Work Paper SCE17AP009

**Revision 0**

**Southern California Edison**

**Smart/Connected Refrigerator**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | See Section 1. |
| **Measure Description** | Refrigerator listed by Energy Star with Connected functionality |
| **Base Case Description** | Refrigerator that meets the federal efficiency standards |
| **Units** | Refrigerator |
| **Energy Savings** | Refer to Excel Calculation Attachment 2 |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 3 |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment 3 |
| **Effective Useful Life** | Appl-ESRefg: 14 years |
| **Measure Installation Type** | Replace on Burnout (ROB) |
| **Net-to-Gross Ratio** | All-Default<=2yrs: 0.7 |
| **Important Comments** | This work paper has a complementary Ex Ante Database data set that will be provided in a separate submission to the California Public Utilities Commission (CPUC). |

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Rev** | **Date** | **Author** | **Summary of Changes** |
| 0 | 12/21/16 | Colman Snaith, TRC | * New calculation template for 2017 program year * This is a new work paper based on SCE13AP001.3 * Added Measure Names and Measure Codes for Connected refrigerators * Modified eligibility criteria for ENERGY STAR Connected functionality * Measure costs updated to reflect Connected refrigerators |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
|  |  |  |  |  |  |

Cal TF website: <http://www.caltf.org/>

# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

This workpaper details the savings associated with the installation of an Energy Star Connected refrigerator. Over the last few years, Energy Star began adopting optional Connected criteria for appliances that are capable of receiving and responding to utility-sourced grid condition signals. If a manufacturer meets the criteria, they receive a Connected designation in the Energy Star products database. The Connected refrigerator energy performance is compared against the minimum DOE federal energy standard; it does not include any demand or energy savings directly related to the Connected functionality, thought this may be explored in future updates. This measure is intended to address energy management technology program offering requirements of AB 793 [A].

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Refrigerator listed by Energy Star with the Connected functionality as defined in Attachment 8 |
| Existing Condition | N/A |
| Code/Standard | Refrigerator that meets the federal efficiency standards |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |
| --- | --- |
| **Measure Codes** | **Measure Name** |
| AP-18713 | Connected Energy Star with no Freezer (11 - 23 ft3) Refrigerator |
| AP-18747 | Connected Energy Star Bottom Mount Freezer, with Ice - Large (16.5 ft3 or greater) Refrigerator |
| AP-18749 | Connected Energy Star Top Mount Freezer, no Ice - Large (20 ft3 or greater) Refrigerator |
| AP-18716 | Connected Energy Star Side Mount Freezer, no Ice - Medium (15-23 ft3) Refrigerator |
| AP-18717 | Connected Energy Star Side Mount Freezer, no Ice - Large (23 ft3 or greater) Refrigerator |
| AP-18718 | Connected Energy Star Side Mount Freezer, with Ice - Medium (15-23 ft3) Refrigerator |
| AP-18719 | Connected Energy Star Side Mount Freezer, with Ice - Large (23 ft3 or greater) Refrigerator |
| AP-18750 | Connected ES Most Efficient Bottom Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18751 | Connected ES Most Efficient Bottom Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator |
| AP-18722 | Connected ES Most Efficient Bottom Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18752 | Connected ES Most Efficient Bottom Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator |
| AP-18724 | Connected ES Most Efficient Top Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18725 | Connected ES Most Efficient Top Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator |
| AP-18753 | Connected ES Most Efficient Top Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18727 | Connected ES Most Efficient Top Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator |
| AP-18728 | Connected ES Most Efficient Side Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18729 | Connected ES Most Efficient Side Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator |
| AP-18730 | Connected ES Most Efficient Side Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator |
| AP-18731 | Connected ES Most Efficient Side Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator |

**Eligibility Requirements**

Customer must have electricity distributed by SCE to the installation address.

Energy Star Mid- and Full-Sized Refrigerators

* Must be on the ENERGY STAR qualifying list for relevant rebate.
* Must be listed with Connected functionality by ENERGY STAR.
* Refrigerators must be 11 cubic feet or greater.
* Keg/beverage centers and wine coolers/chillers do not qualify.

