Report **Group D – D14.01**

Workplan for Water-Energy Nexus Calculator

Submitted to
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ENERGY + WATER + EFFICIENCY

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List of Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
CalWEP	California Water Efficiency Partnership
CEC	California Energy Commission
CET	Cost-Effectiveness Tool
CPUC	California Public Utilities Commission
DEER	Database of Energy Efficiency Resources
eTRM	California Electronic Technical Reference Manual
IOU	Investor-owned utility
PG&E	Pacific Gas and Electric Company
SCE	Southern California Edison Company
SDG&E	San Diego Gas and Electric Company
SoCal Gas	Southern California Gas Company
WEN Calculator	Water-Energy Calculator
W-E Calculator	Water-Energy Calculator
Water Tool	Avoided Water Capacity Cost Model

Executive Summary

Extracting, moving, treating, and using water requires a substantial amount of energy, especially in California where large amounts of water are moved over long distances and steep terrain. As a result, saving water saves energy and can help investor-owned energy utilities (IOUs) meet energy- and greenhouse-gas-reduction goals. Since the early 2000s, the California Public Utilities Commission (CPUC) has been interested in both the energy used by California's water sector and the potential for realizing energy savings through efficiency measures. Since then, the CPUC has advanced work on the water-energy nexus through several studies, pilot programs, and the development of analytical frameworks for evaluating water-related energy savings.

With Decision 15-09-023, the CPUC adopted the Water-Energy Calculator (W-E Calculator), which helps to quantify energy savings from water-conservation projects and programs targeting the water system and to allocate costs and benefits among program administrators. After a year of using the W-E Calculator, new insights were gained to help utilities further integrate the Calculator. In 2016, the CPUC ordered the four major IOUs to create a Plan of Action to update the Water Energy Nexus Cost Calculator and to file it with the CPUC. The unopposed Plan of Action was approved by the CPUC in late 2017 in Decision 17-12-010.

In this workplan, we—the Pacific Institute and SBW Consulting Group D evaluation team—describe how we will improve the utility and function of the W-E Calculator. In addition to this workplan, major project deliverables include the W-E Calculator 2.0, a guidance manual and other training materials, and a project report documenting the process for developing the W-E Calculator 2.0.

Approach

To identify opportunities for improving the utility and functionality of the W-E Calculator, we reviewed 17 documents, including Decision 15-09-23, Decision 17-12-010, the Water Energy Joint Utility Plan of Action, and a paper prepared by Water Energy Innovations, Inc. and RMS Energy Consulting, LLC. We also conducted in-depth interviews with 22 stakeholders, including representatives from energy IOUs, water-energy experts, and CPUC and consultants. We conducted phone and videoconference interviews of about one hour that generally focused on identifying issues with the W-E Calculator and, more broadly, on implementing water-energy nexus measures. Based on the literature review and interviews, we identified a need for the following revisions:

1. Develop a new, simpler calculator to calculate the embedded energy savings, in kWh. As such, we would remove calculations of the avoided embedded energy cost (in $), as well as the cost-effectiveness functionality. We will work with stakeholders and CPUC staff to determine whether to retain calculation of the avoided water capacity cost and environmental benefits within the W-E Calculator.

2. Enhance the functionality of the calculator by providing an easier way to change the resource balance year; allowing the user to estimate the distribution-energy intensity according to the terrain rather than rely on a prescribed value for the hydrologic region; adding a mechanism, such as a GIS overlay or a look-up table, that allows the user to identify the region associated with a project; providing an energy intensity value for trucked water; and adding a water-use designation that captures water savings opportunities from reducing leaks in the water distribution system.
3. Ensure that model inputs, including load shapes, are consistent with information available from the DEER (and its successor the ETRM), as well as from the statewide workpaper SWMI001-Water Energy Nexus for deemed statewide measures, and that model outputs are consistent with the CEDARS report structure and inputs to the CET.
4. Ensure that both the model outputs and the CET are set up in such a way as to allow the embedded savings outputs of the model to be fed into CET and easily added to the direct savings already calculated for measures in CET. This will allow IOUs to claim savings from water-energy nexus measures more easily.
5. Provide support to ensure that users understand and are comfortable with the W-E Calculator 2.0 by developing documentation that is readable and easily understood and by conducting a training session on how to use the model that will be recorded and posted alongside the Calculator so that new users can view it.
6. Present the tool to public water suppliers, as well as water IOUs, to highlight opportunities for water-energy partnerships.

To finalize the revisions needed, we will conduct additional conversations with CPUC staff and stakeholders to develop solutions that address the issues raised during the workplan development. We will write a memo summarizing the proposed changes to the W-E Calculator for review and approval by CPUC. We will implement the approved changes in a draft Excel-based W-E Calculator 2.0 and guidance manual. Once the drafts are complete, we will engage stakeholders through a workshop or webinar to launch beta testing of the Calculator 2.0 with energy IOUs and consultants, and we will provide a help desk to assist users during the beta test. Based on beta testing and comments received from stakeholders, we will finalize the W-E Calculator 2.0 and guidance manual. In addition, we will write a project report that includes key issues raised in existing documents and through stakeholder engagement, changes made to the W-E Calculator, and any recommendations for future changes.

