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| Miscellaneous  Water Energy Nexus Measures  SWMI001-01 |

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Measure Name

Water Energy Nexus Measures

Statewide Measure ID

SWMI001-01

Technology Summary

The purpose of the Water Energy Nexus (WEN) Measures is to quantify the embedded energy savings that result from water efficiency measures implemented through the California utility energy efficiency portfolios. *Embedded energy*in water is defined as the amount of energy that is used to collect, convey, treat, and distribute a unit of water to end users, and the amount of energy that is used to collect and transport used water for treatment prior to safe discharge of the effluent in accordance with regulatory rules.[[1]](#footnote-1)

The embedded energy savings that result from water efficiency measures are not accounted for in the unit energy savings of energy efficiency measures implemented in the California investor-owned utility (IOU) portfolios. The purpose of the WEN Measures is to meet the current California Public Utility Commission (CPUC) requirements to quantify the additional embedded energy savings associated with energy efficiency measures that also achieve water savings.

Background

On January 17, 2014, Governor Brown declared a Drought State of Emergency, commenting 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.” In May 2016, Governor Brown issued Executive Order B-37-16 directing California to prioritize and take concrete, measurable actions through a Water Action Plan that “Make Conservation a California Way of Life” and “Manage and Prepare for Dry Periods” to improve use of water in the State. The California Energy Commission (CEC) and Department of Water Resources have solicited and developed programs that target the water–energy nexus, to conserve water and energy and to reduce greenhouse gas (GHG) emissions.

Consequently, the CPUC, with its broad jurisdiction over energy and water, sought to investigate the immediate-term, mid-term, and long-term actions to combat the drought and future climate challenges. The CPUC expressed an overarching interest in determining the potential benefits of evaluating embedded energy impacts associated with water conservation measures. The *Water/Energy Cost-Effectiveness Analysis* conducted by Navigant Consulting and CPUC Decision 15-09-023, both issued in 2015, were keystone efforts to meet CPUC objectives.

***Water/Energy Cost-Effectiveness Analysis Report* (Navigant, 2015).**[[2]](#footnote-2) The *Water/Energy Cost-Effectiveness Analysis Report* summarized the tools and analyses for informing CPUC decisions about the use of energy ratepayer funds for joint water‐energy programs. The intended uses of the tools and analysis developed by this study include:

* Estimate the IOU and non‐IOU embedded energy savings that result from joint water‐energy programs,
* Assess the benefits that accrue to energy utilities and to water utilities from programs and measures that save both energy and water, and
* Determine if incentivizing measures and programs that save both energy and water is a cost-effective use of IOU energy utility funds.

***Decision Regarding Tools for Calculating the Embedded Energy in Water and an Avoided Capacity Cost Associated with Water Savings (D.15-09-023).***[[3]](#footnote-3) Decision 15-09-023, issued in September 2015 and informed by the Navigant Water/Energy report, addressed several topics related to embedded energy and adopted tools to allow the CPUC to better quantify embedded energy savings of water saving measures.[[4]](#footnote-4) Among many other things, this Decision adopted the Water-Energy Calculator designed to calculate the embedded energy in water and the avoided capacity cost associated with water savings. D.15-09-023 also evaluated the energy benefits associated with conservation of cold-water savings measures and off-site hot water savings.

Water-Energy Calculator

The Water-Energy Calculator assesses water-energy program cost effectiveness for energy efficiency portfolios.[[5]](#footnote-5) The Water-Energy Calculator, one of the tools addressed in D.15-09-023, calculates energy savings associated with moving and treating water, along with related indirect off-site energy impacts. The intended use of this water/energy cost-effectiveness analysis tool is to:

* Estimate the IOU and non-IOU embedded energy savings that result from joint water-energy programs,
* Assess the benefits that accrue to energy utilities and to water utilities from programs and measures that save both energy and water, and
* Determine if incentivizing measures and programs that save both energy and water is a cost- effective use of IOU energy ratepayer funds.

Prior energy efficiency tools measured only the direct energy savings associated with reduced water use in site-specific energy savings programs directed at customers. Consequently, programs or projects that estimate the energy required by the water system above and beyond the site-specific energy use (such as energy use required for hot water use) could not be quantified prior to the Water-Energy Calculator. However, with CPUC approval of the Water-Energy Calculator, embedded energy savings from water conservation projects and programs that target the water system can be quantified, and costs and benefits can be allocated among program administrators.

