Refrigerant Avoided Cost Calculator and Fuel-Sub Calculator Technical Guidance

DEER2026 Appendices A-C, only

Refrigerant Emissions, Associated Costs, and Net Emissions for Fuel Substitution Measures

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APPENDIX A. Fuel Substitution Measure Technical Documentation

Appendix A-1: Source Energy Calculations

Part One of the fuel substitution test requires that the fuel substitution measure reduces source energy consumption, expressed in Btus. The life-cycle source energy of a measure is the source energy used over the effective useful life (EUL) of the technology. To pass Part One of the fuel substitution test, the life-cycle source energy consumption of the measure technology must be lower than or equal to the life-cycle source energy consumption of the baseline technology. In other words, fuel substitution measure permutations must yield life-cycle source energy savings that are greater than or equal to zero. This must be demonstrated by passing Part One of the test performed in the fuel substitution calculator (embedded within the RACC-FS_v3.0.xlsx) when creating or updating a fuel-substitution measure package. Briefly, the fuel substitution calculator converts site energy to source energy using yearly source energy factors. The yearly source energy factors are provided herein and were developed based on the 2021 Preferred System Plan adopted in the CPUC Integrated Resource Planning (IRP) proceeding (Rulemaking (R.) 20-05-003) that was used in the 2024 Avoided Cost Calculators (ACCs).

Table 1 lists the source energy factors for electricity over the current and future years—through 2064—and Table 2 lists the source energy factor for natural gas, which remains constant. To calculate the life-cycle source energy savings, the fuel substitution calculator multiplies annual source energy factors from Table 1 and Table 2 (in Btu/kWh and Btu/Therm, respectively, for electricity and natural gas) by the site energy savings for each year of the measure's EUL. Please refer to the equations in Appendix A-1: Source Energy Calculations and Appendix A-2: Emissions Calculations for additional detail on these calculations.

Table A-1. Annual Source Energy and Emissions for Site-level Electricity Usage

Year	Emissions Intensity (metric tonne CO2/MWh)	Source Energy Heat Rate (Btu/kWh)
2023	0.2060	3,873
2024	0.1940	3,656
2025	0.2030	3,821
2026	0.1810	3,415
2027	0.1670	3,142
2028	0.1520	2,869
2029	0.1330	2,511
2030	0.1140	2,153
2031	0.1080	2,039
2032	0.1020	1,926
2033	0.0962	1,812
2034	0.0905	1,705
2035	0.0850	1,602
2036	0.0790	1,488
2037	0.0730	1,375
2038	0.0670	1,261
2039	0.0573	1,079
2040	0.0518	977

Year	Emissions Intensity (metric tonne CO2/MWh)	Source Energy Heat Rate (Btu/kWh)
2041	0.0472	874
2042	0.0431	772
2043	0.0395	670
2044	0.0362	567
2045	0.0247	465
2046	0.0247	363
2047	0.0247	363
2048	0.0247	363
2049	0.0247	363
2050	0.0247	363
2051	0.0247	363
2052	0.0247	363
2053	0.0247	363
2054	0.0247	363
2055*	0.0247	363
2056*	0.0247	363
2057*	0.0247	363
2058*	0.0247	363
2059*	0.0247	363
2060*	0.0247	363
2061*	0.0247	363
2062*	0.0247	363
2063*	0.0247	363
2064*	0.0247	363

* Values extrapolated beyond range of 2024 ACC models for use in RACC-FSC_v3.0.xlsx for some Accelerated Replacement measure applications.

Table A-2. Annual Source Energy and Emissions for Site-level Natural Gas Usage

Year	Emissions Intensity (metric tonne CO2/Therm)	Source Energy Heat Rate (Btu/Therm)
Constant	0.00531	100,000

Using the measure installation year and applying the yearly source energy values from Table 1 and Table 2 (in Btu/kWh and Btu/Therm, respectively, for electricity and natural gas) over the measure's EUL, the **3 FSC** worksheet calculates the life-cycle source energy savings as shown in the equations that follow for the Normal Replacement (NR) and Accelerated Replacement (AR) measure application types.

