Work Paper PGECOAPP119

**Revision 6**

**Program Administrator**

**Refrigerator or Freezer Recycling**

# At-a-Glance Summary

|  |  |
| --- | --- |
| **Measure Codes** | PG&E measure codes: R217, R218, R219, R220  SCE solution codes: AP-76876, AP-87987, AP-54543, AP-65765 |
| **Measure Description** | The measure case is that an old inefficient refrigerator or freezer has been removed and recycled so that it can no longer be used. A new unit may or may not be installed to replace the recycled unit. |
| **Base Case Description** | The base case is that the owner or a transfer recipient continues to operate an old, inefficient refrigerator or freezer in the absence of the program. |
| **Units** | Each |
| **Energy Savings** | Refer to DEER and Excel Calculation Attachment |
| **Full Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Incremental Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Effective Useful Life** | Appl-RecFrzr: RUL = 4 years  Appl-RecRef: RUL = 5 years |
| **Measure Installation Type** | Early Retirement (RET/ER) |
| **Net-to-Gross Ratio** | Res-sAll-mRefgRec: 0.80 for Residential Refrigerators  Res-sAll-mFrzrRec: 0.95 for Residential Freezers |
| **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** |
| Revision 0 | 08/14/08 | Judith Jennings (PG&E) | **Refrigerator or Freezer Recycling PGECOAPP119 R0.doc** |
| Revision 1 | 05/1/09 | Tim Conroy PG&E) | **Refrigerator or Freezer Recycling PGECOAPP119 R1.doc** |
| Revision 2 | 03/10/10 | Tim Conroy PG&E) | **Refrigerator or Freezer Recycling PGECOAPP119 R2.doc** |
| Revision 3 | 4/25/12 | Jenny Roecks (PG&E) | **Refrigerator or Freezer Recycling PGECOAPP119 R3.doc**  Workpaper updates include savings update to DEER 2011 savings (most up to date values) and NTG from DEER 2.05. Incremental cost updated to more accurately reflect program implementation. |
| Revision 4 | 6/25/12 | Jenny Roecks (PG&E) | **PGECOAPP119 Refrigerator or Freezer Recycling R4.doc**  Workpaper updated with new measure codes to 2011 DEER for 2013-2014 program cycle |
| Revision 5/  SCE13AP007.1 | 6/20/2014 | Jack Melnyk/SCE, Jason Wang/SCE | **SCE WP Lead: SCE13AP007.1**  -Work paper updated for the reporting period, effective 7/1/14 – 12/31/14.  -Used DEER 2014 savings values  -Expanded paper to include all 16 climate zones and all 3 IOUs  -Applied a 0.90 multiplier to Non-res kWh gross savings  -Applied exit sign energy interactive effects to Non-res measures |
| Revison 6 | 12/10/2015 | Jia Huang (PG&E) | **PGECOAPP119 Refrigerator or Freezer Recycling R6.doc**  Workpaper updated with new energy savings, NTG values, and costs for DEER 2015, effective 1/1/2016. |

# Commission Staff and Cal TF Comments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rev** | **Party** | **Submittal Date** | **Comment Date** | **Comments** | **WP Developer Response** |
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# Section 1. General Measure & Baseline Data

## 1.1 Measure Description & Background

The measure case is that an old inefficient refrigerator or freezer has been removed and recycled so that it can no longer be used. A new unit may or may not be installed to replace the recycled unit. These two options are not accounted for in separate measures or solutions codes; the savings values simply reflect a weighted average of both these possibilities.

The base case is that the owner or a transfer recipient continues to operate an old, inefficient refrigerator or freezer in the absence of the program.

