in gallons or therms, respectively. Δt is duration of the time interval period where a customer consumes a continuous nonzero amount of water or gas, measured in hours. BASELINE is the minimum rate of nonzero hourly consumption of water or gas during the time period Δtw is water measured in gallons, and g is gas measured in therms. w indicates water meter data while g indicates gas meter data. i is the individual premise (also measured as customer account). Q will be measured using the data provided by the manual and AMI meters.

With parallel streams of hourly gas and water data, on the same premise (i.e. customer account), t will be synchronous per customer account.

To measure water and gas savings associated with AMI-enabled technology, we use a random control trial (RTC) framework and difference-in-difference modeling approach. Details can be found in response # 12 & #13 below.

4. Does Valor have experience with gas AMI data analysis, especially water heating?

Valor Water engineers and analysts have experience working with water, electricity, and gas data since 2007. Valor Water is a technology transfer company from the University of North Carolina at Chapel Hill, where multiple staff worked with over 10 water and power utilities on analysis projects for advanced meter data analytics. These analytics include AMI, AMR, and appliance analytics.

Dr. Boyle and the Valor team have over 10 years of experience on peer-reviewed research and tools in the areas of water analytics, energy efficiency measurement and verification, advanced meter infrastructure analytics, and econometrics. A sample of white papers and published reports can be found below.[1]

1 Tiger, M.W and Boyle, CE (2016) "A Better Understanding of Nonresidential Water Customers Through Analysis." Journal of American Water Works Association. 108:1: 51-60.

5. **Given that a hot water – or any water leak – within a building would typically be physically observable (especially a leaky storage water heater or pipe), is identification via AMI gas data worth pursuing? Rather than doing a random sample and *waiting* for something to happen, DNV GL believes that you could consider conducting a more forensic study of customers with actual/documented equipment failures. They could explore the use of water-gas AMI data to detect signals of those failures, and determine if this pattern could be used to predict imminent failures. This study could of course only be done for customers that already have AMI water data, and it would also likely require higher resolution data (better than hourly). Please address this concept.**

While SoCalGas does not currently track the details of water leaking when investigating anomalous gas consumption during a field visit, it has been our experience that persistent water leaks are typically not physically visible.

Water leaks that are readily visible are generally corrected shortly after discovery. SoCalGas has found that many leaking water heaters are kept in storage closets, crawl spaces, garages or other seldom trafficked areas, while hot water piping downstream from a water heater is seldom visible and is often located in the ceiling or concrete slab of a residence. Identifying these leaks earlier than they might otherwise have been detected by sight represents a quantifiable opportunity for both water and energy savings, given the study design.

SoCalGas only records actual natural gas usage where unusual gas consumption patterns at customer facilities will not occur until a water leak occurs. The study concept proposed by DNV GL is outside the scope of this pilot as discussed and approved with the CPUC. SoCalGas is not in a position to comment on the proposed concept.

Boyle, Christine and Mary Tiger (2011) "Shifting Baselines in Water Utility Management: Using Customer Level Analysis to Understand the Interplay Between Utility Policy, Pricing, and Household Demand" Water Resources Research Institute, Report #409.

Wichman, C. and Boyle, CE (2012). Community Conservation: A Preliminary Evaluation of Clean Energy Durham's Residential Energy Efficiency Workshops. University of North Carolina at Chapel Hill – EFC Whitepaper. Online access here.

Boyle, Christine E., Shadi Eskaf, and Mary Tiger (2011) "Mining Water Billing Data to Build Customer Relationships" Journal of American Water Works Association, 103 (11) 43-58.

Wichman, C. and Boyle, CE (2011) Water and Electricity Customer Sales Profile for Benson Public Utility. University of North Carolina at Chapel Hill – EFC Whitepaper. Online access here.

6. **Only hourly data will be used: Is this enough resolution for leak detection?**

   Yes. SoCalGas believes that hourly data provides the reasonable granularity for leak detection. It will allow SoCalGas to identify anomalous consumption patterns much more promptly than using monthly billing data. Also, using parallel streams of hourly gas/water consumption data can provide a clear picture of when a hot water leak begins and ends. Hourly data allows for the capability to offer customers timely and cost-effective notifications of leaks which may have both water and energy savings benefits.