Equation A-1. Life-cycle source energy savings for Normal Replacement measures

$$Life - cycle\ source\ energy\ savings_{NR} = (1 + l_e) \times \sum_{i=start\ year}^{EUL_{Msr}+start\ year-1} (\Delta\ kWh \times source\ energy_{kWh,i}) + (1 + l_g) \times (\Delta\ Therm \times source\ energy_{Therm} \times EUL_{Msr})$$

Equation A-2. Life-cycle source energy savings for Accelerated Replacement measures

$$Life - cycle\ source\ energy\ savings_{AR} = (1 + l_e) \times \sum_{i=start\ year}^{RUL_{Ext}+start\ year-1} (\Delta\ kWh_{BL1} \times source\ energy_{kWh,i}) + (1 + l_g) \times (\Delta\ Therm_{BL1} \times source\ energy_{Therm} \times RUL_{Ext}) + (1 + l_e) \times \sum_{i=RUL_{Ext}+start\ year}^{EUL_{Msr}+start\ year-1} (\Delta\ kWh_{BL2} \times source\ energy_{kWh,i}) + (1 + l_g) \times (\Delta\ Therm_{BL2} \times source\ energy_{Therm} \times (EUL_{Msr} - RUL_{Ext}))$$

Where:

$Life - cycle\ source\ energy\ savings_{NR}\ [Btu]$ = Source energy savings for Normal Replacement (NR) Measure application type over the life of the measure.

$l_e\ [percent\ of\ source\ energy]$= methane leakage rate for the electric system ($= l_{e,1} + l_{e,2}$, per Table 3)

$l_g\ [percent\ of\ source\ energy]$= methane leakage rate for the natural gas system ($= l_{g,1} + l_{g,2}$, per Table 3)

$start\ year$ = The year when the measure will go into operational.

$EUL_{Msr}[years]$ = Effective Useful Life of the measure, rounded to the nearest whole number

$\Delta\ kWh$ = Baseline kWh/year – Measure kWh/year in the 1st year. This is typically a negative value for an increase to electric energy usage from a fuel substitution measure.

$source\ energy_{kWh,i} \left[\frac{Btu}{kWh}\right]$ = Yearly source energy values in Table 1 for electricity

$\Delta\ Therm$ = Baseline Therm/year – Measure Therm/year in the 1st year. This is typically a positive value for a decrease in natural gas usage from a fuel substitution measure.

$source\ energy_{Therm} \left[\frac{Btu}{Therm}\right]$ = Source energy value for natural gas in Table 2

$Life - cycle\ source\ energy\ savings_{AR}\ [Btu]$= Source energy savings for Accelerated Replacement (AR) Measure application type over the life of the measure.

$RUL_{Ext}[years]$ = Remaining Useful Life of the existing equipment, rounded to the nearest whole number

$\Delta\ kWh_{BL1}$= $\Delta\ kWh$ over the existing baseline

$\Delta\ Therm_{BL1}$ = $\Delta\ Therm$ over the existing baseline

$\Delta\ kWh_{BL2}$ = $\Delta\ kWh$ over the standard practice baseline

$\Delta\ Therm_{BL2}$= $\Delta\ Therm$ over the standard practice baseline

The units for the values are included within brackets, [ ].

Appendix A-2: Emissions Calculations

Part Two of the fuel substitution test requires that fuel substitution measures not adversely impact the environment. Previously, per Decision D.09-12-022, measurement of environmental impact is limited to carbon dioxide (CO2) emissions. However, in 2021, the environmental impact was broadened to include CO2e methane emissions and CO2e refrigerant emissions. To pass Part Two of the test, life-cycle CO2 and CO2e emissions for the measure technology must be lower than or equal to those of the baseline technology. Life-cycle emissions are defined as the total CO2 emissions plus the total CO2e emissions over the EUL of the measure technology. To determine if a fuel substitution measure permutation passes Part Two of the fuel substitution test, programs shall use the RACC-RSC_v3.0.xlsx.

The approach for calculating CO2 emissions for electricity and natural gas is similar to that used to calculate the source energy factors. Like the source energy calculation, the life-cycle CO2 emissions of a fuel substitution measure are calculated by applying the annual factors (in metric tonne CO2/MWh and metric tonne CO2/Therm respectively, for electricity and natural gas) to the site energy savings in each year of the measure's EUL. Added in 2022, Part Two of the test includes CO2e emissions from methane leakage, but—like those for natural gas—these emission rates do not vary over time. More detail regarding the assumptions used for methane leakage is provided in Appendix A-3: Methane Leakage.

Also added in 2022, Part Two of the fuel substitution test includes the life-cycle emissions due to refrigerant leakage. Refrigerant leakage is divided into two components: annual (a.k.a. operational) leakage, and end-of-life (EOL) leakage where annual leakage is constant for each year of the equipment life and EOL leakage only occurs during the last year of the equipment life. Equation 3 and Equation 4 are used for Normal Replacement (NR) applications and Accelerated Replacement (AR) applications, respectively. More detail regarding the equations used to determine the emissions due to refrigerant leakage are provided in Appendix A-4: Emissions due to Refrigerant Leakage.