1 Background

1.1 Water-Energy Nexus

Extracting, moving, treating, and using water requires a substantial amount of energy, especially in California where large amounts of water are moved over long distances and steep terrain. In a landmark 2005 study, the California Energy Commission (CEC) found that water accounted for nearly 20% of the California's electricity consumption and one-third of its non-power-plant natural-gas consumption.[1] Some of this energy use happens on the customer side of the meter and is referred to as "end-use energy" or "direct energy." The remainder occurs upstream and downstream of the end user, i.e., in water systems that extract, move, and treat water, as well as collect, treat, and discharge wastewater. This upstream and downstream energy usage is referred to as "embedded energy" or "indirect energy."

1.2 Water-Energy Proceedings

The energy used by the water sector in California has been of interest to the California Public Utilities Commission (CPUC) since the mid-2000s. In 2005 and again in 2010, the CPUC's Water Action Plan emphasized the importance of water and energy efficiency. In Decision 07-12-050, the CPUC authorized three "embedded energy in water studies" and numerous pilot projects to study the savings potential of programs targeting embedded energy in water.

With Decision 12-05-015, the CPUC directed staff to develop a robust record of strategies to overcome barriers to the adoption and deployment of programs aimed at improving water-energy-nexus efficiency, including methods for calculating the energy savings and cost effectiveness of water-efficiency measures, issues associated with the joint funding and implementation of water-energy programs, and the development of an updated water-energy cost-effectiveness calculator. In response to this directive, staff created a workplan to address water-energy-nexus issues. They also presented a proposed cost-effectiveness framework that would allow for the evaluation of water-energy-efficiency projects and programs at a public workshop in March 2013. Finally, staff formed a Project Coordination Group for Water Energy Cost-Effectiveness (PCG) to allow industry stakeholders to provide input and assistance on a framework to analyze water-energy programs.

A petition from the Division of Ratepayer Advocates prompted the CPUC to open Rulemaking 13-12-011. The purpose of this rulemaking was to explore how best to "develop more robust methodologies for measuring the embedded energy savings from energy efficiency and conservation measures in the water sector, and for determining the cost-effectiveness of these projects." This would inform whether and how such programs should be cofunded by the

[1] California Energy Commission, November 2005, "California's Water-Energy Relationship," Final Staff Report CEC700-2005-011-SF.

energy IOUs and the water sector—both privately owned water utilities regulated by the CPUC and public water and wastewater agencies—as well as how program costs should be allocated.

In 2014, the CPUC engaged Navigant Consulting, Inc. and GEI Consultants (the Navigant team) to develop a cost-effectiveness framework for analyzing demand-side programs aimed at saving water and energy. Through this effort, the Navigant team developed a set of models and calculators for estimating three water-related benefits:

- the avoided embedded IOU energy in water,
- the avoided capacity cost of water, and
- the environmental benefits of reduced water use.

The Navigant team also populated these models and tools with default assumptions.

With Decision 15-09-023, the CPUC adopted two new tools to better quantify the benefits of water-saving programs:

- the Water-Energy Calculator (W-E Calculator) and
- the Avoided Water Capacity Cost Model (Water Tool).

The W-E Calculator estimates the embedded energy savings benefits from water efficiency programs. The Water Tool estimates the avoided water-system-capacity cost associated with water savings, an input into the W-E Calculator that can then be used to allocate program costs and benefits between program administrators.

In Decision 16-12-047, the CPUC directed the four major investor-owned utilities (IOUs)—Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E), Southern California Gas Company (SoCal Gas), and Pacific Gas and Electric Company (PG&E) (collectively referred to as the Joint IOUs)—to create a Plan of Action to update the W-E Calculator and to file it with the CPUC. Specifically, the Plan of Action was to address how best to:

> "(a) create, and incorporate into the Water-Energy Calculator, a greenhouse gas emissions reductions value for water-energy nexus energy efficiency measures; (b) connect the Water-Energy Calculator with the commonly-used E3 energy efficiency program calculator and the Database for Energy Efficient Resources; (c) within 6 months of the completion of Southern California Gas Company's natural gas study, incorporate into the Water-Energy Calculator a value representing the natural gas embedded in the water system."

The Plan of Action, submitted by the Joint IOUs in August 2017, described the options for addressing each issue identified in Decision 16-12-047, as well as next steps to implement the recommended changes. The CPUC's Energy Division met with representatives of the Joint IOUs in January 2017 to discuss the Energy Division's "Recommendations for Water Energy Calculator Update." The Energy Division's recommendations were also incorporated into the Plan of Action, and in Decision 17-12-010, the CPUC approved the unopposed Plan of Action.

2 Overview of the Water-Energy Calculator

The water-energy tools developed by the Navigant Team include three water-related benefits:

- the avoided capacity cost of water,
- the environmental benefits of reduced water use, and
- the embedded IOU energy savings of water-conservation measures.

The Avoided Water Capacity Cost Model (also referred to as the Water Tool) estimates the avoided capacity cost of water, which then feeds into the W-E Calculator. The environmental benefit of reduced water use is determined based on a secondary review of existing environmental-benefits models, and this value also feeds into the W-E Calculator. Finally, the W-E Calculator estimates the embedded IOU energy savings of water-conservation measures, as well as the IOU avoided embedded-energy cost. The remainder of this section focuses on the W-E Calculator and describes its underlying methodology and relationship to other CPUC tools.