Energy Star Most Efficient Full-Sized Refrigerators

Note: While Connected refrigerators are not yet commercially available for this product class, we anticipate they will become available in the near future as the market matures

* Must be on the ENERGY STAR qualifying list and be indicated as meeting the ENERGY STAR Most Efficient criteria.
* Must be listed with Connected functionality by ENERGY STAR.
* Refrigerators must be 18.1 cubic feet or greater.
* Keg/beverage centers and wine coolers/chillers do not qualify.

Market Applicability

* Building types:

Residential Single Family,

Residential Multi-family,

Residential Mobile Home - Double-Wide

* All SCE climate zones

## 1.2 Technical Description

Qualifying refrigerators are more efficient due to improvements in insulation and compressors. The Connected functionality allows for energy consumption reporting, status messaging, delaying defrost outside of peak periods, and demand response. All refrigerator models must meet the size requirements mentioned in each of the measure names.

## 1.3 Installation Types and Delivery Mechanisms

The installation type is:

* Replace-on-Burnout (ROB).

The delivery mechanism is:

* Financial Support: Down-Stream Incentive – Deemed.

**Installation Type Descriptions**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Installation Type** | **Savings** | | **Life** | |
| 1st Baseline (BL) | 2nd BL | 1st BL | 2nd BL |
| Replace on Burnout (ROB) | Above Code or Standard | N/A | EUL | N/A |

A delivery mechanism is a delivery method paired with an incentive method. Delivery mechanisms are used by programs to obtain program participation and energy savings.

**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. |

**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. |

## 1.4 Measure Parameters

### 1.4.1 DEER Data

SCE’s size requirements for refrigerators do not exactly align with DEER measures. Therefore, the rated energy savings obtained from the DOE equations are multiplied by DEER basis factors to obtain claimed savings for SCE’s size ranges. See Section 2 for more details.

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes (DOE) |
| Scaled DEER measure | Yes |
| DEER Base Case | No |
| DEER Measure Case | No |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | No |
| DEER Version | DEER 2017, READI v2.4.7 |
| Reason for Deviation from DEER | DEER assumes different size ranges and efficiency levels. |
| DEER Measure IDs Used | N/A |

**Net-to-Gross Ratio**

The NTG values were obtained using the DEER READI tool v2.4.7. The relevant NTG values for the measures in this work paper are in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| All-Default<=2yrs | All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years | Res | Any | Any | 0.7 |

**Spillage Rate**

Spillage rates are not tracked in work papers; they are tracked in an external document which will be supplied to the Commission Staff.

**Installation Rate**

The IR values were obtained using the DEER READI tool v2.4.7. 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 v2.4.7. 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)** |
| Appl-ESRefg | High Efficiency Refrigerator | Res | AppPlug | 14 | 4.7 |

### 1.4.2 Codes and Standards Analysis

**Title 20 2016 [508]:** These measures fall under Section 1605.1 of Title 20 of the California Energy Regulations. These State Standards are based on the Federal Regulations for Refrigerators (see “Federal Standards” below).

**Title 24 2016 [496]:** These measures do not fall under Title 24 of the California Energy Regulations.

**Federal Standards** (Attachment 4): These measures fall under Federal DOE regulations. The National Appliance Energy Conservation Act (NAECA) Title 10; Chapter II, Subchapter D; Part 430, Subpart C, §430.32 dictates minimum energy consumption standards for both commercial and non-commercial refrigerators and freezers. These standards are as follows:

|  |  |  |
| --- | --- | --- |
| **Product Class** | **Equations for Maximum Energy Use (kWh/yr)** | |
|  | Based on AV (cu ft) | Based on av (L) |
| 1. Refrigerator-freezers and refrigerators other than all-refrigerators with manual defrost. | 7.99AV + 225.0 | 0.282av + 225.0 |
| 1A. All-refrigerators—manual defrost. | 6.79AV + 193.6 | 0.240av + 193.6 |
| 2. Refrigerator-freezers—partial automatic defrost | 7.99AV + 225.0 | 0.282av + 225.0 |
| 3. Refrigerator-freezers—automatic defrost with top-mounted freezer without an automatic icemaker. | 8.07AV + 233.7 | 0.285av + 233.7 |
| 3-BI. Built-in refrigerator-freezer—automatic defrost with top-mounted freezer without an automatic icemaker. | 9.15AV + 264.9 | 0.323av + 264.9 |
| 3I. Refrigerator-freezers—automatic defrost with top-mounted freezer with an automatic icemaker without through-the-door ice service. | 8.07AV + 317.7 | 0.285av + 317.7 |
| 3I-BI. Built-in refrigerator-freezers—automatic defrost with top-mounted freezer with an automatic icemaker without through-the-door ice service. | 9.15AV + 348.9 | 0.323av + 348.9 |
| 3A. All-refrigerators—automatic defrost. | 7.07AV + 201.6 | 0.250av + 201.6 |
| 3A-BI. Built-in All-refrigerators—automatic defrost. | 8.02AV + 228.5 | 0.283av + 228.5 |
| 4. Refrigerator-freezers—automatic defrost with side-mounted freezer without an automatic icemaker. | 8.51AV + 297.8 | 0.301av + 297.8 |
| 4-BI. Built-In Refrigerator-freezers—automatic defrost with side-mounted freezer without an automatic icemaker. | 10.22AV + 357.4 | 0.361av + 357.4 |
| 4I. Refrigerator-freezers—automatic defrost with side-mounted freezer with an automatic icemaker without through-the-door ice service. | 8.51AV + 381.8 | 0.301av + 381.8 |
| 4I-BI. Built-In Refrigerator-freezers—automatic defrost with side-mounted freezer with an automatic icemaker without through-the-door ice service. | 10.22AV + 441.4 | 0.361av + 441.4 |
| 5. Refrigerator-freezers—automatic defrost with bottom-mounted freezer without an automatic icemaker. | 8.85AV + 317.0 | 0.312av + 317.0 |
| 5-BI. Built-In Refrigerator-freezers—automatic defrost with bottom-mounted freezer without an automatic icemaker. | 9.40AV + 336.9 | 0.332av + 336.9 |
| 5I. Refrigerator-freezers—automatic defrost with bottom-mounted freezer with an automatic icemaker without through-the-door ice service. | 8.85AV + 401.0 | 0.312av + 401.0 |
| 5I-BI. Built-In Refrigerator-freezers—automatic defrost with bottom-mounted freezer with an automatic icemaker without through-the-door ice service. | 9.40AV + 420.9 | 0.332av + 420.9 |
| 5A. Refrigerator-freezer—automatic defrost with bottom-mounted freezer with through-the-door ice service. | 9.25AV + 475.4 | 0.327av + 475.4 |
| 5A-BI. Built-in refrigerator-freezer—automatic defrost with bottom-mounted freezer with through-the-door ice service. | 9.83AV + 499.9 | 0.347av + 499.9 |
| 6. Refrigerator-freezers—automatic defrost with top-mounted freezer with through-the-door ice service. | 8.40AV + 385.4 | 0.297av + 385.4 |
| 7. Refrigerator-freezers—automatic defrost with side-mounted freezer with through-the-door ice service. | 8.54AV + 432.8 | 0.302av + 432.8 |
| 7-BI. Built-In Refrigerator-freezers—automatic defrost with side-mounted freezer with through-the-door ice service. | 10.25AV + 502.6 | 0.362av + 502.6 |
| 8. Upright freezers with manual defrost. | 5.57AV + 193.7 | 0.197av + 193.7 |
| 9. Upright freezers with automatic defrost without an automatic icemaker. | 8.62AV + 228.3 | 0.305av + 228.3 |
| 9I. Upright freezers with automatic defrost with an automatic icemaker. | 8.62AV + 312.3 | 0.305av + 312.3 |
| 9-BI. Built-In Upright freezers with automatic defrost without an automatic icemaker. | 9.86AV + 260.9 | 0.348av + 260.9 |
| 9I-BI. Built-in upright freezers with automatic defrost with an automatic icemaker. | 9.86AV + 344.9 | 0.348av + 344.9 |
| 10. Chest freezers and all other freezers except compact freezers. | 7.29AV + 107.8 | 0.257av + 107.8 |
| 10A. Chest freezers with automatic defrost. | 10.24AV + 148.1 | 0.362av + 148.1 |
| 11. Compact refrigerator-freezers and refrigerators other than all-refrigerators with manual defrost. | 9.03AV + 252.3 | 0.319av + 252.3 |
| 11A.Compact all-refrigerators—manual defrost. | 7.84AV + 219.1 | 0.277av + 219.1 |
| 12. Compact refrigerator-freezers—partial automatic defrost | 5.91AV + 335.8 | 0.209av + 335.8 |
| 13. Compact refrigerator-freezers—automatic defrost with top-mounted freezer. | 11.80AV + 339.2 | 0.417av + 339.2 |
| 13I. Compact refrigerator-freezers—automatic defrost with top-mounted freezer with an automatic icemaker. | 11.80AV + 423.2 | 0.417av + 423.2 |
| 13A. Compact all-refrigerators—automatic defrost. | 9.17AV + 259.3 | 0.324av + 259.3 |
| 14. Compact refrigerator-freezers—automatic defrost with side-mounted freezer. | 6.82AV + 456.9 | 0.241av + 456.9 |
| 14I. Compact refrigerator-freezers—automatic defrost with side-mounted freezer with an automatic icemaker. | 6.82AV + 540.9 | 0.241av + 540.9 |
| 15. Compact refrigerator-freezers—automatic defrost with bottom-mounted freezer. | 11.80AV + 339.2 | 0.417av + 339.2 |
| 15I. Compact refrigerator-freezers—automatic defrost with bottom-mounted freezer with an automatic icemaker. | 11.80AV + 423.2 | 0.417av + 423.2 |
| 16. Compact upright freezers with manual defrost. | 8.65AV + 225.7 | 0.306av + 225.7 |
| 17. Compact upright freezers with automatic defrost. | 10.17AV + 351.9 | 0.359av + 351.9 |
| 18. Compact chest freezers. | 9.25AV + 136.8 | 0.327av + 136.8 |