Equation A-3. Life-cycle emissions savings for Normal Replacement measures

$$\begin{aligned} &Life - cycle\ CO_{2e}\ savings_{NR} \\ &= (1 + la_e) \times \sum_{i=start\ year}^{EUL_{Msr}+start\ year-1} \left(\frac{\Delta kWh}{1{,}000\ kWh/MWh} \times EI_{MWh,i}\right) \\ &+ \left(1 + la_g\right) \times (\Delta\, Therm \times EI_{Therm} \times EUL_{Msr}) + (R_{Std} - R_{Msr}) \end{aligned}$$

Equation A-4. Life-cycle emissions savings for Accelerated Replacement measures

$$\begin{aligned} &Life - cycle\ CO_{2e}\ savings_{AR} \\ &= (1 + la_e) \times \sum_{i=start\ year}^{RUL_{Ext}+start\ year-1} \left(\frac{\Delta kWh_{BL1}}{1{,}000\ kWh/MWh} \times EI_{MWh,i}\right) \\ &+ \left(1 + la_g\right) \times (\Delta\, Therm_{BL1} \times EI_{Therm} \times RUL_{\ Ext}) \\ &+ (1 + la_e) \times \sum_{i=RUL_{Ext}+start\ year}^{EUL_{Msr}+start\ year-1} \left(\frac{\Delta kWh_{BL2}}{1{,}000\ kWh/MWh} \times EI_{MWh,i}\right) \\ &+ \left(1 + la_g\right) \times \left(\Delta\, Therm_{BL2} \times EI_{Therm} \times (EUL_{Msr} - RUL_{\ Ext})\right) \\ &+ \left((R_{Std} + R_{Ext}) - (R_{Msr} + R_{Pre})\right) \end{aligned}$$

Where:

$Life - cycle\ CO_{2e}\ savings_{NR}\ [metric\ tonne\ CO_{2e}]$ = CO2 and CO2e savings for Normal Replacement (NR) Measure application type over the life of the measure.

$la_e\ [percent\ of\ metric\ tonne\ CO_2]$= methane leakage adder for the electric system (= $la_{e,1} + la_{e,2}$, per Table 3)

la_g $[percent\ of\ metric\ tonne\ CO_2]$= methane leakage adder for the natural gas system ($= la_{g,1} + la_{g,2}$, per Table 3)

$start\ year$ = The year when the measure will go into operation.

EUL_{Msr} $[years]$ = Effective Useful Life of the measure, rounded to the nearest whole number

$\Delta\ kWh$ = Baseline kWh/year – Measure kWh/year in the 1st year. This is a negative value for an increase in energy usage and a positive value for decrease in electricity usage due to the fuel substitution measure.

$EI_{MWh,i}$ $[metric\ tonne\ CO_2/MWh]$ = Yearly Emission Intensity [EI] values in Table 1 for electricity

$\Delta\ Therm$ = Baseline Therm/year – Measure Therm/year in the 1st year. Negative value for increase and positive value for decrease in natural gas usage from fuel substitution measures.

$EI_{Therm}[metric\ tonne\ CO_2/Therm]$ = Emission Intensity [EI] value for natural gas in Table 2

$Life - cycle\ CO_{2e}\ savings_{AR}$ $[metric\ tonne\ CO_{2e}]$ = CO2 and CO2e savings for Accelerated Replacement (AR) Measure application type over the life of the measure.

RUL_{Ext} $[years]$= Remaining Useful Life of the existing equipment, rounded to the nearest whole number

$\Delta\ kWh_{BL1}$ = Δ kWh over the existing baseline

$\Delta\ Therm_{BL1}$= Δ Therm over the existing baseline

$\Delta\ kWh_{BL2}$ = Δ kWh over the standard practice baseline

$\Delta\ Therm_{BL2}$ = Δ Therm over the standard practice baseline

$R_{Msr}, R_{Pre}, R_{Std}, R_{Ext}[metric\ tonne\ CO_{2e}]$ = refrigerant leakage emissions of the measure equipment, existing equipment, counterfactual standard practice equipment, and the counterfactual existing equipment

The units for the values are included within brackets, [ ].

