Short Form Work Paper WPSDGENRCC0004

**Revision 5**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Commercial Ice Machines**

**January 2, 2018**

# SDG&E Commercial Oven-Electric and Gas

## Introduction

This short form workpaper documents (WP) the values adopted from PGE’s WP entitled “Commercial Ice Machines” (PGECOFST108 R6 Comm Ice Machines). SDG&E adopts all of the values in PGECOFST108 R6, with some exceptions:

## Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 10/13/2014 | Charles Harmstead / SDGE | Converted to SDGE workpaper from PGE work paper. PGECOFST108 Revision 1 dated January 1, 2008 |
| 1 | 10/15/2010 | Lucie Sidibe/SDG&E | NTG was updated to reflect DEER 2008  Saving was corrected |
| 2 | 06/24/2012 | Peter Ford / SDGE | NTG was updated to reflect DEER 2011 (removed reference sentence from pg. v, August 28, 2012) |
| 2.1 | 06/30/2014 | Kyle Dunn / MWE2 LLC | INTERNAL REVISION ONLY – no material changes made  1. Updated to new workpaper format.  2. Generated calculation spreadsheet based on IOU statewide Calculation Template output, with additional columns and non-CZ cost factor adjustments.  3. Updated EUL ID and EUL per DEER 2014 |
| 4 | 12/28/16 | Kelvin Valenzuela/SDG&E | Adoption from PGE’s PGECOFST108 R5 Comm Ice Machines.docx for Ex-Ante impacts and cost-effectiveness values. |
| 5 | 1/02/18 | Joshua Williams / SDG&E | Updated base case to reflect the DOE 2018 Commercial Ice Machine requirements and measure case to reflect ENERGY STAR V3.0 requirements for Commercial Ice Machines.   1. Adoption from PGE’s PGECOFST108 R6 Comm Ice Machines.docx for Ex-Ante impacts and cost-effectiveness values. 2. SDG&E will be adopting the PGE’s PGECOFST108 R6 Comm Ice Machines.docx, Combined Weighted Energy Reduction (kWh/yr) and the Combined Weighted Average Demand (kW) Savings |