2.1 Water-Energy-Calculator Methodology

The methodology to estimate avoided embedded-energy costs within the W-E Calculator is illustrated in Figure 1. For each water measure, the W-E Calculator provides three major outputs (shown in green in Figure 1):

- **Average Embedded-Energy Savings:** The annual average embedded-energy savings, in kWh and therms, which is based on the average IOU energy intensity (calculated from the historical supply mix for the associated hydrologic region) and the measure water-savings profile.
- **IOU Avoided Embedded-Energy Cost:** The net present value, in 2014 dollars, of the avoided embedded-energy costs over the life of the measure, which is calculated based on the IOU energy intensity of the marginal supply (plus additional associated treatment, distribution, and wastewater systems), monthly water-savings profile, and the avoided energy cost (from the E3 Avoided Cost Model).
- **Avoided Water Capacity Cost:** The net present value, in 2014 dollars, of the cumulative avoided water-capacity costs, which is based on the water-capacity savings and the avoided water-capacity cost (from the Water Tool).

The W-E Calculator uses 2014 dollars for the net present value of the avoided embedded-energy cost and avoided water-capacity cost because it was originally developed in 2014 and has not since been updated.

Importantly, the W-E Calculator uses both average and marginal energy intensity. The average energy intensity, which is calculated using the historical water-supply mix, is used to calculate the embedded-energy savings. By contrast, the marginal energy intensity, which is based on the marginal water supply, is used to estimate the IOU avoided embedded-energy cost. The

Navigant team identified recycled water (wastewater treated to tertiary, unrestricted standards) as the proxy marginal water supply for all hydrologic regions in California, though users of the W-E Calculator can override the default value to enter marginal supply options most appropriate for their local circumstances.

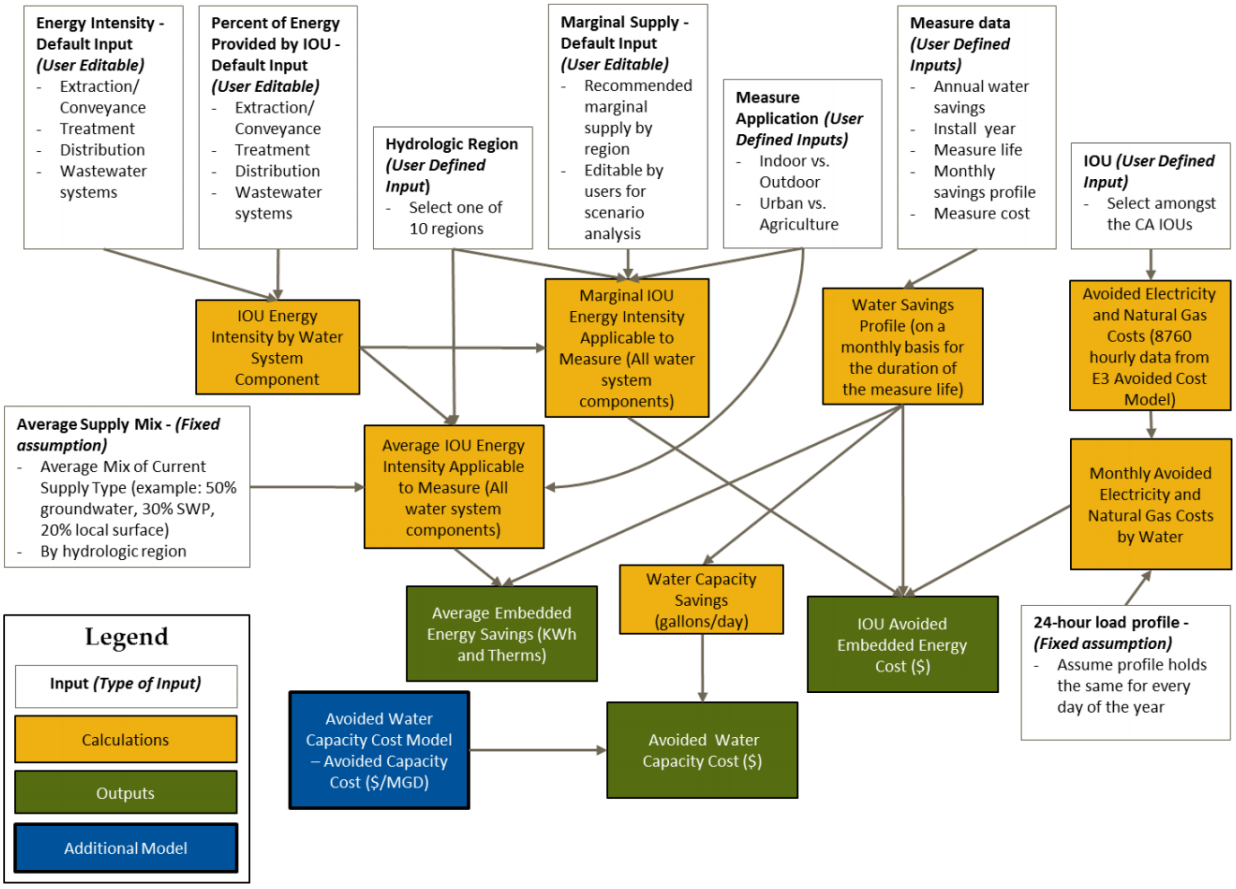

Figure 1: Overview of Embedded Energy Avoided Cost Methodology

2.2 Relationship with Other CPUC Tools

The inputs and outputs of the W-E Calculator are connected to several other CPUC tools. With respect to inputs to the W-E Calculator, hourly estimates of the avoided energy cost are provided by the E3 Avoided Cost Model. Likewise, the avoided capacity cost (in $/MGD) is provided by the Water Tool. Finally, information on selected water-efficiency measures for cost-effectiveness evaluations, such as effective useful life and incremental cost, are provided by the Database of Energy Efficiency Resources (DEER). DEER, however, does not contain information on all possible water measures, and utilities are supplementing the information in the DEER using work papers with the parameters needed.

