**Short Form Work Paper WPSDGENRWH1205B**

**Revision 0**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Large Storage Water Heaters with input rating over 75kBtu/h**

**January 1, 2019**

# Large Storage Water Heaters Short Form WP

## Introduction

This short form workpaper documents the Ex-ante data adoptions of both DEER measures definitions and deemed SCG workpaper (WPSCGNRWH120206A-Rev10) cost for Non-Residential Large Storage Water Heaters with rating over 75 kBTU/h. SDG&E created new Technology Cost IDs which are documented in Table 1 below. The cost values for large storage water heaters rated over 75kBTU/h have been adopted from SCG workpaper (WPSCGNRWH120206A-Rev10).

Table 1: Measure IDs with adopted SCG Cost and SDG&E new UEF Technology Cost IDs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Deliver Type: | Down Stream (PreRebDown) | | | |
| SDGE Imp. ID | DEER Msr ID | Msr Cost ID / Value | Std Cost ID / Value | IMC  (Units = Cap-kBTUh) |
| 465474  465475 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p83TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $3.14/unit |
| 463333  465476 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p90TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $10.46/unit |
| Deliver Type: | Upstream (PreRebUp) | | | |
| 465477  465479 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p83TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $3.14/unit |
| 465478  465480 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p90TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $10.46/unit |
| Deliver Type: | Direct Install (DirInstall) | | | |
| 465481  465483 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p83TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $3.14/unit |
| 465482  465484 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p90TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $10.46/unit |
| Deliver Type: | Mid-Stream (NonUpstrm) | | | |
| 465485  465487 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p83TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $3.14/unit |
| 465486  465488 | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | SDG-Stor\_TE-Gas-gte75kBtuh-0p90TE | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $10.46/unit |

**Document Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 06/15/2012 | Kelvin Valenzuela / SDG&E | Adopted WPSCGNRW120026A\_Rev5\_StorageWH\_NonResr-May22.docx, updated May 18, 2012. |
| 1 | 1/1/2019 | Eduardo Reynoso / SDG&E | 1. Proposed abridge short form workpaper for EAR team review.  2. Adopted SCG workpaper (WPSCGNRWH120206A-Rev10) measure technology cost and base cost, in support of the storage water heaters rated over 75kBTU/h.  3. Created new 1/1/2019 start dates to address Resolutions E-4952/4818 new Measure Application Types.  4. Created internal system programing changes to address DEER Energy Impacts associated with certain Building Types and Locations (Climate Zone “CZ”) that do not exist. Refer to Implementation Requirements on page 3 of this workpaper. |

* + 1. **Eligibility Requirements**:
* All large storage water heating units must meet or exceed the thermal efficiency values described in the following measure summary table to participate in the EEBR program.
* NOx emission level of less than 14 nanograms of NOx (calculated as NO2) per joule of heat output or less than or equal to 20 ppm of NOx emissions (at 3% O2, dry)

**Measure Summary Table**

|  |  |  |
| --- | --- | --- |
| ***Measure ID*** | ***Measure Description*** | ***Baseline Description*** |
| NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | Tier 1  Large Storage Water heater with input rating greater than 75 kBTUh and/or one of the following  • Thermal Efficiency greater than 83%  • UEF ≥ .48 for Medium Draw Units  • UEF ≥ .56 for High Draw Units | Large Gas Storage Water Heater, Et = 0.80, Stdby Loss = 0.56%/hr |
| NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | Tier 2  Large Storage Water heater with input rating greater than 75 kBTUh and/or one of the following  • Thermal Efficiency greater than 90%  • UEF ≥ .76 for Medium Draw Units  • UEF ≥ .80 for High Draw Units | Large Gas Storage Water Heater, Et = 0.80, Stdby Loss = 0.56%/hr |

Implementation Requirements

* + - 1. The rebate applies to gas-for-gas equipment replacements on normal replacement (or burnout) to new installations.
      2. This measure is applicable to any commercial domestic (or “service”) hot water application.
      3. This Workpaper does not cover water heaters used for space conditioning, process end-use applications, pools, or spas.
      4. Applicable commercial building/business types include (but are not limited to) offices, restaurants, retail stores, schools, colleges, hotels, motels, and recreational facilities.
      5. This measure is not limited to specific NAICS codes.
      6. This measure includes replacing a storage water heater with a storage water heater or new construction storage water heater to an existing building.
      7. This workpaper has savings values for many commercial and industrial building types. Non-Residential building types and or locations (climate zones) that are not explicitly included within the ex-ante submission impact table shall use a best available Building type and Location designation. For example, DEER Energy Impact ID “

NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et” (Qualifier = DEER\_for\_2014) does not support Energy Impacts for the following PA, building type, and locations combinations:

|  |  |  |  |
| --- | --- | --- | --- |
| PA | Building Type | Building Vintage | Location |
| SDG | ECC | Ex | 15 |
| SDG | EUn | Ex | 15 |
| SDG | Hsp | Ex | 15 |
| SDG | Nrs | Ex | 15 |
| SDG | WRf | Ex | 8 |
| SDG | WRf | Ex | 14 |
| SDG | WRf | Ex | 15 |

* + - 1. SDG&E is in the process of simplifying its internal Ex Ante data and tracking data warehouse. Part of that process requires that there be savings values for all potential climate zone (CZ) and building type (BT) combinations for lighting measures. While the DEER data used to develop all of the DEER HVAC, water heating and lighting savings values is mostly complete, there are a few cases where DEER is not complete (or not supported), as demonstrated in the table above. The cases for SDG&E are as follows: CZ 8, CZ14 and CZ 15 are missing WRf values and CZ 15 is missing ECC, EUn, Hsp and WRf. SDG&E proposes to fill-in the missing values with the values from an adjacent climate zone. In the case of WRf in CZ 8, we propose the WRf values from CZ 6. Similarly, for CZ 14, we propose to fill-in the missing values from CZ 10. For CZ 15’s missing values, we propose to use values from CZ 14 except for WRf where the values would come from the CZ 10 DEER data, since the CZ 14 is missing WRf data is also missing. We believe that this approach is very conservative as the majority of customers are located in CZ 7 and 10 where the DEER data is 100% complete. Also, SDG&E has only a few dozen nonresidential customers in CZ 15 (Borrego Springs) and the missing building types are generally associated with more populous areas (e.g., community college/university).

To further demonstrate building type and location (CZ) associated with CZ15 (Borrego Springs), the Borrego Medical Clinic (URL: <http://www.borregohealth.org/borrego-medical-clinic> ) 4343 Yaqui Pass Road Borrego Springs, CA 92004 offers Primary Care, Urgent Care and other Specialty Care service that would classify it as a Hospital or Nursing Care building type (versus Office Large/Small “OfL”/“OfS”) but DEER savings impacts for these building types and location (CZ) does not exist (or supported).

* + - 1. Proposed remedy for missing Building Type and Location (CZ) and referencing adjacent location (CZ). Given that the impacts for these already exist we don’t see a need to submitting existing DEER data and consider this an internal system reporting update that will result in insignificant reporting claims.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| PA | Building Type | Building Vintage | Missing Location | Adjacent Location to be used for claims reporting |
| SDG | ECC | Ex | 15 | 14 |
| SDG | EUn | Ex | 15 | 14 |
| SDG | Hsp | Ex | 15 | 14 |
| SDG | Nrs | Ex | 15 | 14 |
| SDG | WRf | Ex | 8 | 6 |
| SDG | WRf | Ex | 14 | 10 |
| SDG | WRf | Ex | 15 | 10 |

Documentation Requirements

* + - 1. The manufacturer’s name and equipment model number must be provided.
      2. If necessary, customer must provide proof of unit efficiency (e.g., manufacturer’s equipment specification sheet).

Terms and Conditions

* + - 1. Only storage water heaters as defined by the California Energy Commission qualify, and they must:
         1. Be used primarily for domestic hot water
         2. Have an input rating of greater than 75,000 kBTU/hour.
         3. Never be used for process end-use.