Appendix A-3: Methane Leakage

In addition to CO2 emissions associated with electricity generation and the combustion of natural gas, there are CO2-e emissions associated with the leakage of methane in both energy systems. When methane is combusted, it produces CO2. However, when it is leaked prior to being combusted, it is not only wasted as a fuel but also has a disproportionately high impact on global warming. Uncombusted methane has a 100-year GWP of 25, meaning it is 25 times more potent than CO2 as a greenhouse gas over a 100-year time horizon. (Over a shorter time horizon, uncombusted methane is even more potent and has a 20-year GWP of 72.)

As methane has a high global warming potential (GWP) it is critical to account for changes in methane leakage that result from the measures in Part Two of the fuel substitution test. Thus, the fuel substitution calculator applies a methane leakage adder to changes in emissions from natural gas and electricity consumption. The tool relies on leakage adders and methodology consistent with the 2024 ACC. The 100-year leakage adder is used by default in the tool. The leakage adder for upstream in-state leakage is applied to both changes in electricity and natural gas emissions. The residential behind-the-meter leakage rate is applied only to change in natural gas emissions for residential measures. See the 2024 ACC documentation for more details.[1]

Table A-3. Methane Leakage Rates and Adders

Leakage Type	Leakage rate (in percent of natural gas consumption)	Leakage adder, 100-year GWP (in percent of CO2e emissions)
Upstream, in state This represents the methane leakage upstream of natural gas power plants and applies to both electric and gas emissions.	$l_{e,1}$: 0.610% $l_{g,1}$: 0.610%	$la_{e,1}$: 5.57% $la_{g,1}$: 5.57%
Downstream, residential behind-the-meter This applies only to programs that eliminate natural gas appliances from a residential building.	$l_{e,2}$: 0.000% $l_{g,2}$: 0.414%	$la_{e,2}$: 0.00% $la_{g,2}$: 3.78%

Appendix A-4: Emissions due to Refrigerant Leakage

Refrigerants are gases which can absorb and transfer heat and are used in many appliances including refrigerators, air conditioners, and electric heat pumps. Most refrigerants used today are very strong greenhouse gases. The most common refrigerant, R-410A, has a 100-yr GWP of 2,088—or more than 2,000 times the global warming impact of CO2. Refrigerants only contribute to global warming when they leak, but given current practices, leakage is inevitable. Thus, it is important to include refrigerant leakage in the assessment of the life-cycle emissions impact of a measure in Part Two of the fuel substitution test.

The impact of the emissions of refrigerant leakage is a function of characteristics of both the device type and the refrigerant that is used. Devices vary by their refrigerant charge, leakage rates, and “top-off” period. Refrigerant charge refers to the amount of refrigerant in the device. Annual leak rate and end of life loss rate dictate how much refrigerant is lost each year and at the EUL of the device, respectively. The last necessary metric is the number of years prior to EOL with no “top-off” refrigerant added to the device. The type of refrigerant also dictates the GWP in order to calculate the emissions due to leakage.

For NR measures, the refrigerant leakage is calculated in two parts, the cumulative annual leakage and the EOL leakage. Annual leakage is the refrigerant charge multiplied by the GWP of the refrigerant and the annual leakage rate. This is then multiplied by EUL and added to the EOL leakage. The EOL leakage is found by calculating the amount of refrigerant charge in the device remaining at its end of life since its last top off multiplied by the EOL loss rate and the GWP of the refrigerant. Refrigerant leakage is calculated for the measure case (Msr), the existing case (Pre), the counterfactual standard practice case (Std), and the counterfactual existing case as indicated in Equation 5, Equation 6, Equation 7, and Equation 8 respectively.

Equation A-5. Refrigerant Leakage Emissions for Measure Equipment

$$R_{Msr} = m_{Msr} \times GWP_{Msr} \times \left(q_{ann,Msr} \times EUL_{Msr} + q_{EOL,Msr} \times \left(1 - q_{ann,Msr} \times t_{EOL,Msr}\right)\right)$$

Equation A-6. Refrigerant Leakage Emissions for Existing Equipment

$$R_{Pre} = m_{Ext} \times GWP_{Ext} \times q_{EOL,Ext} \times \left(1 - q_{ann,Ext} \times t_{EOL,Ext}\right) \times Factor_{Recovery}$$

[1] CPUC Avoided Cost Calculators at https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/der-cost-effectiveness

Equation A-7. Refrigerant Leakage Emissions for Counterfactual Standard Practice Equipment

$$R_{Std} = m_{Std} \times GWP_{Std} \times \left(q_{ann,Std} \times \begin{cases} 0 \; for \; NR \\ RUL_{Ext} \; for \; AR \end{cases} + q_{EOL,Std} \times \left(1 - q_{ann,Std} \times t_{EOL,Std}\right) \right)$$