**Base, Standard, and Measure Cases**

|  |  |
| --- | --- |
| **Case** | **Description of Typical Scenario** |
| Measure | Refrigerator or Freezer Recycling |
| Existing Condition | Old, inefficient refrigerator or freezer |
| Code/Standard | N/A |
| Industry Standard Practice | N/A |

Measures and Codes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure Codes** | | | | **Measure Name** |
| SCG | SDG&E | SCE | PG&E |
|  |  | AP-76876 | R217 | Unit 1 Refrigerator Recycling (Res) |
|  |  | AP- 87987 | R217 | Unit 1 Refrigerator Recycling (Non Res) |
|  |  | AP-76876 | R218 | Unit 2 Refrigerator Recycling (Res) |
|  |  | AP- 87987 | R218 | Unit 2 Refrigerator Recycling (Non Res) |
|  |  | AP-54543 | R219 | Unit 1 Freezer Recycling (Res) |
|  |  | AP-65765 | R219 | Unit 1 Freezer Recycling (Non Res) |
|  |  | AP-54543 | R220 | Unit 2 Freezer Recycling (Res) |
|  |  | AP-65765 | R220 | Unit 2 Freezer Recycling (Non Res) |

Eligible units for this program are consumer refrigerators or freezers of any vintage that are at least 10 cubic feet in size. A customer may receive a rebate for up to two appliances each year.

These measures are available in all climate zones for both residential and non-residential applications.

## 1.2 Technical Description

These measures are offered through the Appliance Recycling Program (ARP). The program prevents continued use of operable yet inefficient refrigerators and freezers in residences and businesses, whether by current owners or potential transfer recipients, by picking up such units and recycling them in an environmentally safe manner. The program also allows commercial customers who use the eligible refrigerators or freezers to participate in the program.

The potential effect of interceding in the market by recycling inefficient refrigerators/freezers is that it encourages people to remove or replace their inefficient units before they become non-operational. It also takes these inefficient units off the resale market, and therefore reduces the inventory of used units that are for sale. If used units are hard to find, customers will be more likely to choose new units, which are typically more efficient.

This work paper also addresses a retailer pickup approach. In this approach, retailers will pick up ARP-qualified refrigerators and freezers upon delivery of new appliances. The ARP vendors then collect those refrigerators and freezers in bulk from the retailer’s warehouse. This approach will reduce the cost of running the program.

## 1.3 Installation Types and Delivery Mechanisms

**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 |
| New Construction (NEW/NC) | Above Code or Standard | N/A | EUL | N/A |
| Retrofit or Early Replacement (RET/ER) | Above Customer Existing | Above Code or Standard | RUL | EUL-RUL |
| Retrofit First Baseline Only (REF) | Above Customer Existing | N/A | EUL | N/A |
| Retrofit Add-on (REA) | Above Customer Existing | N/A | EUL | N/A |

The program type is Retrofit or Early Retirement (RET/ER) because the recycled unit is operable and would continue to be used without this program. This program type is appropriate as the measure is the early replacement of a refrigerator with no 2nd baseline period. There is no second baseline period because the retrofit has no code or standard.

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** |
| Appliance Turn-in and Recycling | The program motivates customers, through financial incentives, to recycle appliances that are functional but inefficient. This prevents the continued use of those appliances, by both the current owner and potential future owners. |
| Audit/Information/Testing Services | The program performs a free assessment of a customer’s facility and provides the customer with information and guidance on energy efficiency opportunities. |
| Commissioning and Retrocommissioning | The program modifies or repairs existing equipment to ensure that it works as intended. |
| Financial Support | The program motivates customers, through financial incentives such as rebates or low interest loans, to implement energy efficient measures or projects. |
| Innovative Design | The program funds new ideas that meet reasonable scientific scrutiny for potential energy savings. These innovative measures typically have small market penetration (less than 5%) or are targeted toward relatively unreached market segments. |
| 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). |
| Partnership | The program implements projects through a partnership between the utility and an institutional, government, or community-based organization. |
| Performance Based | The program offers financial incentives that vary based on the energy efficiency performance of specific projects. |
| Up-Stream Programs | See Up-Stream Incentive and Up-Stream Buy Down in the Incentive Method table. |