**Measure Summary**

**Table 1: Measure Summary Table**

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts cost-effectiveness values for large storage water heaters for commercial and indusial applications. The cost values are adopted from SCG’s workpaper as described in the revision history above herein. All measures definitions and savings parameters are adopted from DEER database, as stated herein. |
| **1.1 Measure & Baseline Data** | DEER measure definitions have been modified by the SCG workpaper as noted herein.     |  |  |  |  | | --- | --- | --- | --- | | SDGE Imp. ID | Measure ID | DEER Measures Description | Baseline Description | | Refer to ex-ante table | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p83Et | Large Storage Water heater with input rating greater than 75 kBTUh and/or one of the following  • Thermal Efficiency greater than 83%  • UEF ≥ .48 for Medium Draw Units  • UEF ≥ .56 for High Draw Units | Large Gas Storage Water Heater, Et = 0.80, Stdby Loss = 0.56%/hr | | Refer to ex-ante table | NG-WtrHt-LrgStrg-Gas-gte75kBtuh-0p90Et | Large Storage Water heater with input rating greater than 75 kBTUh and/or one of the following  • Thermal Efficiency greater than 83%  • UEF ≥ .48 for Medium Draw Units  • UEF ≥ .56 for High Draw Units | Large Gas Storage Water Heater, Et = 0.80, Stdby Loss = 0.56%/hr | |
| **1.2 Technical Description** | DEER Difference Summary   |  |  | | --- | --- | | **DEER Item** | **Used for Workpaper?** | | Modified DEER methodology | No | | Scaled DEER measure | No | | DEER Base Case | Yes | | DEER Measure Case | Yes | | DEER Building Types | Yes | | DEER Operating Hours | Yes | | DEER eQUEST Prototypes | N/A | | DEER Version | DEER 2014 (Qualifier: DEER\_for\_2014) | | Reason for Deviation from DEER | N/A | | DEER Measure IDs Used | |  | | --- | | NG-WtrHt-LrgStrg-Gas-gte75kBtuh—0p83Et  NG-WtrHt-LrgStrg-Gas-gte75kBtuh—0p90Et | | |
| Measures | Per DEER/READI Measures IDs as noted herein above per Revision History |
| Code for All Measures | Adopted from SCG workpaper (WPSCGNRWH120206A-Rev10)  The manufacturing of storage water heaters is federally regulated and have established standards within the California Code of Regulations. Title 20, Section 1605.1(f)[[1]](#endnote-1) shows the current standards for water heaters. For gas fired storage water heaters, units with an input rating greater than 75,000 BTUh, the following standards shown in Table 1 will apply. These standards were rated with thermal efficiency (%) and in maximum standby loss (Btu/hr).      As of December 29, 2016, the Department of Energy developed a final ruling within the Federal Register which has changed the way that all residential and some commercial water heating technology would be rated. All water heaters within the scope of the ruling will no longer be rated with the Energy Factor (EF), thermal efficiency, or standby loss but now be using the Uniform Energy Factor (UEF). The UEF is the DOE’s newly developed metric for communicating the energy efficiency of water heaters. UEF ratings are determined by assigning water heaters into one of four different categories of hot water usage and then evaluating their performance based on that usage. These categories are based on draw pattern and differ by the labels *very small, low, medium,* and *high*. This allows water heaters to be compared more easily between different types (i.e. Storage and Tankless), so long as they are being compared within those same bins. The final ruling from the Federal Register dated on December 29, 2016. The ruling contains the following table that can be referenced when evaluating the UEF of units that coincide with the current code standards of Title 20 for water heaters.  **Table 3: Equations to Convert Current Title 20 Code to UEF**    The final ruling also contains tables that define what is meant by the draw patterns of very small, low, medium, and high.  Section 429.17 (B) Determine the applicable draw pattern as follows:  (1) For consumer gas-fired water heaters, consumer oil-fired water heaters, consumer electric water heaters, tabletop water heaters, grid enabled water heaters, residential-duty commercial gas water heaters, residential-duty commercial oil filed water heaters: Use the New FHR (First Hour Rating) to select the applicable draw pattern from the table in this paragraph:  **Table 4: Storage Water Heater Draw Patterns**    (2) For instantaneous gas-fired water heaters, instantaneous electric water heaters, and residential-duty commercial electric instantaneous water heaters: Use New Max GPM to select the applicable draw pattern from the table in this paragraph:  **Table 5: Instantaneous Water Heater Draw Patterns** |