Equation A-8. Refrigerant Leakage Emissions for Counterfactual Existing Equipment

$$R_{Ext} = m_{Ext} \times GWP_{Ext} \times \left(q_{ann,Ext} \times RUL_{Ext} + q_{EOL,Ext} \times \left(1 - q_{ann,Ext} \times t_{EOL,Ext}\right) \right)$$

Where:

$R_{Msr}, R_{Pre}, R_{Std}, R_{Ext} [metric\ tonne\ CO_{2e}]$ = refrigerant leakage emissions of the measure equipment, existing equipment, counterfactual standard practice equipment, and counterfactual existing equipment, respectively

$m_{Msr}, m_{Ext}, m_{Std} [lb]$ = refrigerant charge contained by the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$GWP_{Msr}, GWP_{Ext}, GWP_{Std} [metric\ tonne\ CO_{2e}/metric\ tonne\ CO_2]$ = the global warming potential (GWP) of the refrigerant in the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$q_{ann,Msr}, q_{ann,Ext}, q_{ann,Std} [percent]$ = annual leakage rate of the refrigerant in the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$EUL_{Msr}, EUL_{Ext}, EUL_{Std} [years]$ = the effective useful life (EUL) of the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$q_{EOL,Msr}, q_{EOL,Ext}, q_{EOL,Std} [percent]$ = the end of life (EOL) leakage rate of the refrigerant in the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$t_{EOL,Msr}, t_{EOL,Ext}, t_{EOL,Std} [years]$ = the time since the refrigerant was last topped off in the measure equipment, existing equipment, and counterfactual standard practice equipment, respectively

$Factor_{Recovery} [dimensionless]$ = a factor that varies depending upon the measure application type and whether documentation is provided showing that refrigerant was appropriately recovered from existing equipment as indicated in Table 4.

$RUL_{Ext} [years]$ = the remaining useful life (RUL) of the existing equipment

The units for the values are included within brackets, [ ].

Table A-4. $Factor_{Recovery}$ by Existing Refrigerant Recovery Documentation and Measure Application Type

Existing Refrigerant Recovery Documentation	Normal Replacement (NR)	Accelerated Replacement (AR)
No Recovery Documentation Provided (status quo)	0 (see Figure 1)	1 (see Figure 3)
Recovery Documentation Provided	-1 (see Figure 2)	0 (see Figure 4)

As indicated in Table 4, the figures that follow show the annual and end-of-life emissions for the four possible combinations of existing equipment recovery documentation and measure application type described for the fuel substitution measure involving a residential central heat pump replacing a central gas furnace with air-conditioning.[2]

[2] Per measure package SWHC045-03 at https://www.caetrm.com

Figure A-1. Normal Replacement Application without Existing Refrigerant Recovery Documentation