AV= adjusted volume in cubic feet; av = adjusted volume in liters.

Code Summary

|  |  |  |
| --- | --- | --- |
| **Code** | **Reference** | **Effective Dates** |
| Title 20 (2016) | Section 1605.1(a) | November 2016 |
| DOE | Standards for Residential Refrigerators and Freezers | September 15, 2014 |

## 1.5 EM&V, Market Potential, and Other Studies – Base Case and Measure Case Information

### 1.5.1 Process Evaluation of Southern California Edison’s 2006-2008 Home Energy Efficiency Rebate (HEER) Program

In 2009 KEMA published the *Process Evaluation of Southern California Edison’s 2006-2008 Home Energy Efficiency Rebate (HEER) Program: Final Report* (Attachment 5)*.* SCE offered Energy Star refrigerator rebates through their HEER program in 2006-2008 and offered Energy Star refrigerator rebates for the 2010-2012 program cycle. The KEMA study evaluated customer awareness of, and interest in, the SCE HEER program. This report did not provide information pertinent to the energy savings, NTG, EUL or cost estimates for this workpaper.

### 1.5.1 Refrigerator Market Profile

The EPA’s ENERGY STAR also published a *Refrigerator Market Profile* in 2009 (Attachment 6) to give energy efficiency program designers and policy makers an idea of market opportunities and savings potential for energy efficient refrigerators. The energy savings potential identified in the report was based on the difference in energy consumption between the installed refrigerator base leading up to 2009 and the Energy Star refrigerator specification. The savings potential from this study cannot be easily compared to the savings identified in this workpaper because the workpaper measures estimate the difference in energy consumption between the federal standard for refrigerator energy consumption and a refrigerator that is more efficient than Energy Star. Many refrigerators comprising the installed base in the ENERGY STAR report do not meet current federal standard.

## 1.6 Data Quality and Future Data Needs

No future data needs are anticipated.

# Section 2. Calculation Methodology

## 2.1 Electric Energy Savings Estimation Methodologies

**Energy Star Refrigerators**

DEER 2017 contains savings impacts for standard sized refrigerators in the following size categories: mini, small, medium, large, and very large. However, in order to retain consistency with the non-Connected refrigerator incentive offer (SCE13AP001.3) and the previous program cycle, the IOU measures for standard sized refrigerators are split into at most three size categories (same as DEER 2011): x-large, large, and medium. Therefore, the DEER 2017 impacts are not directly applicable and savings impacts are recalculated with IOU size categories. The following outlines the methodology to crosswalk the DEER 2017 size categories to the IOU size categories.