| **1.3 Installation Type and Delivery Mechanisms** | **Delivery Method Descriptions**   |  |  | | --- | --- | | **Delivery Method** | **Description** | | Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. | | New Construction | The program offers financial incentives and/or design assistance to customers involved with new building construction. This is intended is to motivate customer to exceed Title 24 building energy efficiency requirements (residential or nonresidential). |   **Incentive Method Descriptions**   |  |  | | --- | --- | | **Incentive Method** | **Description** | | Down-Stream Incentive | The customer installs qualifying energy efficient equipment and submits an incentive application to the utility program. Upon application approval, the utility program pays an incentive to the customer. Such an incentive may be deemed or customized. | | Mid-Stream Incentive | The program gives a financial incentive to a midstream market actor, such as a retailer or contractor, to encourage the promotion of efficient measures. The incentive may or may not be passed on to the end-use customer. | | Up-Stream Incentive | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, to encourage the manufacture, provision, or distribution of an efficient measure. The incentive may or may not be passed on to the end-use customer. | | Direct Install (DirInstall) | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. | |
| Installation Type | **Installation Type Descriptions**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Installation Type** | **Savings** | | **Life** | | | 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL | | Replace on Burnout (ROB)  (expiry date = 12/31/2018)  Normal Replacement (NR)  (start date = 1/1/2019) | Above Code or Standard | N/A | EUL | N/A | | New Construction (NEW/NC) | Above Code or Standard | N/A | EUL | N/A | |
| Delivery Mechanisms |  |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio | Com – Default>2yrs  SDG&E is using the default as there is no other applicable NTGD |
| Installation Rate | The IR values were obtained using the DEER READI tool. The relevant IR values for the measures in this work paper are in the table below.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **GSIA ID** | **Description** | **Sector** | **BldgType** | **ProgDelivID** | **GSIAValue** | | Def-GSIA | Default GSIA values | Any | Any | Any | 1 | |
| Effective and Remaining Useful Life | The EUL and RUL values were obtained using the DEER READI tool. DEER defines the RUL as 1/3 of the EUL value. The RUL value is only applicable to the first baseline period for an RET measure with an applicable code baseline. The relevant EUL and RUL values for the measures in this work paper are in the table below.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **EUL ID** | **Description** | **Sector** | **UseCategory** | **EUL (Years)** | **RUL (Years)** | | WtrHt-Com | Commercial Water Heater | Com | SHW | 15 | 0 | |
| **Section 2. Calculation Methodology** | Measures will be processed using DEER Measure/Impact ID by building type and Building Location. All will be processed and claimed using “Existing” vintage. |
| Energy Savings/Peak Demand Reduction – All Measures | All Energy Impacts per DEER Measure IDs noted herein above.  **Table 6: Average Large Tier UEF Values**   |  |  |  | | --- | --- | --- | |  | Tier 1 (>= 83% TE) | Tier 2 (>= 90% TE) | | Average Medium Draw UEF | **0.48** | **0.63** | | Average High Draw UEF | **0.56** | **0.72** | |
| **Section 3. Load Shapes** | ElecImpProfile: SDGE:35-OTI-OtherIndustrial-PROC\_OTH  Gas: Annual |
| **Section 4. Costs** |  |
| Base Cost | |  |  |  |  | | --- | --- | --- | --- | | SDG&E Impl. ID | Base Cost ID | Base Cost Value | Units | | Ex-ante submission | SDG-Stor\_TE-Gas-gte75kBtuh-0.80TE\_BASE | $ 42.35 | Cap-kBTUh | |
| Measure Cost | |  |  |  |  |  | | --- | --- | --- | --- | --- | | SDG&E Impl. ID | Measure Cost ID | Msr Cost Value | IMC | Units | | Ex-ante submission | SDG-Stor\_TE-Gas-gte75kBtuh-0p83TE | $ 45.49 | $ 3.14 | Cap-kBTUh | | Ex-ante submission | SDG-Stor\_TE-Gas-gte75kBtuh-0p90TE | $ 52.81 | $ 10.46 | Cap-kBTUh | |

1. Department of Energy. (Revised 2018, May). California Code of Regulations, Title 20; Retrieved From <http://www.energy.ca.gov/title20/> [↑](#endnote-ref-1)