With respect to outputs from the W-E Calculator, estimates of the embedded-energy savings are tracked and reported to the CPUC. Embedded-energy savings are not currently factored into the

utility cost-effectiveness evaluation, although this could be done by integrating with the Cost-Effectiveness Tool (CET)—one of the recommendations of the Plan of Action discussed in more detail in the following sections.

3 Review of Updates Needed

In this section, we summarize recommended updates for improving the functionality and utility of the W-E Calculator based on interviews with stakeholders, and on a careful review of the W-E Calculator and documents about the W-E Calculator prepared by and/or submitted to the CPUC.

3.1 Literature Review

We compiled a list of documents to review related to the development and use of the W-E Calculator (Table 1). We submitted this list to CPUC Energy Division staff for review and they added additional documents. We then reviewed each of the documents, identifying opportunities to improve the utility and functionality of the model.

Table 1: Documents Reviewed for the W-E Calculator Updates

Author(s) (Organization)	Date	Title
CPUC	2013	Rulemaking R.13-12-011
Morgenstern & Younghein (CPUC)	3/21/2013	Energy Division Staff Proposal for a Water/Energy Cost-Effectiveness Framework
McDonald et al. (Navigant)	10/7/2014	Water/Energy Cost-Effectiveness Analysis, Final Report
Commissioner Sandoval (CPUC)	4/27/2015	Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Energy Investor Owned Utilities and Water Sector to Promote Water-Energy Nexus Programs; Rulemaking 13-12-011, Assigned commissioner's amended scoping memorandum and ruling
CPUC, Navigant, GEI Consulting Engineers and Scientists	9/1/2015	Avoided Water Capacity Cost Model, Draft V1.04
CPUC	9/25/2015	Decision 15-09-023 September 17, 2015, Before the Public Utilities Commission of the State of California, Rulemaking 13-12-011
CPUC	2/1/2016	Water-Energy Calculator Draft: Version 1.05
Jill Kjellsson (PG&E)	4/6/2016	W-E Calculator 2.0 Workshop: Experience Implementing the W-E Calculator
Athena Besa (SDG&E) and Carlo Gavina (SCG)	4/6/2016	Water Energy Nexus Calculator 2.0 Workshop
Elise Torres (TURN)	4/6/2016	R. 13-12-011: Track 3 Water Energy Nexus Calculator 2.0 Workshop
Water Energy Innovations, Inc. and RMS Energy Consulting, LLC	4/17/2017	Implementation of the California Public Utilities Commission's Water-Energy Calculator: Issues and Opportunities
RMS Energy Consulting, LLC	4/18/2017	WEN Calculator Usage Reconsideration
San Diego Gas & Electric	4/21/2017	Work Paper WPSDGEWEN001 Revision 0, Water Energy Nexus Measures
Water Energy Innovations, Inc.	7/5/17	Natural Gas Intensity of Water

Author(s) (Organization)	Date	Title
CPUC	8/14/2017	Water Energy Nexus Cost Calculator Plan of Action
CPUC	12/14/2017	Decision 17-12-010
The Climate Registry	6/1/2019	Water-Energy GHG Metrics Guidance for Water Managers in Southern California, V2.0

3.2 Interviews

We conducted interviews with 22 stakeholders, including representatives from investor-owned energy utilities, water-energy experts, and CPUC and consultants (Table 2). Interviews generally focused on identifying issues with the W-E Calculator and, more broadly, with implementing water-energy-nexus measures. CPUC reviewed the interview questions, which are provided in Appendix A. We altered the questions slightly, based on the stakeholder's area of interest and expertise, and sent all interviewees the questions in advance of the call. We conducted the interviews by phone and videoconference, and each lasted approximately one hour.

Table 2: List of Interviewees and Organizations Represented

Name	Organization/Company
Amy Reardon	California Public Utilities Commission
Peter Biermayer	California Public Utilities Commission
Eric Merkt	Consultant
Bob Ramirez	DNV GL
Kerri-Ann Richard	Energy & Resource Solutions
Amul Sathe	Guidehouse (formerly Navigant Consulting, Inc.)
Kristin Landry	Guidehouse (formerly Navigant Consulting, Inc.)
Scott Fable	Pacific Gas and Electric
Mary Anderson	Pacific Gas and Electric
Martin Vu	RMS Energy Consulting, LLC
Angela Crowley	RMS Energy Consulting, LLC
Athena Besa	San Diego Gas and Electric
Sandra Williams	San Diego Gas and Electric
Jennifer Scheuerell	Sound Data Management, LLC
Ryan Bullard	Southern California Edison
Brandon Sanders	Southern California Edison
Erin Brooks	Southern California Gas Company
Paul Deang	Southern California Gas Company
Carlo Gavina	Southern California Gas Company
Chelsea Hasenauer	The Climate Registry

Name	Organization/Company
Kendra Olmos	UC Davis, Center for Water-Energy Efficiency
Laurie Park	Water Energy Innovations, Inc.