Measure Case Description

The energy efficiency measures for which embedded energy savings are estimated with the Water-Energy Calculator (version 1.05) are listed below. Table 1 specifies statewide measures eligible for utility energy efficiency portfolios (“IOU WEN Measures”) and Table 2 lists the measures for which water savings values developed by the Metropolitan Water District (“MWD WEN Measures”). Note that only the first ten rows are provided in each table. See the RMS Consulting, LLC. 2020. “2020 WEN Master Spreadsheet.xlsx.” Prepared for San Diego Gas & Electric (SDG&E).

Table 1: Statewide IOU WEN Measures and Codes

| **Line #** | **Measure Name & Offering** |
| --- | --- |
| 1 | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft – SFM, MFM In-Unit |
| 2 | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft - MFM Common Area |
| 3 | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft - Non Res |
| 4 | Commercial steam cooker Electric |
| 5 | Commercial steam cooker Natural gas |
| 6 | Commercial combination oven/steamer Electric (less than 15 pans) |
| 7 | Commercial combination oven/steamer Electric (15-28 pans) |
| 8 | Commercial combination oven/steamer Electric (more than 28 pans) |
| 9 | Commercial combination oven/steamer Natural gas (less than 15 pans) |
| 10 | Commercial combination oven/steamer Natural gas (15-28 pans) |

Table 2: Statewide MWD WEN Measures and Codes[[6]](#footnote-6)

| **Line #** | **Measure Name & Offering** |
| --- | --- |
| 53 | Com-High Efficiency Toilet (Melded) |
| 54 | Com-4 Liter Toilet (Melded) |
| 55 | Com-Zero/Ultra Low Water Urinal |
| 56 | Com-Dry Vacuum Pump (1/2 hp) |
| 57 | Com-Cooling Tower Conductivity Controller |
| 58 | Com-pH Cooling Tower Controller |
| 59 | Com-Weather Based Irrigation Controller-Stat |
| 60 | Com-Central Computer Irrigation Controller-Stat |
| 61 | Com-Rotary Multi-Stream Nozzle |
| 62 | Com-Large Rotary Nozzle |
| 63 | Com-Turf Removal (/square foot) |

Base Case Description

The WEN measures identified in the Measure Case Description are defined as “rider measures” for which the incremental embedded energy savings were estimated. Therefore, the base case is defined as the base case assumed for each specific measure to estimate the water savings required for the Water-Energy Calculator.

Code Requirements

The WEN measures identified in the Measure Description section are defined as “rider measures” for which the incremental embedded energy savings were estimated. Therefore, the WEN measures are subject to the applicable codes and standards identified in the Code Requirements for each specific IOU WEN measure workpaper and MWD WEN measure.[[7]](#footnote-7) Additionally, the MWD Integrated Water Resources Plan[[8]](#footnote-8) and D.15-09-023[[9]](#footnote-9) address California Plumbing Code and certain Building Energy Efficiency Standards (Title 24) ramifications.

Normalizing Unit

The WEN measures identified in the Measure Description section are defined as “rider measures” for which the incremental embedded energy savings were estimated. Therefore, the normalizing unit is the unit defined for each specific IOU WEN measure workpaper and MWD WEN measure.[[10]](#footnote-10)

Program Requirements

Measure Implementation Eligibility

The WEN measures identified in the Measure Description section are defined as “rider measures” for which the incremental embedded energy savings were estimated. The WEN measures adhere to the measure application type, delivery type, and sector combinations of each specific IOU WEN measure and MWD WEN measure.[[11]](#footnote-11)

A goal of the WEN measure implementation should be to minimize customer requirements to file multiple incentive applications with multiple parties. To realize this goal, appropriate delivery mechanisms should be evaluated and applied. An assessment of how to integrate the delivery mechanism between incentives offered by water agencies and those offered for energy efficiency needs to be discussed.

Eligible Products

Eligible products include all measures specified in the Measure Case Description and RMS Consulting, LLC. 2020. “2020 WEN Master Spreadsheet.xlsx.” Prepared for San Diego Gas & Electric (SDG&E).

Eligible Building Types and Vintages

The eligible building types and vintages of each WEN measure are specified in each IOU WEN measure workpaper and/or the MWD water savings list.[[12]](#footnote-12)

Eligible Climate Zones

See “Hydraulic Region to Climate Zone Mapping” in the Electric Savings section.

Program Exclusions

None.

Data Collection Requirements

Data collection requirements are to be determined.

Use Category

Miscellaneous

Electric Savings (kWh)

Embedded electric energy savings of the WEN Measures specified in the Measure Case Description were calculated with the Water-Energy Calculator (version 1.05).[[13]](#footnote-13) To calculate the embedded energy savings, the Water-Energy Calculator requires water savings values from existing approved statewide deemed energy efficiency measures and/or water savings values developed by MWD.