## Measure Summary

Table : Measure Summary Table

| **Section** | **Value** |
| --- | --- |
| **Summary & Purpose** | This short form workpaper documents ex-ante load impacts and cost-effectiveness values for Commercial Ice Machines. The base energy consumption and measure energy consumption values are from PG&E’s workpaper, PGECOFST108, Revision 6. |
| **1.1 Measure & Baseline Data** | Measure:   |  |  |  |  | | --- | --- | --- | --- | | **SDG&E Measure ID** | **Measure Descriotion** | **SDG&E Measures ID** | **Deliv. Type** | |  | | | | | 464053 | Food Service - IceMach-Commercial Ice Machines SCU <110 lbs/day | WPSDGENRCC0004-Rev04-Msr001 | NC | | 464054 | Food Service - IceMach-Commercial Ice Machines SCU <110 lbs/day | WPSDGENRCC0004-Rev04-Msr001 | ROB | | 464055 | Food Service - IceMach-Commercial Ice Machines SCU 110-200 lbs/day | WPSDGENRCC0004-Rev04-Msr002 | NC | | 464056 | Food Service - IceMach-Commercial Ice Machines SCU 110-200 lbs/day | WPSDGENRCC0004-Rev04-Msr002 | ROB | | 464057 | Food Service - IceMach-Commercial Ice Machines SCU >200 lbs/day | WPSDGENRCC0004-Rev04-Msr003 | NC | | 464058 | Food Service - IceMach-Commercial Ice Machines SCU >200 lbs/day | WPSDGENRCC0004-Rev04-Msr003 | ROB | | **Ice Maker Head (IMH)** | | | | | 464059 | Food Service - IceMach-Commercial Ice Machines IMH <300 lbs/day | WPSDGENRCC0004-Rev04-Msr004 | NC | | 464060 | Food Service - IceMach-Commercial Ice Machines IMH <300 lbs/day | WPSDGENRCC0004-Rev04-Msr004 | ROB | | 464061 | Food Service - IceMach-Commercial Ice Machines IMH 300 to 799 lbs/day | WPSDGENRCC0004-Rev04-Msr005 | NC | | 464062 | Food Service - IceMach-Commercial Ice Machines IMH 300 to 799 lbs/day | WPSDGENRCC0004-Rev04-Msr005 | ROB | | 464063 | Food Service - IceMach-Commercial Ice Machines IMH 800 to 1499 lbs/day | WPSDGENRCC0004-Rev04-Msr006 | NC | | 464064 | Food Service - IceMach-Commercial Ice Machines IMH 800 to 1499 lbs/day | WPSDGENRCC0004-Rev04-Msr006 | ROB | | 464065 | Food Service - IceMach-Commercial Ice Machines IMH >1500 lbs/day | WPSDGENRCC0004-Rev04-Msr007 | NC | | 464066 | Food Service - IceMach-Commercial Ice Machines IMH >1500 lbs/day | WPSDGENRCC0004-Rev04-Msr007 | ROB | |  | | | | | 464067 | Food Service - IceMach-Commercial Ice Machines RCU <988 lbs/day | WPSDGENRCC0004-Rev04-Msr008 | NC | | 464068 | Food Service - IceMach-Commercial Ice Machines RCU <988 lbs/day | WPSDGENRCC0004-Rev04-Msr008 | ROB | | 464069 | Food Service - IceMach-Commercial Ice Machines RCU 988 or greater lbs/day | WPSDGENRCC0004-Rev04-Msr009 | NC | | 464069 | Food Service - IceMach-Commercial Ice Machines RCU 988 or greater lbs/day | WPSDGENRCC0004-Rev04-Msr009 | ROB | |
| **1.2 Technical Description** |  |
| Measures | Table 1 ENERGY STAR V3.0 Program Requirements for Batch Type Automatic Commercial Ice Makers   |  |  |  |  | | --- | --- | --- | --- | | Equipment Type | Ice Harvest Rate  (lbs. ice/24 hrs.) | Maximum Energy Use  (kWh/100 lbs. ice) | Potable Water Use limit (gal/100b ice) | | Ice Maker Head (IMH) | H\* < 300 | 9.20 – 0.01134 x H\* | ≤20 | | 300 ≤ H\* < 800 | 6.49 – 0.0023 x H\* | | 800 ≤ H\* ≤ 1500 | 5.11 – 0.00058 x H\* | | 1500 ≤ H\* ≤ 4000 | 4.24 | | Remote Condensing Unit (RCU) | H\* < 988 | 7.17 – 0.00308 x H\* | ≤20 | | 988 ≤ H\* ≤ 4000 | 4.13 | | Self-Contained Unit (SCU) | H\* < 110 | 12.57 – 0.0399 x H\* | ≤25 | | 110 ≤ H\* < 200 | 10.56 – 0.0215 x H\* | | 200 ≤ H\* ≤ 4000 | 6.25 |   Table 2 ENERGY STAR V3.0 Program Requirements for Continuous Type Automatic Commercial Ice Makers   |  |  |  |  | | --- | --- | --- | --- | | Equipment Type | Ice Harvest Rate  (lbs. ice/24 hrs.) | Maximum Energy Use  (kWh/100 lbs. ice) | Potable Water Use limit (gal/100b ice) | | Ice Maker Head (IMH) | H\* < 310 | 7.90 – 0.005409 x H\* | ≤15 | | 310 ≤ H\* < 820 | 7.08 – 0.002752 x H\* | | 820 ≤ H\* ≤ 4000 | 4.82 | | Remote Condensing Unit (RCU) | H\* < 800 | 7.76 – 0.00464 x H\* | ≤15 | | 800 ≤ H\* ≤ 4000 | 4.05 | | Self-Contained Unit (SCU) | H\* < 200 | 12.37 – 0.0261 x H\* | ≤15 | | 200 ≤ H\* < 700 | 8.24 – 0.005429 x H\* | | 700 ≤ H\* ≤ 4000 | 4.44 |   \*H = Ice Harvest Rate (IHR) for the commercial ice machine as determined by applying ARI Standard 810. |