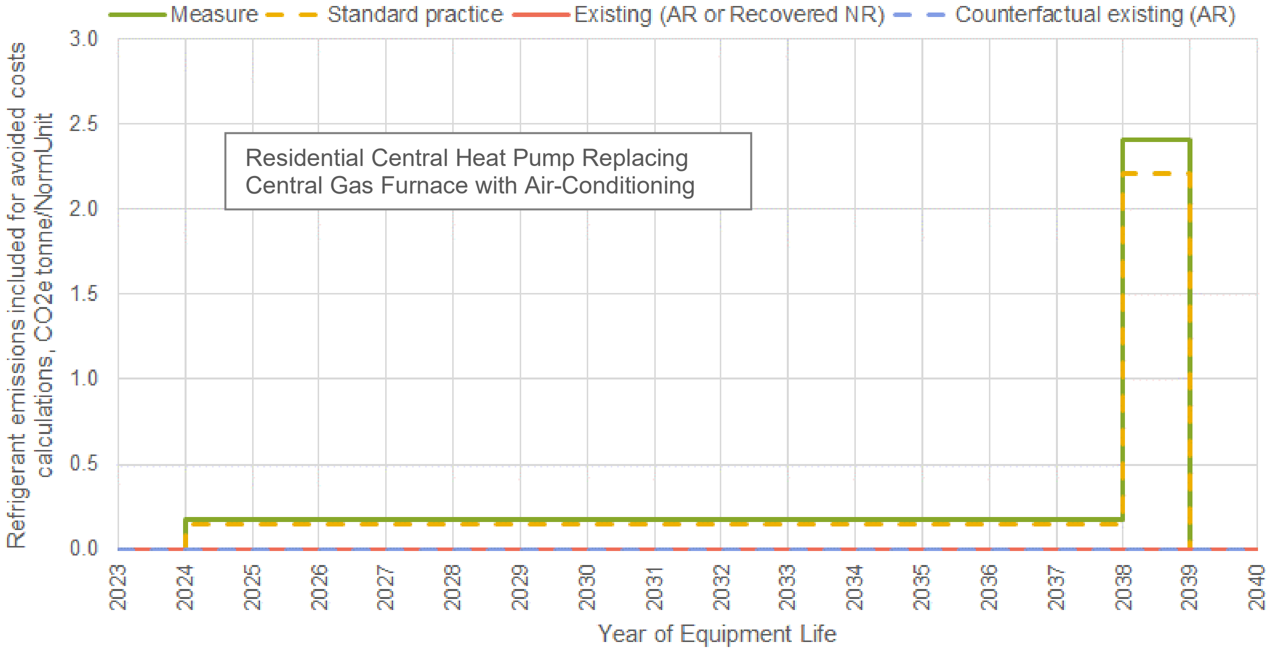


Figure A-2. Normal Replacement Application with Existing Refrigerant Recovery Documentation

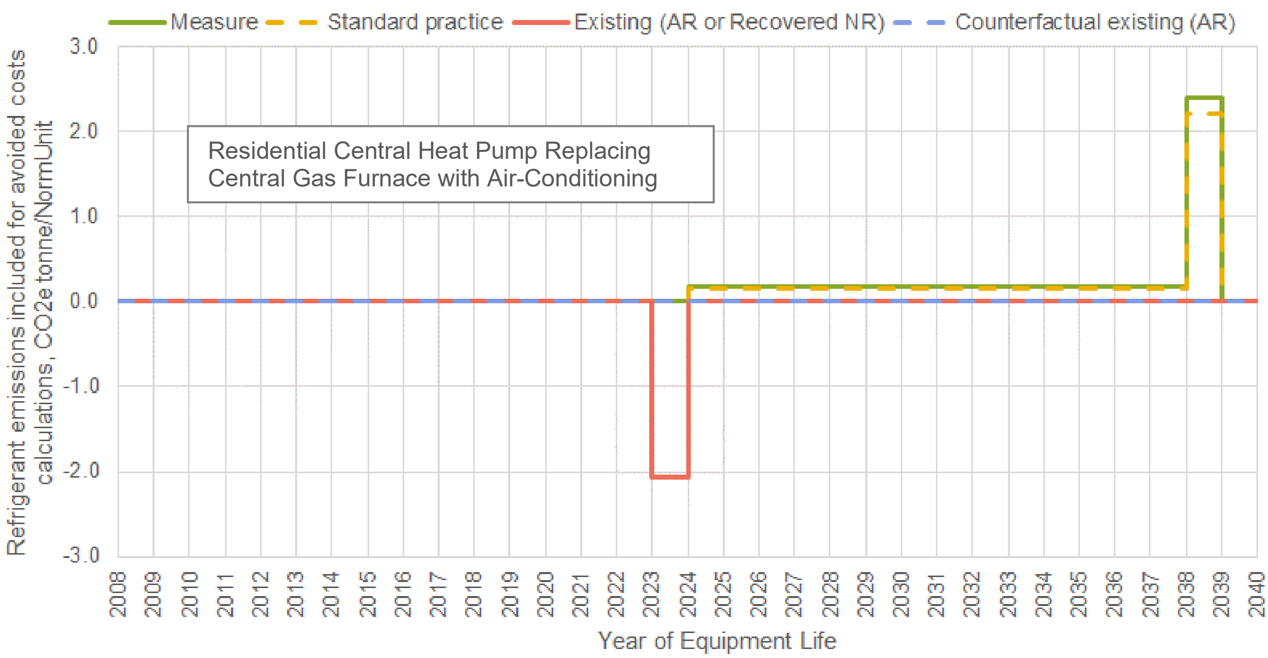


Figure A-3. Accelerated Application without Existing Refrigerant Recovery Documentation