The resultant embedded energy savings values represent incremental energy savings by hydrological zone. Because the unit energy savings (UES) of the IOU WEN measures do not account for embedded energy in water (as defined in the Technology Summary), the estimated embedded energy savings for WEN measures are additive to the approved UES values. The incremental embedded energy savings were calculated for the measures specified in the Measure Case Description. Other water saving measures may be incorporated later as data becomes available.

Overview of the Water-Energy Calculator Approach

The Water-Energy Calculator (version 1.05) calculates all three water‐related benefits in a single tool that can be used for analyzing the benefits of water conservation measures. Specifically, this tool provides:

* Analysis of the Avoided Embedded IOU Energy in Water is contained within the Water Energy Calculator.
* The Avoided Capacity Cost of Water is calculated by the Avoided Water Capacity Cost Model (developed by the Navigant team). These values feed into the Water Energy Calculator.
* Environmental Benefits of Reduced Water Use is obtained from secondary data review of existing environmental benefits models.



Figure 1: Overview of Tools and Analysis

The Water-Energy Calculator estimates IOU and non‐IOU embedded energy savings. These embedded energy savings consider the energy intensity of the weighted average mix of water supplies to a given region as well as the energy intensities of the other system components (treatment, distribution, and wastewater systems as appropriate).

The Water-Energy Calculator requires water savings values developed for measures implemented in the IOU portfolios (“IOU WEN measures”) and water savings values developed by the Metropolitan Water District (MWD), referred to as “MWD WEN measures.” The following sections detail the step-by-step procedure on how the final embedded water energy savings are outputted from the Water-Energy Calculator.

Embedded Energy Savings of IOU WEN Measures

A list of statewide IOU energy efficiency measures for which water savings has been estimated was identified (see Figure 2). Each WEN measure was then input into the Water-Energy Calculator. Parameters that are required for the input sheet include:

* Annual Water Savings (gallons)
* Installation Year
* Savings Profile (i.e. Constant, Cooling Tower or Irrigation)
* Hydrologic Region (ten in total)
* Sector (i.e. Urban or Agricultural)
* Water Use (i.e. Indoor or Outdoor)



Figure 2: Sample List of IOU WEN Measures



Figure 3: Water-Energy Calculator Input Tab

Embedded Energy Savings of MWD WEN Measures

A similar process was followed for MWD WEN measures. For MWD WEN measures, the MWD *Integrated Water Resources Plan 2015 Update* describes the how the active water savings estimates were calculated.[[14]](#footnote-14)

Device savings are limited by decay rates, or a corresponding device life, but not both at the same time. For example, a residential high-efficiency toilet (HET) saves about 38 gallons per day over a lifetime of 20 years with no assumed decay rate. For a complete list of current and past device and program savings factors, see Appendices A and B. Annual savings are expressed in acre-feet (AF).

*Si* is the annual savings in acre-feet (AF) for device *i*.

*di* is the number of devices *i* installed under an active conservation program.

*ai* is the gallons per day savings from a baseline. Baselines are specific to each device and represent the typical amount of water usage for a conventional device prior to more efficient alternatives being made available, either through plumbing code enforcement or market innovations. For example, a HET with a 1.28 gallons-per-flush (GPF) has a savings factor of 38 gallons per day compared to the 3.5 GPF toilets available before the 1992 plumbing codes.

365 is the number of days assumed in one year for the purpose of simplifying the calculation.

325,851 is the number of gallons in one acre-foot of water.

Lifetime savings is the sum of annual savings over the life expectancy of the device:

*Li* is the lifetime savings of device i.

*n* is the number of years a device is expected to produce savings before it fails. This varies depending on the type of device.

*t* is the year when device i is producing savings.

*Si* is the annual savings in acre-feet (AF) for device i.

Similar to the IOU WEN measures, the water savings values from the MWD list were input into the Water-Energy Calculator, as shown in Figure 3. After the applicable input fields were entered, the Water-Energy Calculator output the applicable fields, as illustrated, in Figure 4 including:

* Average Annual Embedded IOU Electric Energy (kWh)
* Average Annual Embedded Non-IOU Electric Energy (kWh)
* Average Annual Embedded Gas Energy (therms)
* Avoided IOU Electric Energy Costs (in 2014 dollars)
* Avoided Gas Energy Cost (in 2014 dollars)



Figure 4: Water-Energy Calculator Output Tab

Hydrologic Region to Climate Zone Mapping

Through collaboration with IOUs, the CPUC Energy Division and the CPUC Reporting Team, agreement was reached on how to take existing customer data (zip code) and determine hydrologic region, which is an input into the Water-Energy Calculator.[[15]](#footnote-15) Particularly, in cases where a zip code has multiple hydrologic regions, it became difficult to assign that specific application to a hydrologic region. Figures 6 and 7 illustrate the assignment of a hydrological zone to a zip code that directly maps to a CEC climate zone.