3.3 Summary of Findings

The interviews provide key insights on implementing water-energy programs and use of the W-E Calculator. We find that energy IOUs' water-energy-efficiency programs are primarily focused on hot-water savings. Energy IOUs are partnering with water utilities for some of these programs, including those for hot-water measures and for custom programs at the water utilities' facilities. The programs selected are largely limited to those measures that are described in work papers. Energy-efficiency programs are shifting toward third-party implementation, and the impact of this shift on water-energy programs is not yet known.

Further, we find that energy IOUs are using the W-E Calculator to estimate the embedded-energy savings from their water-energy-nexus programs. Some are also using it to evaluate potential savings from proposed standards and codes. While embedded-energy savings are reported to the CPUC for informational purposes, these savings are not currently being credited toward IOU efficiency goals. Additionally, the embedded-energy savings are not integrated into evaluations of measure cost effectiveness because the Cost-Effectiveness Tool (CET) is not currently designed to receive those inputs.

Through the interviews and review of the literature, we identified several areas for improving the W-E Calculator, which are summarized below.

W-E Calculator Errors

Both the interviews and literature review identified several errors embedded in the W-E Calculator. There were a few issues with the default selections and values for various water-system components. For example, while Decision 15-09-023 specifies that users can change default selections for various water-system components, the W-E Calculator currently only allows the user to change the default selection for water supply and does not allow the user to change water treatment, distribution, or wastewater collection and treatment. Likewise, the W-E Calculator erroneously assumes that the embedded-energy requirements for recycled-water distribution are the same as those for potable-water distribution.

There were also several errors associated with implementing key calculator features. For example, while there is a placeholder for entering natural-gas energy intensity of all water-system components, those cells are not integrated into calculations of embedded-energy savings or avoided embedded-energy cost. Likewise, the urban-runoff function of the model allows the user to account for embedded energy attributable to capturing and treating runoff from outdoor irrigation in combined sewers. However, this function overestimates embedded-energy savings because it assumes that all the water saved (rather than some fraction of it) would have gone to the sewer system and been treated to secondary standards. Finally, several issues were raised

about the resource balance year, suggesting that marginal supply was not appropriately integrated into calculations of embedded-energy savings.

Calculator Functionality

The W-E Calculator is an Excel-based tool that most users find easy to use. The most common feedback from the interviews was that W-E Calculator outputs should be consistent with inputs needed for other CPUC tools, including the CET and CEDARS. Additionally, several components of the W-E Calculator could be removed to provide a streamlined calculator. For example, the Plan of Action and Decision 17-12-010 recommended that greenhouse-gas emissions not be included in the W-E Energy Calculator because they are already integrated into other models. Likewise, some interviewees suggested that avoided water and wastewater utility cost and the water-related environmental benefits could be removed from the W-E Calculator because they do not use these components regularly and do not need them for advancing water-energy-efficiency programs. Others, however, have suggested that avoided water capacity cost and environmental benefits could be captured as non-energy benefits in the Avoided Cost Calculator.

The literature review and interviews also identified several components that could be added or updated to improve the functionality of the calculator. The opinions of stakeholders differed on the potential addition of default natural-gas values. While this feature would increase the model functionality, it would not likely be used because natural-gas use by water and wastewater systems is small and declining. In addition, the CPUC Decision 15-09-023 suggested adding a GIS overlay of IOU service territories and hydrologic regions. Finally, several other features could improve the model functionality, such as providing simple menus for users to select water-system components, energy-intensity values, resource balance year, and terrain; providing an energy intensity value for trucked water; and adding a water-use designation that captures water savings opportunities from reducing leaks in the water distribution system.

CPUC Policies and Procedures

The interviews and literature review also revealed where additional clarity and guidance on CPUC policies and procedures are needed. First, there is some confusion about whether embedded-energy savings can be credited toward energy-efficiency goals. It is also unclear whether users must justify departing from the default selections, e.g., selecting imported water rather than recycled water as the marginal supply, or whether they only need to justify adjusting the default values. Moreover, it is unclear what type of justification is needed. Finally, there are several technical questions about how to handle those areas that fall into multiple hydrologic regions and select an appropriate resource balance year for calculating embedded energy savings.

Education and Outreach

The interviews identified the need for a comprehensive user manual and additional user support for the W-E Calculator. Several stakeholders noted that the user manual should be written for an audience that may not be familiar with the water sector and that terms should be clearly

defined. Additionally, some interviewees suggested that water utilities may be potential users of the tool, and that additional stakeholder outreach with water utilities could help determine application and interest.

3.4 Key Recommendations

Based on the literature review and interviews, we propose the follows changes:

Simplify the W-E Calculator

We propose to develop a new, simpler calculator to calculate the embedded energy savings, in kWh. As such, we would remove calculations of the avoided embedded energy cost (in $), as well as the cost-effectiveness functionality. We will work with stakeholders and CPUC staff to determine whether to retain calculation of the avoided water capacity cost and environmental benefits within the W-E Calculator. As described in the next section, comparability with CET is a major priority for this update.