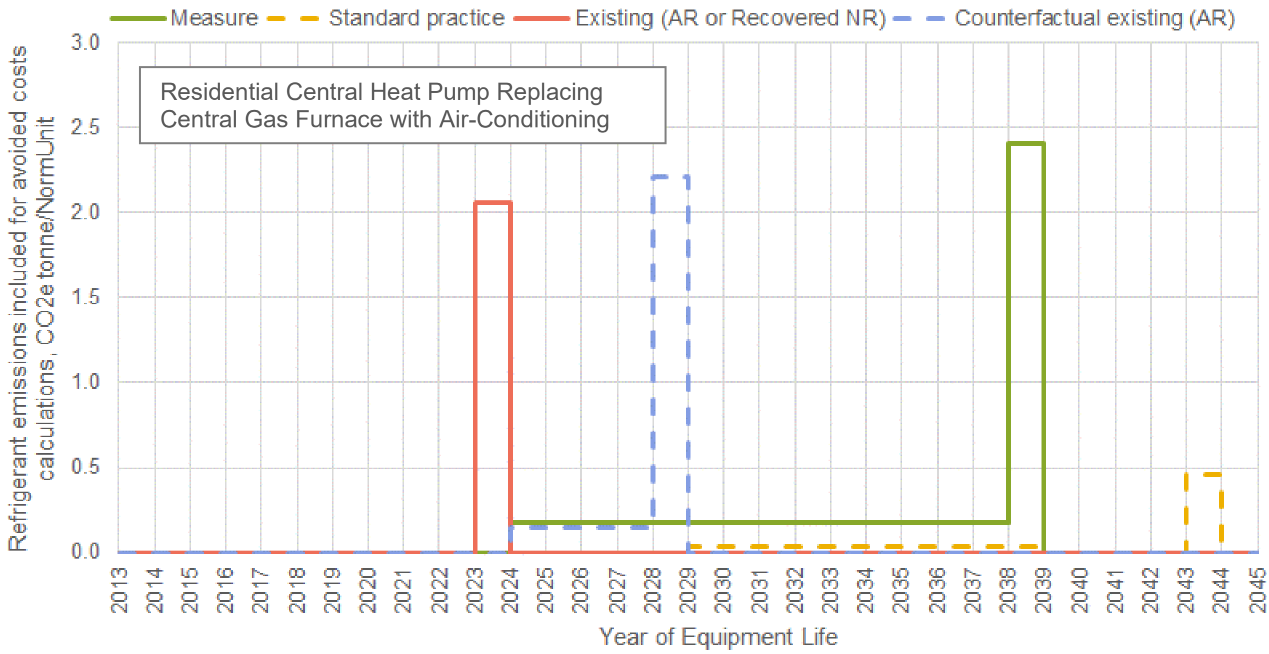
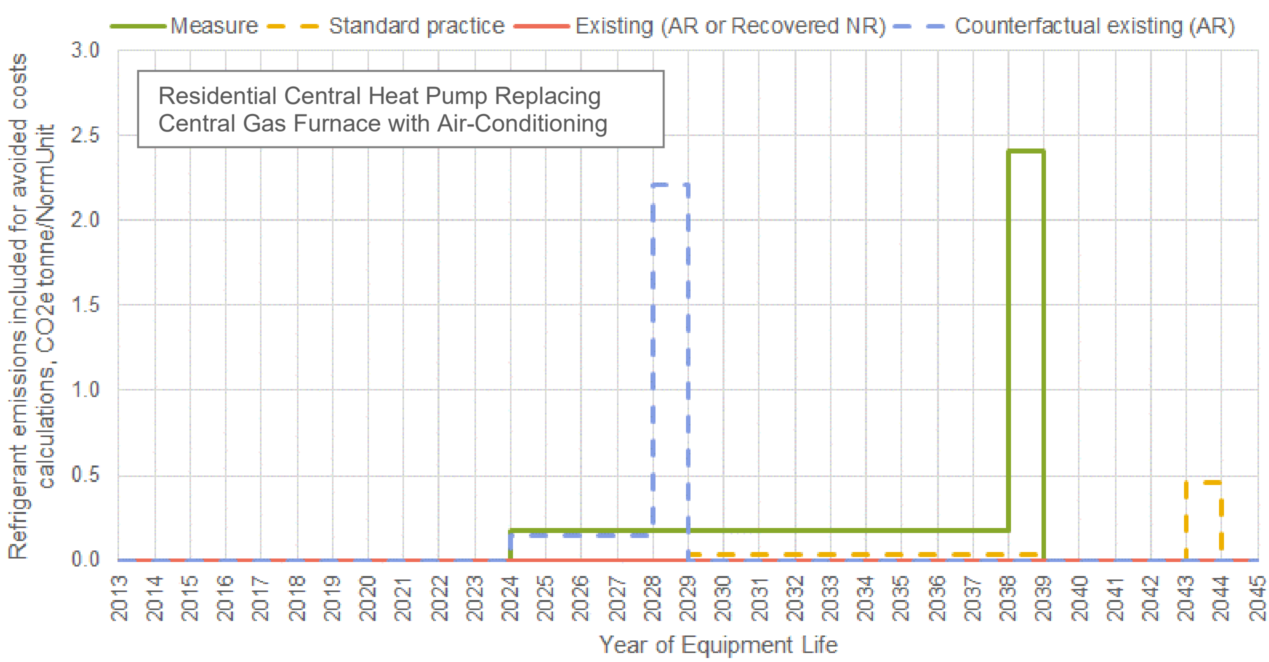