Figure 5: Moss Landing Zip Code Map Bordering San Francisco Bay and Central Coast Hydrological Zones

The WEN Working Group collaboratively determined that the hydrological region assigned to that zip code would be the one with the largest area within the zip code. For example, Moss Landing is located on the coast within Monterey County, California. The primary zip code used by Moss Landing is 95039. The California Energy Commission (CEC) Climate Zone places the Moss Landing zip code (95039) in Climate Zone 3 as shown on the very left of Figure 7. Secondly, the ten hydrological regions are depicted in the middle of Figure 7, showing that portions of the Moss Landing zip code map to the San Francisco Bay hydrological zone but the majority of the zip code maps to the Central Coast hydrological zone. Lastly, the 16 CEC Climate Zones are shown on the right of Figure 7 where Moss Landing would be mapped to Climate Zone 3.





Figure 6: CEC Zip Code to Hydrological Zone to Climate Zone Mapping

Despite being near the coast and having both San Francisco Bay (SF) and Central Coast (CC) hydrological zones as possible options for zip code 95039, CC has the largest hydrologic region assigned to zip code 95039. Therefore, based on the WEN Working Group agreed-upon approach, CC would be used as the hydrological zone mapped to CEC Climate Zone 3 because CC is the largest hydrological zone within the 95039-zip code.

Table 3provides an example of the zip code to hydrologic region look-up table that was be used to understand the geographic variations in the number of measure installations by hydrologic region, water savings by hydrologic region, embedded energy savings by hydrologic region, etc.

Table 3: Zip Code, Hydrolic Region, and Climate Zone Mapping Example[[16]](#footnote-16)

|  |  |  |  |
| --- | --- | --- | --- |
| **Zip-Code** | **Possible Hydrologic Regions** | **Largest Hydrological Region  Assigned to Zip Code** | **Climate-Zone** |
| 95039 | SF, CC | CC | CZ 3 |

Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case. Load shape is peculiar for Water-Energy programs as it is difficult hard to determine what time energy is being used for the delivery and treatment of water and wastewater. At the instant water is used on-site, energy is used many hours ahead and after that to treat and pump and collect.

At the February 14, 2017 WEN Working Group meeting, the CPUC EAR team suggested using a Refrigeration energy load shape, which is constant and generally flat throughout the year and similar to how WEN cold water measures are typically used. However, at the March 14, 2017 WEN Working Group meeting, CPUC ED staff indicated that they would coordinate with the CPUC ED Reporting Team on creating a flat load shape for the IOU reporting teams to use for MWD WEN measures.

For illustrative purposes, the relevant load shapes for the first ten IOU WEN measures and MWD WEN measures are shown in the Table 4 and Table 5, respectively.

Table 4. Applicable Building Types and Load Shapes – IOU WEN Measures

| **Line #** | **Measure Description** | **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| --- | --- | --- | --- | --- |
| 1 | Energy Star most efficient clothes washer, >2.5 cubic ft - SFM. MFM In-Unit | SFM | IOU:RES: DEER: Res\_ClothesDishWasher | RES |
| 2 | Energy Star most efficient clothes washer, >2.5 cubic ft - MFM Common Area | MFM | IOU:RES: DEER: Res\_ClothesDishWasher | RES |
| 3 | Energy Star most efficient clothes washer, >2.5 cubic ft - Non-Res | Com | IOU:RES: DEER: Res\_ClothesDishWasher | NON\_RES |
| 4 | Commercial steam cooker Electric | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 5 | Commercial steam cooker Natural gas | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 6 | Commercial combination oven/steamer Electric (less than 15 pans) | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 7 | Commercial combination oven/steamer Electric (15-28 pans) | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 8 | Commercial combination oven/steamer Electric (more than 28 pans) | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 9 | Commercial combination oven/steamer Natural gas (less than 15 pans) | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |
| 10 | Commercial combination oven/steamer Natural gas (15-28 pans) | Com | IOU:RSD-Restaurant–SitDown-PROC\_OTH | NON\_RES |