We will ensure that the new calculator is consistent with Decision 15-09-23. This includes, but is not limited to, using the long-run marginal water supply to estimate embedded-energy savings and allowing the user to modify default selections and values for water extraction and conveyance, water treatment, water distribution, and wastewater systems.

Enhance the Calculator Functionality

We propose to enhance the functionality of the calculator in several ways. First, we will provide an easier way to change the resource balance year. Second, we will let the user estimate the distribution-energy intensity according to the terrain, rather than according to a prescribed value for the hydrologic region; add an energy intensity estimate for trucked water; and add a water-use designation that would capture water savings opportunities from reducing leaks in the water distribution system. Third, we will add a mechanism, such as GIS overlay or a look-up table, that lets the user identify the region associated with a project.

Ensure Integration of the W-E Calculator with Other CPUC Tools

We propose to ensure that the W-E Calculator is adequately and appropriately integrated into other CPUC tools. Model inputs will be consistent with information available from DEER (and its successor, the eTRM). Energy savings from cold-water measures are not currently captured in DEER, and we propose to continue using the workpaper process for the information needed. In the future, methodologies and references for savings from cold-water measures may be integrated into the eTRM.

Likewise, model outputs will be consistent with the CEDARS report structure and inputs to the CET. In the Plan of Action, the Joint Utilities put forth a recommended approach for connecting the W-E Calculator and CET:

> "Take the IOU Embedded Energy in kWh output from the WEN Calculator and input it into the CET to calculate a TRC. This method would ensure that the TRC calculation for

> embedded energy is consistent with that for direct energy savings. CET calculations will be performed with the combined total (direct plus embedded) energy savings. The CET has different inputs than the WEN Calculator, therefore, measure attributes for the direct energy saving measure will be used for the embedded energy savings even if they don't directly apply to the water efficiency portion of the measure (for example, end use load shape, Climate Zone, building type, etc.). While these results aren't as accurate because of the assumptions that must be made for the inputs, from a usability perspective this is still the best path forward. The CPUC will also need to integrate the embedded energy with the direct energy savings of a measure when performing TRC calculations for direct and water saving measures in order for the IOUs and CPUC calculations to be the same."

This approach was approved by the CPUC in Decision 17-12-010. We propose to follow this approach until the CET can be updated and ensure that the W-E Calculator output can be easily integrated into the CET.

Expand Education and Outreach

We propose to provide adequate support to ensure that users understand and are comfortable with the new W-E Calculator. This will include developing documentation that is readable and easily understood. We will also conduct a training session on how to use the model. The training session will be recorded and posted alongside the Calculator so that new users can view it.

While the W-E Calculator is designed for the energy IOUs, there is an opportunity to use this tool to further partner with water suppliers. We propose to present the tool to public water suppliers, as well as water IOUs. The presentations will not focus on the functionality of the tool, but rather on the opportunities for water-energy partnerships. We will provide a high-level presentation of the Calculator so that the water suppliers understand why and how it is used. Likely venues for these presentations would be conferences and trainings hosted by the California Water-Efficiency Partnership (CalWEP) and the California Water Association.

4 Project Goals, Objectives, and Deliverables

This section describes the project goals and objectives, as well as the project deliverables.

4.1 Project Goals and Objectives

The goal of this project is to develop a new, simpler Water-Energy Calculator (W-E Calculator 2.0). In pursuit of this goal, we have three primary objectives:

1. Engage stakeholders to identify key issues and concerns to inform changes to the W-E Calculator;
2. Update the W-E Calculator, in accordance with Decision 17-12-010, the Water Energy Joint Utility Plan of Action, and input received through stakeholder engagement; and
3. Develop readable and accessible documentation for the W-E Calculator that can be easily understood by a nontechnical audience, along with a help desk and recorded training session.

4.2 Project Deliverables

This project requires an update to the W-E Calculator and associated updates to user-manuals and other user-documentation and support tools. This work will produce four deliverables:

1. **W-E Calculator 2.0 Workplan:** The workplan presented here describes the process for revising the W-E Calculator for the CPUC, including an overview of the current W-E Calculator and key findings from the literature and stakeholder interviews, as well as an overview of the project goals, tasks, and deliverables.
2. **W-E Calculator 2.0:** The new, simpler W-E Calculator (which we refer to as W-E Calculator 2.0) will provide the embedded-energy savings of water-energy-conservation activities, in kWh. The W-E Calculator 2.0 will be an Excel-based tool with default inputs that can be modified by the user. Wherever possible, the inputs and outputs of the W-E Calculator will match those developed for other CPUC tools.
3. **Guidance manual for W-E Calculator 2.0:** The guidance manual for the W-E Calculator 2.0 will be the written user support for implementing the calculator.
4. **Project report:** The final report will document the process for developing the revised water-energy calculations, including the issues raised in existing documents and through stakeholder engagement, changes made to the W-E Calculator, and any recommendations for future changes.

These deliverables require coordination to ensure consistent and appropriate communication with DEER update teams, water agencies, IOUs, the CPUC, and stakeholders. The plan for continued engagement and outreach is described in more detail in section 6.

5 Task Plan

This section describes the tasks for revising the W-E Calculator and developing supporting materials. Its structure corresponds to the budget portion of the workplan.

5.1 Task 1: Develop a Workplan

In Task 1, we developed this workplan for revising the W-E Calculator, which includes the scope of the revision. This required carefully reviewing relevant documents addressing the development and use of the W-E Calculator and interviewing key stakeholders about their uses of and experiences with the W-E Calculator. The workplan was presented to stakeholders for feedback via a webinar, and that feedback was incorporated into the final workplan.