| Code for All Measures | ***California Title 20:*** This measure falls under Title 20 of the California Energy Regulations. Under this regulation, the following is required: all commercial ice machines manufactured on or after January 28, 2018 are required to meet the specifications outlined in the Tables 6 and 7 below.  Table Title 20 Energy Efficiency Requirements for Air-Cooled Batch Type Commercial Ice Machines Effective January 28, 2018   |  |  |  |  | | --- | --- | --- | --- | | Equipment Type | Ice Harvest Rate  (lbs. ice/24 hrs.) | Maximum Energy Use  (kWh/100 lbs. ice) | Potable Water Use limit (gal/100b ice) | | Ice Maker Head (IMH) | H\* < 300 | 10 – 0.01233 x H\* | NA | | 300 ≤ H\* < 800 | 7.05 – 0.0025 x H\* | | 800 ≤ H\* < 1500 | 5.55 – 0.00063 x H\* | | 1500 ≤ H\* < 4000 | 4.61 | | Remote Condensing, Not Remote Compressor Unit (RC) | 50 ≤ H\* < 1000 | 7.97 – 0.00342 x H\* | NA | | 1000 ≤ H\* < 4000 | 4.55 | | Remote Condensing, Remote Compressor Unit (RCRC) | H\* < 942 | 7.97 – 0.00342 x H\* | NA | | 942 ≤ H\* < 4000 | 4.75 | | Self-Contained Unit (SCU) | H\* < 110 | 14.79 – 0.0469 x H\* | NA | | 110 ≤ H\* < 200 | 12.42 – 0.02533 x H\* | | 200 ≤ H\* < 4000 | 7.35 |   \*H = Ice Harvest Rate (IHR) for the commercial ice machine as determined by applying AHRI Standard 810.  Table 7 Title 20 Energy Efficiency Requirements for Air-Cooled Continuous Commercial Ice Machines Effective January 28, 2018   |  |  |  |  | | --- | --- | --- | --- | | Equipment Type | Ice Harvest Rate  (lbs. ice/24 hrs.) | Maximum Energy Use  (kWh/100 lbs. ice) | Potable Water Use limit (gal/100b ice) | | Ice Maker Head (IMH) | H\* < 310 | 9.19 – 0.00629 x H\* | NA | | 310 ≤ H\* < 820 | 8.23 – 0.0032 x H\* | | 820 ≤ H\* < 4000 | 5.61 | | Remote Condensing, Not Remote Compressor Unit (RC) | H\* < 800 | 9.7 – 0.0058 x H\* | NA | | 800 ≤ H\* < 4000 | 5.06 | | Remote Condensing, Remote Compressor Unit (RCRC) | H\* < 800 | 9.9 – 0.0058 x H\* | NA | | 800 ≤ H\* < 4000 | 5.26 | | Self-Contained Unit (SCU) | H\* < 200 | 14.22 – 0.03 x H\* | NA | | 200 ≤ H\* < 700 | 9.47 – 0.00624 x H\* | | 700 ≤ H\* < 4000 | 5.1 |   \*H = Ice Harvest Rate (IHR) for the commercial ice machine as determined by applying AHRI Standard 810.  **California Title 24:** This measure does not fall under Title 24 of the California Energy Regulations  **Federal Standards:** DOE has updated federal commercial ice machine regulations in January 2018 which align with California Title 20.  **Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 810 (I-P):** AHRI Standard 810, Performance Rating of Automatic Commercial Ice-Makers, is considered the industry standard for estimating commercial ice machine energy use. The AHRI test data was used to estimate the energy consumption of the base case equipment. |
| Requirements | This specification covers both batch type machines which include cubed and half cubed ice machines, and continuous machines which include flake and nugget ice machines. Performance data is based on testing to Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 810[[1]](#endnote-1). Only air-cooled machines (self-contained, icemaker heads, or remote condensing) are eligible; water-cooled ice machines are excluded. The efficiency specifications must meet the requirements listed for batch machines in Table 1 and Table 2 for continuous machines, per the ENERGY STAR V3.0 Program Requirements for Automatic Commercial Ice Makers. Visit [ahrinet.org](http://www.ahrinet.org/Home.aspx) for product information and testing procedures. To qualify, the entire AHRI tested Ice Making system must be purchased. Remote machines must be purchased with qualifying remote condenser or remote condenser/compressor unit. |
| **1.3 Installation Type and Delivery Mechanisms** |  |
| Installation Type | New Construction (NC) , Replace on Burn-out (ROB) |
| Delivery Mechanisms | Downstream Rebate – Deemed  NOTE: Measures are offered in the SDG&E Direct Install program yet require a customer co-pay and are treated as downstream deemed. |
| **1.4.1 DEER Data** |  |
| Net-to-Gross Ratio | Com-Default>2yrs; NTG kWh : 0.6 |
| Effective and Remaining Useful Life | **10 years** (DEER EUL\_ID: Cook-IceMach)  Source: [www.Deeresources.com](http://www.Deeresources.com) |