**Incentive Method Descriptions**

|  |  |
| --- | --- |
| **Incentive Method** | **Description** |
| Direct Install | The program implements energy efficiency measures for qualifying customers, at no cost to the customer. |
| 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. |
| Up-Stream Buy Down | The program gives a financial incentive to an upstream market actor, such as a manufacturer or distributor, with specific requirements to pass down the incentive to the end use customer. Such an incentive buys-down the cost of an efficient measure for the end-use customer by at least the amount of the financial incentive. |
| Giveaway | The program provides customers with energy efficiency equipment or services for free. |
| Exchange/Replacement | The utility program holds events where customers can trade functional equipment for similar but more energy efficient equipment, free of charge. |
| On-bill Finance/Loan | The program offers financing for the cost an efficient measure as part of the utility bill. This can be an add-on option to an existing program or can serve as an organizing principle for its own program. |

The delivery method for these measures is Appliance Turn-in and Recycling / Down-Stream Incentive – Deemed. The program offers a monetary incentive and a free pickup of each eligible refrigerator or freezer. In a portion of the program quantities, SCE will work in collaboration with retailers to pick up refrigerators in bulk.

## 1.4 Measure Parameters

### 1.4.1 DEER Data

DEER Difference Summary

|  |  |
| --- | --- |
| **DEER Item** | **Used for Workpaper?** |
| Modified DEER methodology | Yes |
| Scaled DEER measure | No |
| DEER Base Case | Yes |
| DEER Measure Case | Yes |
| DEER Building Types | Yes |
| DEER Operating Hours | Yes |
| DEER eQUEST Prototypes | Yes |
| DEER Version | DEER 2015, READI v2.3.0 |
| Reason for Deviation from DEER | DEER does not contain savings impacts for commercial building types. |
| DEER Measure IDs Used | Res-Refrig-ARP, Res-Freezer-ARP |

**Net-to-Gross Ratio**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **NTGR ID** | **Description** | **Sector** | **BldgType** | **Measure Delivery** | **NTGR** |
| Res-sAll-mRefgRec | Refrigerator, Efficiency characteristics of recycled unit | Res | Any | Prescriptive Rebate | 0.8 |
| Res-sAll-mFrzrRec | Freezer, Efficiency characteristics of recycled unit | Res | Any | Prescriptive Rebate | 0.95 |

**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. 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)** |
| Appl-RecRef | Refrigerator Recycling (RUL) | Res | AppPlug |  | 5 |
| Appl-RecFrzr | Freezer Recycling (RUL) | Res | AppPlug |  | 4 |

### 1.4.2 Codes and Standards Analysis

There are no federal, state, or regional code requirements that apply to the prevented use and recycling of refrigerators and freezers.

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

### 1.5.1 Work Order 35: Appliance Recycling Program Impact Evaluation[[1]](#endnote-1)

Work Order 35 (completed October 24, 2014) is an ex-post measurement and verification (EM&V) study of the 2010-2012 Statewide Residential Appliance Recycling Program (ARP). This evaluation effort was conducted by DNV-GL and guided by the California Public Utilities Commission’s Energy Division, in coordination with CPUC internal experts, and the three California IOUs. The study used in-situ metering as well as participant and non-participant acquirer/discarder surveys to assess the net impact of the IOU ARP program. Analyses from Work Order 35 informed savings and net-to-gross impacts for DEER 2015.

## 1.6 Data Quality and Future Data Needs

No additional data needs are expected under the current implementation framework.

# Section 2. Calculation Methodology

The following table indicates which measures are taken directly from or created with the DEER READI tool.

READI Data Used

|  |  |  |
| --- | --- | --- |
| **Measure Code** | **Measure Name** | **READI Data** |
| R217, R218 | Appliance Recycling Program: Refrigerator | Res-Refrig-ARP |
| R219, R220 | Appliance Recycling Program: Freezer | Res-Freezer-ARP |

The savings for the residential measures are taken directly from DEER. For the non-residential measures, the savings are derived from the residential measures using the following steps:

1. Obtain the savings for the “SFm” building type from DEER.
2. Divide the “SFm” savings by the average residential CFL interactive effects, and then multiply the result by the non-residential exit sign interactive effects.
3. Multiply the result calculated in item 2 by 0.9 per Energy Division’s recommendation (see attachment).