5.2 Task 2: Develop a Revised W-E Calculator

In Task 2, we will develop the draft W-E Calculator 2.0. To finalize the revisions, we will conduct additional conversations with CPUC staff and stakeholders to develop solutions that address the issues raised during the initial workplan development. We will write a memo summarizing the proposed changes to the W-E Calculator for CPUC to review and approve. We will implement the approved changes in a new Excel-based W-E Calculator (W-E Calculator 2.0) and prepare a draft guidance manual.

To develop the Calculator, SBW Consulting and Pacific Institute will develop a conceptual model of the revised W-E Calculator. We will review the model defaults for continued relevance and update then as needed. The draft guidance manual will provide an overview of the W-E Calculator, including the necessary inputs and outputs, key terms and definitions, and references for the model defaults.

We will provide the draft W-E Calculator and guidance manual to the CPUC for review and comments and revise the Calculator based on feedback. We will then beta-test the draft W-E Calculator 2.0 and guidance manual with energy IOUs and consultants. We will engage stakeholders through a workshop or webinar, launch beta testing, and provide a help desk to assist users during the beta test.

5.3 Task 3: Finalize the W-E Calculator 2.0, Guidance Manual, and Project Report

In Task 3, we will finalize the W-E Calculator 2.0 and guidance manual based on comments received from beta testers and stakeholders. In addition, we will develop a draft project report that includes key issues raised in existing documents and by stakeholders, changes made to the W-E Calculator, and any recommendations for future changes. We will submit the draft project report to CPUC for review. We will then integrate comments received and copy-edit the report

for readability by a nontechnical audience. We will then make the W-E Calculator, guidance manual, and project report available for final review and approval by CPUC.

6 Engagement and Outreach Plan

While developing the W-E Calculator, we will engage with the CPUC staff throughout the project. During Task 1, we worked with CPUC to identify resources to review and stakeholders to interview. As a result of Task 1, we provided CPUC the interview findings, a review of resources, and the draft workplan for comment.

During Task 2, we will provide CPUC a memo outlining the proposed changes to the W-E Calculator for review, and the subsequent draft Calculator and guidance manual for review. We will engage with key staff involved in DEER and the CET to improve potential integration with these tools. In addition, during Task 2, Pacific Institute will beta-test the W-E Calculator with users in coordination with CPUC. In Task 3, we will provide CPUC the revised W-E Calculator, guidance, and project documentation for review and comment.

We consulted the energy IOUs, consultants, and experts while developing this workplan (Task 1). We will continue to engage these stakeholders during the remaining tasks. We will solicit feedback on the workplan through a webinar and a two-week comment period. During Task 2, we will incorporate feedback from stakeholders while finalizing the revisions to the W-E Calculator and beta-testing the revised W-E Calculator and Guidance Manual. While water utilities are not a focus of this Calculator revision, we will also invite them to all workshops and webinars and invite them to provide comments on the workplan, draft W-E Calculator 2.0, and guidance manual.

7 Project Management

This section presents our budget, management, and staffing for revising the W-E Calculator.

7.1 Budget and Schedule

Table 3 presents the budget and schedule for revising the W-E Calculator for Pacific Institute and SBW Consulting.

Table 3: W-E Calculator Revision Budget and Schedule

Task	Task Description	Budget by category	Completion Date
Task 1	Develop workplan by interviewing stakeholder and identifying issues	$88,000	Spring 2021
Task 2	Develop revised W-E calculator and draft guidance manual using beta-testing	$88,000	Fall 2021
Task 3	Finalize calculator and documentation (guidance manual and project report)	$44,000	Winter 2021/2022
	Total	**$220,000**	

7.2 Management and Staffing

Figure 2 shows an organizational chart of the management-and-staffing structure. The Pacific Institute is responsible for defining necessary calculator updates and leading the development of the W-E Calculator guidance manual and project report. In addition, Pacific Institute will serve as the primary lead for communication and outreach on the project. SBW Consulting will lead the technical development of the revised W-E Calculator and assist with developing the guidance manual.