The average total volume of the size category is taken as the average of the lower and upper range of the applicable size category. The total volume is crosswalked to adjusted volume for the applicable refrigerator type using the methodology in the DOE’s Technical Support Document. Using the adjusted volume, the federal mandated maximum annual unit energy consumption can be derived from the energy standard equations in section 1.4.2. Similarly, the annual unit energy consumption of an Energy Star refrigerator can be calculated by applying the adjusted volume to Energy Star’s equation for determining eligibility. The difference between the federal code UEC and Energy Star UEC is the rated energy savings. The rated energy savings is converted to claimed energy savings by applying DEER basis factors. DEER basis factors are taken from DEER 2014: “RE-Appl-RefgCond-basis”. Below is an example for refrigerators with bottom mounted freezers without icemaker (climate zone 1, >= 16.5 cubic feet):

See Attachment 2 for more details.

**Energy Star Most Efficient Refrigerators**

Savings impacts for Energy Star Most Efficient standard sized refrigerators are calculated the same way as for Energy Star refrigerators except that the total volume is calculated as an average of volumes in the Energy Star qualified products list.

**Connected Refrigerator Allowance**

Connected refrigerators are eligible by the EPA for a temporary 5% allowance on annual energy use, which increases the maximum annual energy consumption. This allowance was intended as a temporary solution to entice manufacturers to participate at the outset of the Connected specification, thus it is ignored and the methodology here is identical to SCE13AP001.3

## 2.2. Demand Reduction Estimation Methodologies

Demand savings are obtained by applying the applicable DEER basis factor for kW savings to the delta between the rated federal code UEC and the rated measure UEC. The DEER basis factors were last updated in DEER 2014.

See Section 2.1 for details.

# Section 3. Load Shapes

The ideal load shape for net benefits estimates would represent the difference between the base case and measure case. The closest load shapes that are applicable to the measures in this work paper are listed in the table below.

Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| **Building Type** | **Load Shape** | **E3 Alternate Building Type** |
| Residential Mobile Home - Double-Wide | DEER:RefgFrzr\_HighEff | RES |
| Residential Multi-family | DEER:RefgFrzr\_HighEff | RES |
| Residential Single Family | DEER:RefgFrzr\_HighEff | RES |

# Section 4. Costs

## 4.1 Base Case Cost

Since the work paper measures do not exactly match DEER2017 measures, the Refrigerator Cost workbook (based on WO017 cost models) was used to calculate work paper costs (see Attachment 3 Refrigerator Costs, tab “RefgFrzr Technology.”) The following costs were out of scope of the cost models and were therefore assigned certain values:

* Measure “Energy Star with no Freezer (11 - 23 ft3) Refrigerator” was assigned the base case cost for “Energy Star Side Mount Freezer, no Ice - Medium (15-23 ft3) Refrigerator”

The labor cost for replacing non-compact models is 1.5 hours at an hourly rate of $48.60 (DEER Labor Rate ID “R-App”), for a total of $72.90.

## 4.2 Measure Case Cost

A spreadsheet of all Energy Star listed refrigerators was extracted from the Energy Star website. All listed refrigerators with Connected functionality were identified and models with similar properties, but not Connected, were also identified. A web survey was performed to determine availability and retail costs.

It was discovered that generally refrigerators with Connected functionality also have additional features when compared to similar non-Connected models. A cost adder of $300 for Connected functionality was determined by calculating the difference between the average cost of Connected refrigerators and the average cost of similar non-Connected refrigerators. See Attachment 3 for more details.

The WO017 cost model (see Refrigerator Costs Attachment 3) was used to calculate non-Connected refrigerator costs and the average cost adder of $300 for Connected functionality was applied to determine work paper costs.

The following costs were out of scope of the cost models and were therefore assigned certain values:

* Measure “Connected Energy Star with no Freezer (11 - 23 ft3) Refrigerator” was assigned the measure case cost for “Connected Energy Star Side Mount Freezer, no Ice - Medium (15-23 ft3) Refrigerator”

The measure labor costs are the same as in the base case.