7. **The primary focus is to estimate gas savings from a more timely identification and repair of the hot water leak, yet repair of the leak is necessary for a pre/post analysis to be completed. Expectations are that the leaks will be "..resolved by customer in the treatment group in a [more?] timely manner than those in the control group." Can relative "timeliness" even be reasonably determined?**

   The project is being deployed as a RCT. An RCT represents a 'gold standard' methodology for measuring the impact of a technical or program intervention by providing the ability to isolate the effect of the intervention in the context of confounding factors (e.g. price, weather, economic conditions).

   To execute the RCT, the 1,000 participating households will be randomly assigned into a treatment group and control group. Given that the project has budget limitations on number of AMI meters installed, there will be some limits on the ability to test multiple hypotheses with robust external validity. However, the research team will work to use advanced statistical techniques and models to ensure robustness of results, as well as clearly define the limitations of the sampling approach.

   The treatment group will receive AMI meters and access to customer engagement software and leak alert notifications that are uniquely enabled by AMI-based data collection for a 12-month period. The control group will also receive leak alerts once they are identified with the monthly meter-read information. The control group's usage will be tracked via the existing water meters with monthly reads for comparison with the treatment group.

   The treatment (AMI) group receives leak notifications earlier than the control (non-AMI) group. Valor's current AMI water leak detectors (hot and non-hot) require a minimum of 3 days (refer to Δt period above) after the onset of a water leak to make a prediction, whereas the non-AMI leaks detector has to wait until the end of the month. This does not necessarily mean that the AMI algorithm can detect the same leak as the non-AMI algorithm 25 days in advance; as this strongly depends on the time of the month that the leak started ("25 days in advance" could happen if the leak started towards the start of the

month). Depending on the optimal threshold, the time between the onset of a leak and when we can send out a notification could increase/decrease.

"Timeliness" in terms of early notifications can indeed be reasonably determined but only on a case-by-case basis, since this depends on the time of the month that the leak started. The number of days by which an AMI customer can receive a leak notification earlier than a non-AMI customer can range from anywhere from 0-30 days, though statistically a 15 day average is expected.

a. **How will gas and water savings be estimated? From pre/post measurements, but how will the "incidents" of water usage be identified and the leak separated out from a normal variation in usage [i.e. fewer showers taken?]**

   Valor has a set of leak algorithms for both water and gas that have been validated by water utility field crews and found to have a high rate of precision. We do this by using anomaly detection methods to analyze and locate the digital signature of a leak (see basic formula in Equation 1 above). The digital signature of a leak, in both water and gas data, shows up despite normal variation in water or gas use. By accounting for this variation, we can single out the leak signature in a precise manner, and in doing so, gain a fairly accurate measure of the amount leaked. Based on validated results to date, we have an above 80% success rate in identifying water leaks. We also integrate machine learning to "train" the mathematical models to learn as larger numbers of leaks are identified and modeled. Machine learning allows for constant improvement of the algorithms and even greater precision to be achieved over time.

8. **The targeted participant sample is 500 water AMI customers (50% each to 2 water subdivisions) who also have gas AMI equipment. Both Residential and Commercial customers will be included, and the doc does not describe how the 500 study points will be distributed. There is also a control group of 500 customers who are not AMI water customers but do have gas AMI equipment.**

   In order to draw a random control trial sample that best represents the attributes of the underlying population, we use a historic data set of 48 months of consumption data per customer to stratify and randomly select customers. The stratification categories include: Region (either LA or Fontana), Classification (includes residential, commercial, industrial), Meter Size (5/8", 1", 2", 3", 4", 6", and 8"), and each customer's water usage profile.

   a. **What is the purpose of the control group and how would they even be used when there is no AMI water data, especially given the approach of first identifying *all* water leaks from the hourly *AMI* water data, and then identifying *hot* water leaks from the gas AMI data?**

Valor Water has models to identify leaks for monthly and hourly data. For the control group (monthly data), we have set volumetric thresholds in our monthly non-AMI leak detection algorithm using data from over million water customers. On a monthly basis we can then measure a number of aspects: 1) validate the water leak flag with the gas hot water leak flag; 2) measure the associated water loss; 3) confirm the leak resolution; and 4) measure the associated water loss rate for entry into the monthly water loss comparison (to AMI). SoCalGas aims to measure a delta here, a reference group is necessary to conduct the pre/post – treatment/control analysis.