Table 5 Applicable Building Types and Load Shapes – MWD WEN Measures

| **Line #** | **Measure Description** | **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| --- | --- | --- | --- | --- |
| 53 | Com-High Efficiency Toilet (Melded) | Com | TBD: Flat Load Shape | NON\_RES |
| 54 | Com-4 Liter Toilet (Melded) | Com | TBD: Flat Load Shape | NON\_RES |
| 55 | Com-Zero/Ultra Low Water Urinal | Com | TBD: Flat Load Shape | NON\_RES |
| 56 | Com-Dry Vacuum Pump (/1/2 hp) | Com | TBD: Flat Load Shape | NON\_RES |
| 57 | Com-Cooling Tower Conductivity Controller | Com | TBD: Flat Load Shape | NON\_RES |
| 58 | Com-pH Cooling Tower Controller | Com | TBD: Flat Load Shape | NON\_RES |
| 59 | Com-Weather Based Irrigation Controller-Stat | Com | TBD: Flat Load Shape | NON\_RES |
| 60 | Com-Central Computer Irrigation Controller-Stat | Com | TBD: Flat Load Shape | NON\_RES |
| 61 | Com-Rotary Multi-Stream Nozzle | Com | TBD: Flat Load Shape | NON\_RES |
| 62 | Com-Large Rotary Nozzle | Com | TBD: Flat Load Shape | NON\_RES |

Reporting for WEN WP Measures

Although the Water-Energy Calculator originally was developed for use in energy efficiency portfolio and project development, the tool solely calculates embedded water energy savings and currently does not integrate into the E3 Energy Efficiency Cost Effectiveness Calculator to quantify cost-effectiveness. The Decision on Updating the Water Energy Nexus (R.13-12-011)[[17]](#footnote-17) finding of fact indicated the following:

* A calculation, exogenous to the current version of the Water-Energy Calculator must be performed to access the E3 Cost Effectiveness Calculator for mainstream energy efficiency program development.
* A calculation, exogenous to the current version of the Water-Energy Calculator must be performed to determine GHG emissions saved from WEN energy efficiency programs.
* The California IOUs must use all three calculators to determine the GHG emissions reductions of WEN measures.

Additionally, as indicated in the 2015 Navigant *Water/Energy Cost-Effectiveness Analysis Report*:

“to the extent possible, measure‐specific data (e.g., energy impacts, net‐to‐gross ratios, costs and useful lives) used in the calculation of the TRC and PAC tests should be taken from the most up‐to‐date version of the Database for Energy Efficiency Resources (DEER). As water‐energy considerations enter the CPUC cost‐effectiveness framework, DEER will need to be updated to store new water‐related information.” (p. 59)

In November 2016, Energy Efficiency Data Management and Reporting Team of the CPUC Energy Division was tasked to work with water-energy stakeholders, including IOU energy efficiency program managers, to propose a method for reporting savings claims for embedded energy savings derived from WEN measures. The overarching goals were to:

1. Minimize changes to the current IOU energy efficiency program tracking claims reporting structure,
2. Minimize unnecessary fields which result in excessive 'blank' values for non-water measures, and
3. Allow very clear alignment of the resource measure (i.e. low-flow showerhead) and the water-energy measure.

After a discussion with the WEN Working Group, it was determined that an appropriate reporting approach would be to create a secondary measure for the embedded savings associated with the water measures. The purpose of water measure reporting is to report on-site energy savings; the purpose of the secondary measure would be for reporting embedded savings.

To capture the relationship between the on-site savings and embedded savings from a water efficiency measure, the WEN Working Group created a Water Measure Table (Table 6), which, like the CustomMeasure and DeemedMeasure tables, has a one-to-one relationship with the Claim table. **Figure 8** depicts how embedded energy savings (Line 21) will be reported as a separate line item in the Monthly Energy Efficiency Program Report.



Figure 7: 2017 EE Monthly Report Template

Each Claim requires either a CustomMeasure or a DeemedMeasure record, and water-saving measures can be either Deemed or Custom measures. Claims that are water-saving measures also need a WaterMeasure 'sister' record, linked by the ClaimID. The WaterMeasure table contains the key inputs and outputs from the Water-Energy Calculator. The process of adding this table to the energy efficiency program tracking specification would follow adopted change management guidelines, and the IOU Reporting Teams already has a list of proposed specification modifications for 2017 claims to which this would be added once agreed upon by the WEN Working Group.

Table 6: Proposed Water Measure Table



A result of the November 2016 meeting, a list of questions was issued for stakeholder consideration before the reporting schemes for accounting for WEN measures were finalized. Specifically, before adding this WaterMeasure table to the EE program tracking specification, the team has some threshold questions for energy water stakeholders:

* Does this approach seem reasonable; if not, what modifications should be considered?
* Does the table capture all appropriate fields?
* Is there a reason why the calculator does not produce kW savings? Should kW be added to the table? Is demand reduction available for reporting?
* Is there a reason why the water calculator provides (AvAnnualTherms) as a savings field for embedded water/energy savings? (This question will not impact the proposal, necessarily, just informational.)