| **Section 2. Calculation Methodology** | Assumptions that were not taken directly from DEER 2016 are specified in PGE’s PGECOFST108 R6 Comm Ice Machines.docx  **Energy Savings Assumption (ΔW):** The Base case for both existing units and above code savings were taken from the California Energy Commission (CEC) Title 20 regulations for commercial ice machines. As listed in section 1.4.2. Table below details energy savings for each measure code. Measure case requirements were taken from ENERGY STAR V3.0 Program Requirements for Automatic Commercial Ice Makers[[2]](#endnote-2) which became effective on January 28, 2018 to reflect concurrent DOE regulations. |
| Energy Savings/Peak Demand Reduction – All Measures | |  |  |  |  |  | | --- | --- | --- | --- | --- | | **PGE Measure Code** | **SDG&E**  **Implementation ID** | **Measure Description** | **Cost Effectivenss (kWh/yr)** | **Demand Saving (kW)** | | **Self-Contained Unit (SCU)** | | | | | | FS014 | 464053 | Food Service - IceMach-Commercial Ice Machines SCU <110 lbs/day | 344 | 0.035 | | 464054 | Food Service - IceMach-Commercial Ice Machines SCU <110 lbs/day | | FS015 | 464055 | Food Service - IceMach-Commercial Ice Machines SCU 110-200 lbs/day | 497 | 0.051 | | 464056 | Food Service - IceMach-Commercial Ice Machines SCU 110-200 lbs/day | | FS016 | 464057 | Food Service - IceMach-Commercial Ice Machines SCU >200 lbs/day | 745 | 0.077 | | 464058 | Food Service - IceMach-Commercial Ice Machines SCU >200 lbs/day | | **Ice Maker Head (IMH)** | | | | | | FS017 | 464059 | Food Service - IceMach-Commercial Ice Machines IMH <300 lbs/day | 414 | 0.042 | | 464060 | Food Service - IceMach-Commercial Ice Machines IMH <300 lbs/day | | FS018 | 464061 | Food Service - IceMach-Commercial Ice Machines IMH 300 to 799 lbs/day | 666 | 0.068 | | 464062 | Food Service - IceMach-Commercial Ice Machines IMH 300 to 799 lbs/day | | FS019 | 464063 | Food Service - IceMach-Commercial Ice Machines IMH 800 to 1499 lbs/day | 1178 | 0.121 | | 464064 | Food Service - IceMach-Commercial Ice Machines IMH 800 to 1499 lbs/day | | FS020 | 464065 | Food Service - IceMach-Commercial Ice Machines IMH >1500 lbs/day | 1553 | 0.16 | | 464066 | Food Service - IceMach-Commercial Ice Machines IMH >1500 lbs/day | | **Remote Condensing Unit (RCU)** | | | | | | FS021 | 464067 | Food Service - IceMach-Commercial Ice Machines RCU <988 lbs/day | 1319 | 0.135 | | 464068 | Food Service - IceMach-Commercial Ice Machines RCU <988 lbs/day | | FS022 | 464069 | Food Service - IceMach-Commercial Ice Machines RCU 988 or greater lbs/day | 2123 | 0.218 | | 464069 | Food Service - IceMach-Commercial Ice Machines RCU 988 or greater lbs/day | |
| **Section 3. Load Shapes** | SDG:35-OTI-OtherIndustrial-PROC\_OTH  Annual |
| **Section 4. Costs** |  |
| **Section 4.1 Base and Measure Costs** |  |
| Base Cost |  |
| StdCostID 1: | $1,898 (PG&E FS014) |
| StdCostID 2: | $2,219 (PG&E FS015) |
| StdCostID 3: | $2,806 (PG&E FS016) |
| StdCostID 4: | $2,489 (PG&E FS017) |
| StdCostID 5: | $3,411 (PG&E FS018) |
| StdCostID 6: | $5,132 (PG&E FS019) |
| StdCostID 7: | $6,314 (PG&E FS020) |
| StdCostID 8: | $4,995 (PG&E FS021) |
| StdCostID 9: | $6,390 (PG&E FS022) |
| Measure Cost |  |
| Measure 1: | $2,050 (PG&E FS014) |
| Measure 2: | $2,397 (PG&E FS015) |
| Measure 3: | $3,030 (PG&E FS016) |
| Measure 4: | $2,689 (PG&E FS017) |
| Measure 5: | $3,684 (PG&E FS018) |
| Measure 6: | $5,542 (PG&E FS019) |
| Measure 7: | $6,819 (PG&E FS020) |
| Measure 8: | $5,394 (PG&E FS021) |
| Measure 9: | $6,901 (PG&E FS022) |
| Section 5. Measures to Be Retired | Measure:  402013 - Ice Machines 101-200 lbs/day  402014 - Ice Machines 201-300 lbs/day  402015 - Ice Machines 301-400 lbs/day  402016 - Ice Machines 401-500 lbs/day  402017 - Ice Machines 501-1000 lbs/day  402018 - Ice Machines 1001-1500 lbs/day  402019 - Ice Machines >1500 lbs/day |

1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 810 (I-P) 2016 *Performance Rating of Automatic Commercial Ice-Makers*, <http://www.ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_810_I-P-2016.pdf> [↑](#endnote-ref-1)
2. ENERGY STAR V3.0 Program Requirements For Automatic Commercial Ice Makers

   <https://www.energystar.gov/sites/default/files/Final%20V3.0%20ACIM%20Specification%205-17-17_1.pdf> [↑](#endnote-ref-2)