9. **How will hot water leaks be distinguished from other water leaks (which also have potential to save energy)? Water data will be used to identify ALL water leaks, *then* hourly gas data will be used to identify HOT water leaks. But there is no explanation of how this will be detected, just that a leak in a hot water tank can contribute to constant firing versus the more typical (at least in residential) periodic firing.**

   Hot water leaks are distinguished from other water leaks by the joint analysis of gas and water data. Valor has validated hot water leak data from both water and gas customers. We use the parallel stream of both data flows (on test customers) to identify this appliance level leak, which looks different from typical non-hot water leaks (a garden hose leak, a leaky toilet, a leaky pipe, etc.).

10. **SGVWC will also conduct its own investigation into the value and benefits of AMI for its *entire* service area:**

    a. **"Consumer engagement and acceptance" There are no details of how this aspect will be implemented**

       Water AMI participants will continue to receive their water bills, as they always have, from SGVWC's manual read meters and legacy billing system. However, AMI participants will have access to a secure web portal and consumer engagement program with personalized hourly water usage information to help customers find leaks and manage their daily water use data. Customer participation levels and satisfaction with using this customer service application will be tracked and recorded during the 1-year pilot program.

       After registering online, customers gain access to their current usage, past usage, and other useful comparisons. Customers can see the estimated cost of the water they've already used (any time during the billing cycle), as well as a projected end-of-period bill. Customers can also establish a billing or usage threshold ($ or gallons) and be notified when their bill amount/consumption exceeds, or is projected to exceed, that value.

SGVWC will also deploy specialized software to analyze, identify, and locate apparent water loss[2] from customers' hourly AMI data and pro-actively notify customers via automated call, text, or e-mail when potential leaks have occurred.

b. "Reduced energy usage" is mentioned: Does this mean they will look at it from the water-pumping electricity savings perspective?

Yes. SoCalGas looks at energy savings in two ways: 1) The embedded energy per gallon and associated savings from proactive alerting and water loss reduction (i.e. water pumping, conveyance, etc., see CPUC Water Energy Nexus Calculator) and 2) Gas savings associated with proactive alerting on this gas powered appliance and timely resolution of the hot water leak.

11. A primary objective of these pilots is to "test the impact of joint delivery of energy and water data to customers on energy and water savings behaviors", but this study does not appear to include customer interaction/behavior. The only customer interaction will be for water leaks, not gas consumption, and when/if SCG goes on-site to verify leaks: "Test group accounts will also have access to a web-based water customer portal that provides notifications to participants about water leaks in their homes or businesses on a daily basis." Please explain.

SoCalGas and San Gabriel Valley will coordinate the notification of hot water leaks and water leaks, with SoCalGas performing site visit in the event of a potential hot water leak, and San Gabriel Valley providing customer notification in the case of a cold water leak. In the event that SoCalGas cannot validate the potential hot water leak at the customer premise, San Gabriel Valley may follow up with the customer. AMI participants will have access to a secure web portal and consumer engagement program with personalized hourly water usage information to help customers find leaks and manage their daily water use data. Customer participation levels and satisfaction with using this customer service application will be tracked and recorded during the one-year pilot program.

After registering online, customers gain access to their current usage, past usage, and other useful comparisons. Customers can see the estimated cost of the water they've already used (any time during the billing cycle), as well as a projected end-of-period bill. Customers can also establish a billing or usage threshold ($ or gallons) and be notified when their bill amount/consumption exceeds, or is projected to exceed, that value.

[2] Apparent Losses, as defined in American Water Works Association Manual of Practice M36, Water Audits and Loss Control Programs, 2009, are the non-physical losses that occur in utility operations due to customer meter inaccuracies, systematic data handling errors in customer billing systems an unauthorized consumption. This water is consumed but is not properly measured, accounted or paid for.

12. **An objective is identifying the benefits of combined water and gas analytics - to a greater extent than can be done with data analytics from just one AMI utility source. But one source – gas AMI data – may be enough for this issue, as evidenced by the statement about leaks being 30% of anomalous gas use issues. For the 30% anomalous gas items, how many of those leaks were physically visible or the converse, how many were NOT readily apparent (these type of leaks might be a good application for the study…unless they are a very small % of the 1%)?**

    The Pilot will help us evaluate if data analytics from one AMI utility source will be enough to identify hot water leaks. The inclusion of water data is relevant for identifying cold and hot water leaks. It will also be an important element with assessing the full extent of the leak and other implications. The gas consumption data will also be a key element for identifying hot water leaks for San Gabriel Valley Water Company.

    The visibility of leaks is currently not recorded during a field visits for anomalous gas consumption issues. During the Pilot, field technicians will record information about the premise and the hot water appliance leak on site - if visible.