Peak Electric Demand Reduction (kW)

Not applicable. Currently the Water-Energy Calculator does not compute demand reduction associated with embedded energy.

Gas Savings (Therms)

Embedded gas energy savings of the WEN Measures specified in the Measure Case Description were calculated with the Water-Energy Calculator (version 1.05).[[18]](#footnote-18) See Electric Savings for details.

Life Cycle

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention not caused the replacement or alteration.

The methodology to calculate the RUL conforms with Version 5 of the Energy Efficiency Policy Manual, which recommends “one-third of the effective useful life in DEER as the remaining useful life until further study results are available to establish more accurate values.”[[19]](#footnote-19) This approach provides a reasonable RUL estimate without the requiring any a priori knowledge about the age of the equipment being replaced.[[20]](#footnote-20) Note that the RUL value is applicable only to the first baseline period for an retrofit measure with an applicable code baseline.

The sources for the EUL and RUL values for the WEN Measures are as follows:

* For the IOU WEN Measures, the EUL and RUL shall equal the EUL and RUL values in the RMS Consulting, LLC. 2020. “2020 WEN Master Spreadsheet.xlsx.” Prepared for San Diego Gas & Electric (SDG&E).
* For the MWD measure, the EUL shall equal the value that has been evaluated and approved by MWD.

The first ten rows for IOU WEN measures and MWD WEN measures are provided in Table 7 and Table 8 below.

Table 7: Effective Useful Life and Remaining Useful Life - IOU WEN Measures

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Line #** | **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| 1 | Appl-EffCW | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft - SFM. MFM In-Unit | SFM. MFM In-Unit | AppPlug | 11 | 3.7 |
| 2 | Appl-EffCW | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft - MFM Common Area | MFM Common Area | AppPlug | 11 | 3.7 |
| 3 | ComLau-EffCW | ENERGY STAR Most Efficient clothes washer, >2.5 cubic ft - Non-Res | Non-Res | AppPlug | 11 | 3.7 |
| 4 | Cook-ElecStmCooker | Commercial steam cooker Electric | Commercial | FoodServ | 12 | 4 |
| 5 | Cook-GasStmCooker | Commercial steam cooker Natural gas | Commercial | FoodServ | 12 | 4 |
| 6 | Cook-ElecCombOven | Commercial combination oven/steamer Electric (less than 15 pans) | Commercial | FoodServ | 12 | 4 |
| 7 | Cook-ElecCombOven | Commercial combination oven/steamer Electric (15-28 pans) | Commercial | FoodServ | 12 | 4 |
| 8 | Cook-ElecCombOven | Commercial combination oven/steamer Electric (more than 28 pans) | Commercial | FoodServ | 12 | 4 |
| 9 | Cook-GasCombOVen | Commercial combination oven/steamer Natural gas (less than 15 pans) | Commercial | FoodServ | 12 | 4 |
| 10 | Cook-GasCombOVen | Commercial combination oven/steamer Natural gas (15-28 pans) | Commercial | FoodServ | 12 | 4 |

Table 8: Effective Useful Life and Remaining Useful Life - MWD WEN Measures

| **Measure #** | **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** |
| --- | --- | --- | --- | --- | --- | --- |
| 53 | - | Com-High Efficiency Toilet (Melded) | Commercial | - | 20 | 6.67 |
| 54 | - | Com-4 Liter Toilet (Melded) | Commercial | - | 20 | 6.67 |
| 55 | - | Com-Zero/Ultra Low Water Urinal | Commercial | - | 20 | 6.67 |
| 56 | - | Com-Dry Vacuum Pump (/1/2 hp) | Commercial | - | 7 | 2.33 |
| 57 | - | Com-Cooling Tower Conductivity Controller | Commercial | - | 5 | 1.67 |
| 58 | - | Com-pH Cooling Tower Controller | Commercial | - | 5 | 1.67 |
| 59 | - | Com-Weather Based Irrigation Controller-Stat | Commercial | - | 10 | 3.33 |
| 60 | - | Com-Central Computer Irrigation Controller-Stat | Commercial | - | 10 | 3.33 |
| 61 | - | Com-Rotary Multi-Stream Nozzle | Commercial | - | 5 | 1.67 |
| 62 | - | Com-Large Rotary Nozzle | Commercial | - | 10 | 3.33 |

Since the embedded energy savings of the WEN measures are incremental to the approved unit energy savings, the impact of differences in EUL values are expected to be minimal. There may also be differing values between proposed MWD EUL values and those adopted for the IOU energy efficiency portfolios. An assessment of the differences relative to the overall energy impact accuracy may be warranted in the future.