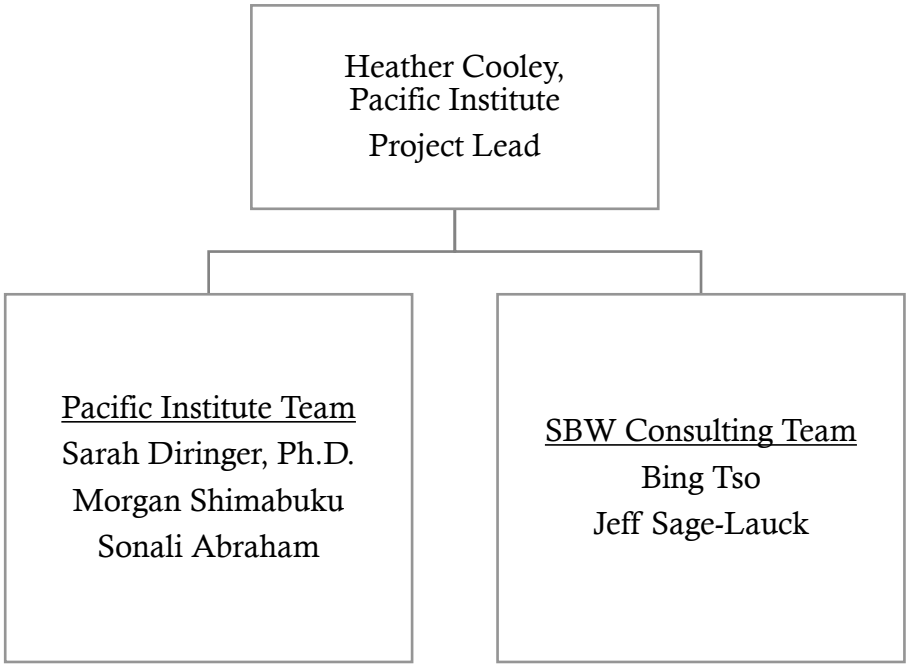

Figure 2: W-E Calculator Revision Organizational Chart

Appendices

A. Interview Questions

We conducted interviews with energy utilities, consultants, and researchers. The questions cover two topics: water-energy savings and the W-E Calculator. We developed separate questions for energy utilities and for consultants and researchers.

A.1 Interview Questions for Energy Utilities

General Questions about Water-Energy Savings Estimates

1. Do you currently have any water measures in your energy efficiency programs?
    a. If yes,
        1) Which measures are included?
        2) What were some of the challenges you encountered when integrating these measures into your programs?
        3) Is there anything that would help you to include more of these measures into your programs?
    b. If no,
        1) Why not?
        2) Is there anything that would help you to include more of these measures into your programs?
2. Have you estimated the energy savings from water efficiency measures?
    a. If no, why not?
    b. If yes,
        1) Did you evaluate the direct energy savings (aka hot water savings), the embedded energy savings (e.g., the energy associated with treating and transporting water/wastewater), or both?
        2) For what purpose did you use these estimates, e.g., programmatic planning or site estimates for specific projects?
        3) Did you get credit for the embedded and/or direct energy savings toward meeting your energy efficiency goals?
        4) Did this evaluation change your investment decision?
        5) What methods and tools did you use to estimate the embedded energy savings, e.g., the Water-Energy Calculator?

Specific Questions About the Water-Energy Calculator (W-E Calculator)

1. How familiar are you with the Water-Energy Calculator (W-E Calculator)?
2. Did you participate in the development of the W-E Calculator, e.g., attending workshops or providing comments? If so, how?
3. Have you used the W-E Calculator? (For reference, the calculator and user guide are available here: https://www.cpuc.ca.gov/nexus_calculator/)
   a. If no,
      1) Why not?
      2) What tools would be useful for integrating energy benefits into efficiency investments?
   b. If yes,
      1) Why did you use the W-E Calculator?
      2) What was your general impression of the W-E Calculator?
      3) Did you use the default values in the W-E Calculator?
      4) Did you use the water and wastewater utility cost test? If so, for what purpose?
      5) What outputs from the W-E Calculator were of greatest interest? Which were least of interest?
      6) Were you confident in the results provided by the W-E Calculator?
      7) What changes to the W-E Calculator do you think are necessary? Of these, what is of greatest importance? What would be of lesser importance?
      8) How could the outputs from the W-E Calculator be better integrated into existing CPUC calculation tools?
4. Is there anything else you think we should keep in mind when updating the W-E Calculator?
5. Who else should we talk to at your organization or elsewhere?

A.2 Interview Questions for Consultants and Researchers

General Questions Water-Energy Programs

1. Are you familiar with the energy efficiency program offerings? If yes,
   a. What types of water efficiency measures are being integrated into these programs (e.g., cold water measures, hot water measures, or both)?
   b. What are the challenges with integrating water efficiency measures into these programs?

c. What would help to integrate more measures into these programs?

d. Are there any policy issues that need to be addressed to better integrate water measures into energy efficiency programs?

2. Are you familiar with energy efficiency program evaluations? If yes,

a. to what extent are direct energy savings (aka hot water savings) being estimated? embedded energy savings (e.g., the energy associated with treating and transporting water/wastewater)?

b. Are they using the Water-Energy Calculator for these evaluations, or are they using other methods?

c. For what purpose are these estimates used, e.g., programmatic planning or site estimates for specific projects?

d. What are some of the barriers for estimating embedded energy savings?

e. Are the energy IOUs getting credit for the embedded and direct energy savings toward meeting energy efficiency goals?

Specific questions about the Water-Energy Calculator (W-E Calculator)

Use of the W-E Calculator

1. For what purpose(s) have you used the W-E Calculator?
2. Did you integrate environmental benefits into your cost calculations?
3. Did you use the water and wastewater utility cost test? If so, for what purpose?
4. What changes to the W-E Calculator would improve its usability?

Model Defaults

1. What marginal supply and energy intensity estimates are the energy IOUs using? Default values or other values?
2. What are the issues and concerns with the model defaults?

Outputs

1. What outputs are most important?
2. What outputs are of least interest or even unnecessary?
3. Were you confident in the results provided by the W-E Calculator? Why or why not?
4. How could the W-E Calculator outputs be better integrated into existing CPUC tools?
5. Can or should the W-E Calculator and its outputs be used for other purposes?

Other questions or concerns

1. Is there anything else you think we should keep in mind when updating the W-E Calculator?

2. Who else should we talk to?