See excel file “PGECOAPP119 Supplemental Calculations.xlsx” 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** |
| Any | DEER:RefgFrzr\_HighEff | RES |

# Section 4. Costs

Costs for refrigerator and freezer recycling are included in Work Order 17 2010-2-12 Ex Ante Measure Cost Study. Work Order 17 includes average costs of $78 and $50 for recycling one unit and 2+ units, respectively.

DEER 2015 stipulates the following participant cost to be added to customer incentive and program administrator costs:

*As shown in Table 5 and Table 6 several of the alternative path dispositions include the purchase of a new appliance rather than a used appliance. The percentages range from about 1 percent for PG&E freezers to about 8 percent for SDG&E refrigerators. The incremental cost associated with the purchase of a new appliance versus acquiring a used appliance has never been considered in the participant cost portion for the measure cost calculations used in determining the TRC. In future workpapers, IOUs must add this cost, based on the typical cost of new units with similar features as collected appliances, as a participant cost so that the TRC costs include this participant cost in addition to the program contractor, customer incentive and program administrator costs.*

A top-freezer refrigerator typically sells for around $200 on Craiglist while a similar new refrigerator sells for $550 in Lowes. Thus, the incremental cost of a new vs used refrigerator is estimated to be $350. Only 10% of recycled refrigerators in the program involve the purchase of a new refrigerator, so a participant cost of $35 is added to the IMC. A chest freezer typically sells for about $80 on Craigslist while a similar new chest freezer sells for $230 on Lowes. Thus, the incremental cost of a new vs used freezer is estimated to be $150. Only 4% of recycled freezers in the program involve the purchase of a new freezer, so a participant cost of $6 is added to the IMC. This is summarized in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Measure** | **WO 17 IMC** | **Additional participant cost** | **Total IMC** |
| Unit 1 Refrigerator Recycling | 78 | 35 | 113 |
| Unit 2 Refrigerator Recycling | 50 | 35 | 85 |
| Unit 1 Freezer Recycling | 78 | 6 | 84 |
| Unit 2 Freezer Recycling | 50 | 6 | 56 |

See the “costs” tab in the file “PGECOAPP119 R6 Supplemental Calculations.xlsx” for details.

## 4.1 Base Case Cost

The base case cost for these measures is zero because this is discretionary removal of the customers’ existing equipment.

## 4.2 Measure Case Cost

The customer does not incur any cost for participating in this program. Therefore the measure case cost is zero.

## 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 |
| NEW/NC |
| RET/ER | (MEC + MLC) – (BEC + BLC) | MEC + MLC | (MEC + MLC) – (BEC + BLC) |
| REF | (MEC + MLC) – (BEC + BLC) | MEC + MLC | N/A |
| REA | MEC + MLC | MEC + MLC | N/A |

MEC = Measure Equipment Cost; MLC = Measure Labor Cost

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

**Full and Incremental Costs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure** | **Installation Type** | **Incremental Measure Cost** | **Full Measure Cost** | |
| **1st Baseline** | **2nd Baseline** |
| Unit 1 Refrigerator Recycling | ER | N/A | $113 | $113 |
| Unit 2 Refrigerator Recycling | ER | N/A | $85 | $85 |
| Unit 1 Freezer Recycling | ER | N/A | $84 | $84 |
| Unit 2 Freezer Recycling | ER | N/A | $56 | $56 |

# References

1. KEMA, Inc. (October 24, 2014). Work Order 35: Appliance Recycling Program Impact Evaluation. Retrieved from <http://www.calmac.org/publications/20102012_ARP_Impact_Evaluation_Final_Report.pdf> [↑](#endnote-ref-1)