Base Case Material Cost ($/unit)

The WEN measures identified in the Measure Description section are defined as “rider measures” for which the incremental embedded energy savings were estimated for each specific IOU WEN measures. Therefore, base case costs have already been developed and are reported in existing workpapers and/or are available in the MWD water savings list.[[21]](#footnote-21) Thus, the cost for WEN measures is assumed to be $0.

However, for cost-effectiveness calculation purposes, the incremental cost of a WEN measure is assumed to be $0.01 to allow cost-benefit values to be generated for program evaluation purposes. More specifically, direct savings IOU WEN measure will use $0.01 for the cost of the measure when running the Water-Energy Calculator since the costs of the measures are included in the calculations for the direct savings measure. For MWD WEN cold water measures, the IOUs will work with the water agencies to determine the dollar amount to assist with marketing and/or incentives based on the embedded energy savings output from the Water-Energy Calculator. For the cost-effectiveness calculation purposes MWD WEN cold water measures will also use $0.01 for the calculation purposes.

Measure Case Material Cost ($/unit)

See Base Case Material Cost.

Base Case Labor Cost ($/unit)

See Base Case Material Cost.

Net-to-Gross (NTG)

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. The sources for NTG values adopted for the WEN measures are as follows:

* If the WEN measure is a currently approved measure for the utility energy efficiency portfolios, the NTG ratio is equal the NTG ratio of the approved measure, as indicated in the RMS Consulting, LLC. 2020. “2020 WEN Master Spreadsheet.xlsx.” Prepared for San Diego Gas & Electric (SDG&E).
* If a WEN measure is not currently approved for the California energy efficiency portfolios (i.e., toilets) then Metropolitan Water District (MWD) NTG values were adopted, if available. (Note that the MWD does not provide NTG values for these measures at this time.)
* If a WEN measure is not approved for the California energy efficiency portfolios and a NTG ratio is not provided by the MWD, the NTG value of 0.85 stipulated by the California Public Utility Commission (CPUC) in Decision D.15-09-023 shall be adopted.[[22]](#footnote-22) (Because MWD does not provide NTG ratios, all MWD measures are assigned a 0.85 NTG for cost-effectiveness calculation purposes.)

The NTG ratios for the first 10 rows of IOU WEN measures is provided below.

Table 9: Net to Gross Ratio Ratios – IOU WEN Measures

| **Line #** | **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | Res-sAll-mCW | Energy Star most efficient clothes washer, >2.5 cubic ft - SFM. MFM In-Unit | Any | Any | Any | 0.31 |
| 2 | Com-Default>2yrs | Energy Star most efficient clothes washer, >2.5 cubic ft - MFM Common Area | Any | Any | Any | 0.60 |
| 3 | Com-Default>2yrs | Energy Star most efficient clothes washer, >2.5 cubic ft - Non-Res | Any | Any | Any | 0.60 |
| 4 | Com-Default>2yrs | Commercial steam cooker Electric | Any | Any | Any | 0.60 |
| 5 | Com-Default>2yrs | Commercial steam cooker Natural gas | Any | Any | Any | 0.60 |
| 6 | Com-Default>2yrs | Commercial combination oven/steamer Electric (less than 15 pans) | Any | Any | Any | 0.60 |
| 7 | Com-Default>2yrs | Commercial combination oven/steamer Electric (15-28 pans) | Any | Any | Any | 0.60 |
| 8 | Com-Default>2yrs | Commercial combination oven/steamer Electric (more than 28 pans) | Any | Any | Any | 0.60 |
| 9 | Com-Default>2yrs | Commercial combination oven/steamer Natural gas (less than 15 pans) | Any | Any | Any | 0.60 |
| 10 | Com-Default>2yrs | Commercial combination oven/steamer Natural gas (15-28 pans) | Any | Any | Any | 0.60 |

Gross Savings Installation Adjustment (GSIA)

The gross savings installation adjustment (GSIA) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor varies by end use, sector, technology, application, and delivery method. The GSIA rate for all WEN measures is equal to the GISA for the particular statewide measure, and if not a statewide measure the GSIA would equal the default GSIA value.

Non-Energy Impacts

The non-energy impacts for all WEN measures is the estimated water savings, as documented in specific IOU WEN workpapers and/or by the MWD. Estimated water savings values are input into the Water-Energy Calculator to estimate embedded energy.