13. **The sample size calculation near the bottom of the second page of attachment 2 is wrong. You use the sample size calculation for estimating a population proportion, which is only appropriate for market research surveys, not for this application. It is the number that you need to get a precision (the plus/minus amount for an estimate) of 5% with 95% confidence for the percentage of cases (customers) with some characteristic or in a certain group. This is only appropriate for yes/no questions, ratings, satisfaction, appliance ownership (e.g. do you have AC?). It is not appropriate for estimating a quantity such as energy or water savings. This does not automatically mean the sample is too small, it just means that we don't know if the sample will be big enough or not. (VALOR)**

    <u>Final Number of Accounts Under Consideration</u>

    SoCalGas began with a full set of San Gabriel Valley Water Company's (SGVWC) 76,348 water accounts and used these accounts to stratify and randomly select the sample pilot test treatment and control sets groups for a total sample size of 1,000 customers. SoCalGas collected and randomly selected a sample of 500 treatment accounts -- roughly 250 each for Los Angeles and Fontana -- that are also representative of the underlying population (see Selection Criteria under Response #8 above). SoCalGas then used a matching stratification approach to randomly select the 500 control group customers. In sampling, SoCalGas used the distribution of the characteristics described above for the year 2013. SoCalGas chose this year as it is often considered to be the "last good year" of water use, representative of typical customer behavior before the onset of the California drought.

Since some of the percentages for the various segments (Region, Classification, Meter/Bill Size, Use/Peak-quadrant) were fairly low, in drawing samples for a total sample size of 250 for each of Los Angeles and Fontana, there were some segments that should not be drawn samples for, for the simple reason that the number of samples to be picked out of that segment was rounding off to zero.

SoCalGas will use regression analysis to evaluate the impact of AMI-related interventions on water and gas usage, while controlling for weather and water prices. SoCalGas will employ a difference-in-difference modeling approach to measure the changes in two groups over time, a treatment and a control group, to ascertain a treatment effect equivalent, in this case, to the reduction in water and gas consumption that is attributed to AMI-related interventions (customer portal and leak alerts).

Difference-in-difference methods are commonly used to assess treatment effects in non-randomized experiments. SoCalGas will have 48 months of pre-intervention data to serve as an additional basis for comparison. Similar to difference-in-averages methods, difference-in-differences also relies on the changes in the treatment group relative to the control group, although it has several advantages for this analysis: 1) explicit inclusion of control variables; 2) tests of statistical significance; and 3) allowing the treatment period to vary between premises. To estimate a treatment effect for the difference-in-difference model, two types of regression models will be used under varying control scenarios: ordinary least squares and panel data models with fixed effects.

The regression model takes the form:

$$\ln(Q_{wgit}) = b_1 AMI_{wgit} + b_2 post_{wgit} + b_3 weather_{wgit} + b_4 price_{wit} + b_5 q_t + u_i + e_{wgit}$$

where:

$\ln(Q_{wgit})$ = the natural log of monthly water (*w*) or gas (*g*) consumption for premise *i* at time *t*.

AMI_{wgit} = whether premise *i* had an AMI meter at time *t* (i.e., 0 or 1)

$post_{wgit}$ = whether the time period of the observation is after AMI meters were installed

$weather_{wgit}$ = a weather variable indicating maximum monthly temperature (*F)

$price_{wit}$ = the average price a customer faced for monthly consumption ($/gal)

q_t = a time variable indicating the month (i.e., 0, 1, 2, … , 12)

u_i = premise fixed effects

e_{wgit} = error term

A logarithmic dependent variable is used for two reasons: 1) it mitigates the effect of extremely high consumption on the parameters of interest and 2) it allows for a simple "percent reduction" interpretation of coefficients.

SGVWC Sample Size Significance

The goal is to determine a sample size that will allow SoCalGas to establish statistically significant results for an hourly AMI vs. monthly manual reads effectiveness environmental benefits comparison. In general, SoCalGas recommends as large a sample size as possible within a practical resource budget. SoCalGas will use RTC framework, which is described as being appropriate for technical program evaluation by highly regarded experimental design researchers (see Shadish Cook and Campbell, 2002).

In summary, SoCalGas expects to, with its test sample size of 1,000 customers, make statistically plausible inferences about results of the study across the San Gabriel Valley Water Company service areas.

No information is given about how the control group will be selected, except that it will be a quasi-experimental design. See response to question # 8 above.