## 4.3 Full and Incremental Measure Cost

**Full and Incremental Measure Cost Equations**

|  |  |  |  |
| --- | --- | --- | --- |
| **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| ROB | (MEC + MLC) – (BEC + BLC) | (MEC + MLC) – (BEC + BLC) | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

BEC = Base Case Equipment Cost; BLC = Base Case Labor Cost

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Solution Codes** | **Measure** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| AP-18713 | Connected Energy Star with no Freezer (11 - 23 ft3) Refrigerator | $324.00 | $324.00 | N/A |
| AP-18747 | Connected Energy Star Bottom Mount Freezer, with Ice - Large (16.5 ft3 or greater) Refrigerator | $330.00 | $330.00 | N/A |
| AP-18749 | Connected Energy Star Top Mount Freezer, no Ice - Large (20 ft3 or greater) Refrigerator | $322.00 | $322.00 | N/A |
| AP-18716 | Connected Energy Star Side Mount Freezer, no Ice - Medium (15-23 ft3) Refrigerator | $324.00 | $324.00 | N/A |
| AP-18717 | Connected Energy Star Side Mount Freezer, no Ice - Large (23 ft3 or greater) Refrigerator | $328.00 | $328.00 | N/A |
| AP-18718 | Connected Energy Star Side Mount Freezer, with Ice - Medium (15-23 ft3) Refrigerator | $326.00 | $326.00 | N/A |
| AP-18719 | Connected Energy Star Side Mount Freezer, with Ice - Large (23 ft3 or greater) Refrigerator | $331.00 | $331.00 | N/A |
| AP-18750 | Connected ES Most Efficient Bottom Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator | $338.00 | $338.00 | N/A |
| AP-18751 | Connected ES Most Efficient Bottom Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator | $342.00 | $342.00 | N/A |
| AP-18722 | Connected ES Most Efficient Bottom Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator | $352.00 | $352.00 | N/A |
| AP-18752 | Connected ES Most Efficient Bottom Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator | $327.00 | $327.00 | N/A |
| AP-18724 | Connected ES Most Efficient Top Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator | $329.00 | $329.00 | N/A |
| AP-18725 | Connected ES Most Efficient Top Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator | $333.00 | $333.00 | N/A |
| AP-18753 | Connected ES Most Efficient Top Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator | $341.00 | $341.00 | N/A |
| AP-18727 | Connected ES Most Efficient Top Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator | $345.00 | $345.00 | N/A |
| AP-18728 | Connected ES Most Efficient Side Mount Freezer, no Ice - Large (18.1-22.5 ft3) Refrigerator | $337.00 | $337.00 | N/A |
| AP-18729 | Connected ES Most Efficient Side Mount Freezer, no Ice - X-Large (greater than 22.5 ft3) Refrigerator | $339.00 | $339.00 | N/A |
| AP-18730 | Connected ES Most Efficient Side Mount Freezer, with Ice - Large (18.1-22.5 ft3) Refrigerator | $347.00 | $347.00 | N/A |
| AP-18731 | Connected ES Most Efficient Side Mount Freezer, with Ice - X-Large (greater than 22.5 ft3) Refrigerator | $350.00 | $350.00 | N/A |

# Attachments

1. SCE17AP009.0 A1 – Calculation Template\_Final.xlsx
2. SCE17AP009.0 A2 – Refrigerator Savings Calculations.xlsx
3. SCE17AP009.0 A3 – Refrigerator Costs.xlsx
4. SCE17AP009.0 A4 – Code of Federal Regulations.pdf
5. SCE17AP009.0 A5 – SCE\_HEER\_Process\_Evaluation\_Final Report.pdf
6. SCE17AP009.0 A6 – EPA ref\_market\_profile.pdf
7. SCE17AP009.0 A7 – EPA Refrigerators\_and\_Freezers.pdf
8. SCE17AP009.0 A8 – ENERGY STAR Connected Criteria.pdf

# References

1. References\_12122016\_100741.xlsx

[496]

[508]

[A] **Assembly Bill No. 793 (Quirk) Approved 10-8-15.** <https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB793>