DEER Differences Analysis

This section provides a summary of inputs and methods based upon the Database of Energy Efficient Resources (DEER), and the rationale for inputs and methods that are not DEER-based.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Comment / Used for Workpaper** |
| Modified DEER methodology | No |
| Scaled DEER measure | No |
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | No |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2019, READI v2.5.1 |
| Reason for Deviation from DEER | DEER does not contain embedded energy savings for WEN measures |
| DEER Measure IDs Used | N/A |
| NTG | (Specified for each WEN measure) |
| GSIA | Def-GSIA |
| EUL/RUL | (Specified for each WEN measure) |

**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| Rev | Date | Author | Summary of Changes |
| 0 | 04/21/17 | RMS Energy Consulting, LLC | New Workpaper. |
| 1 | 09/17/19 | RMS Energy Consulting, LLC | * Master spreadsheet was updated to correct typos on naming on worksheets. * MWD commercial large rotary nozzle savings were corrected. * Applicable MWD outdoor measures were updated from urban to agricultural sector. * Master List Measures includes 110 WEN measures identified in the 2019-09-17 WEN Master Spreadsheet |
| 2 | 07/20/2020 | RMS Energy Consulting,  LLC | Updated workpaper template to latest California statewide workpaper format as requested by DNV GL Ex-Ante team. |

1. Navigant Consulting, Inc. and GEI Consultants. 2015. *Water/Energy Cost-Effectiveness Analysis. Revised Final Report.* Prepared for the California Public Utilities Commission (CPUC). April. [↑](#footnote-ref-1)
2. Navigant Consulting, Inc. and GEI Consultants. 2015. *Water/Energy Cost-Effectiveness Analysis. Revised Final Report.* Prepared for the California Public Utilities Commission (CPUC). April. [↑](#footnote-ref-2)
3. California Public Utilities Commission (CPUC). 2015. *Decision 15-09-023 in the Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Investor Owned Utilities and the Water Sector to Promote Water-Energy Nexus Programs (R.13-12-011).*Issued September 25.  [↑](#footnote-ref-3)
4. California Public Utilities Commission (CPUC). 2015. Decision 15-09-023 in the Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Investor Owned Utilities and the Water Sector to Promote Water-Energy Nexus Programs (R.13-12-011). Issued September 25.  [↑](#footnote-ref-4)
5. California Public Utilities Commission (CPUC), Navigant Consulting, Inc., and GEI Consultants. (n.d.) “Water-Energy Calculator. Version 1.05.” [↑](#footnote-ref-5)
6. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9, Table A.9-3. [↑](#footnote-ref-6)
7. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9. [↑](#footnote-ref-7)
8. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9. [↑](#footnote-ref-8)
9. California Public Utilities Commission (CPUC). 2015. Decision 15-09-023 in the Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Investor Owned Utilities and the Water Sector to Promote Water-Energy Nexus Programs (R.13-12-011). Issued September 25.  [↑](#footnote-ref-9)
10. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9, Table A.9-3. [↑](#footnote-ref-10)
11. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9, Table A.9-3. [↑](#footnote-ref-11)
12. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9, Table A.9-3. [↑](#footnote-ref-12)
13. California Public Utilities Commission (CPUC), Navigant Consulting, Inc., and GEI Consultants. (n.d.) “Water-Energy Calculator. Version 1.05.” [↑](#footnote-ref-13)
14. Metropolitan Water District of Southern California (MWD). *2016. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9. [↑](#footnote-ref-14)
15. (no author). (n.d.). “Zip to Hydrologic Region Look-Up Table 170412.xlsx.” [↑](#footnote-ref-15)
16. (no author). (n.d.). “Zip to Hydrologic Region Look-Up Table 170412.xlsx.” [↑](#footnote-ref-16)
17. California Public Utilities Commission (CPUC). *Decision 16-12-047 in the Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Energy Investor Owned Utilities and the Water Sector to Promote Water-Energy Nexus Programs (R.13-12-011).* Issued December 20 [↑](#footnote-ref-17)
18. California Public Utilities Commission (CPUC), Navigant Consulting, Inc., and GEI Consultants. (n.d.) “Water-Energy Calculator. Version 1.05.” [↑](#footnote-ref-18)
19. California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32. [↑](#footnote-ref-19)
20. KEMA, Inc. 2008. "Summary of EUL-RUL Analysis for the April 2008 Update to DEER." Memorandum submitted to Itron, Inc. [↑](#footnote-ref-20)
21. Metropolitan Water District of Southern California (MWD). *2106. Integrated Water Resources Plan. 2015 Update.* Report 1518. January. Appendix 9, Table A.9-3. [↑](#footnote-ref-21)
22. California Public Utilities Commission (CPUC). 2015. *Decision 15-09-023 in the Order Instituting Rulemaking into Policies to Promote a Partnership Framework between Investor Owned Utilities and the Water Sector to Promote Water-Energy Nexus Programs (R.13-12-011).*Issued September 25. OP 7. [↑](#footnote-ref-22)