Figure A-4. Accelerated Application with Existing Refrigerant Recovery Documentation



Appendix A-5: Basis for Weights Used for Residential Fuel Substitution Measures

Given that weather is warming and the proportion of residential homes with HVAC space cooling is increasing, a comparison of the results of the 2009 and 2019 Residential Appliance Saturation Studies[3][4] (RASS) were used to establish a set of climate-zone specific weights for imputing space cooling for the standard practice baseline case for residential heat pump fuel substitution measures.

Table A-5. Proportions of Homes with Natural Gas Furnace and Room/Central Air Conditioning

Building Location	2009 RASS (n=17,056)	2019 RASS (n=24,323)	Ten-year Increase Extrapolated to 2024
CZ01	2.8%	41.5%	61.0%
CZ02	43.8%	54.6%	60.1%
CZ03	13.3%	30.7%	39.2%
CZ04	61.3%	74.2%	80.7%
CZ05	17.5%	17.4%	17.4%
CZ06	43.7%	62.4%	71.9%
CZ07	42.0%	65.2%	76.7%
CZ08	69.8%	89.4%	99.4%
CZ09	87.3%	94.0%	97.5%
CZ10	96.4%	98.1%	99.1%
CZ11	98.6%	94.3%	94.3%
CZ12	93.2%	97.5%	99.5%
CZ13	97.8%	95.7%	95.7%
CZ14	98.8%	95.6%	95.6%
CZ15	96.7%	99.0%	100.0%
CZ16	74.4%	91.9%	100.0%
Statewide	67.4%	80.1%	86.6%

On the **3 FSC** worksheet in RACC-FSC_v3.0.xlsx, users shall use an imputed cooling baseline for residential electric heat pump measures where the existing equipment does not include air conditioning. Refer to examples provided in the body of the Technical Guidance Document for more information regarding how this is to be done.

Appendix A-6: Sites with On-Site Generation

The presence of non-IOU fuel on-site generation sources does not impact the fuel substitution test used to determine the fuel substitution measure eligibility. The measures should comply with established fuel substitution test requirements.

For claimable energy savings used for incentive, reporting, and cost effectiveness calculations, the guidance established in Non-IOU Supplied Energy Sources – Guidance Document – V1.1[5] shall be followed with no exemptions.

The section below discusses the potential impact of fuel substitution measures on claimable energy savings.

[3] KEMA, Inc. 2010. *2009 California Residential Appliance Saturation Study*, California Energy Commission. Publication number: CEC-200-2010-004.

[4] DNV GL Energy Insights USA, Inc. 2020. *2019 California Residential Appliance Saturation Study*. California Energy Commission. Publication Number: CEC-200-2021-005.

[5] Energy Efficiency Savings Eligibility at Sites with non-IOU Supplied Energy Sources—Guidance Document. Version 1.1 November 6, 2015

The main premise in CPUC's non-IOU fuel guidance applies when non-IOU energy sources are present and there is a reduction in energy supplied from grid/ system that is subject to electric energy efficiency surcharges or the non-bypassable gas surcharge. Therefore, only the reduced fuel usage requires the non-IOU fuel analysis.[6] The increased fuel usage does not require non-IOU fuel analysis unless new non-IOU on-site generation sources are added at the facility.

For natural gas to electric measures, the increase in kWh usage is not subject to non-IOU fuel analysis. The Therm savings are not subject to non-IOU fuel analysis because there is no on-site generation of natural gas which is regulated. Hence, the calculations of claimable energy savings are not impacted even when on-site natural gas generation is present.

For electric to natural gas measures, the decrease in kWh usage is subject to non-IOU fuel analysis similar to other energy efficiency measures. For the same reason explained above, the Therm increase does not require non-IOU fuel analysis. The kWh savings after non-IOU fuel analysis is added to the Therm savings (converted to kWh) for calculating the claimable energy savings.

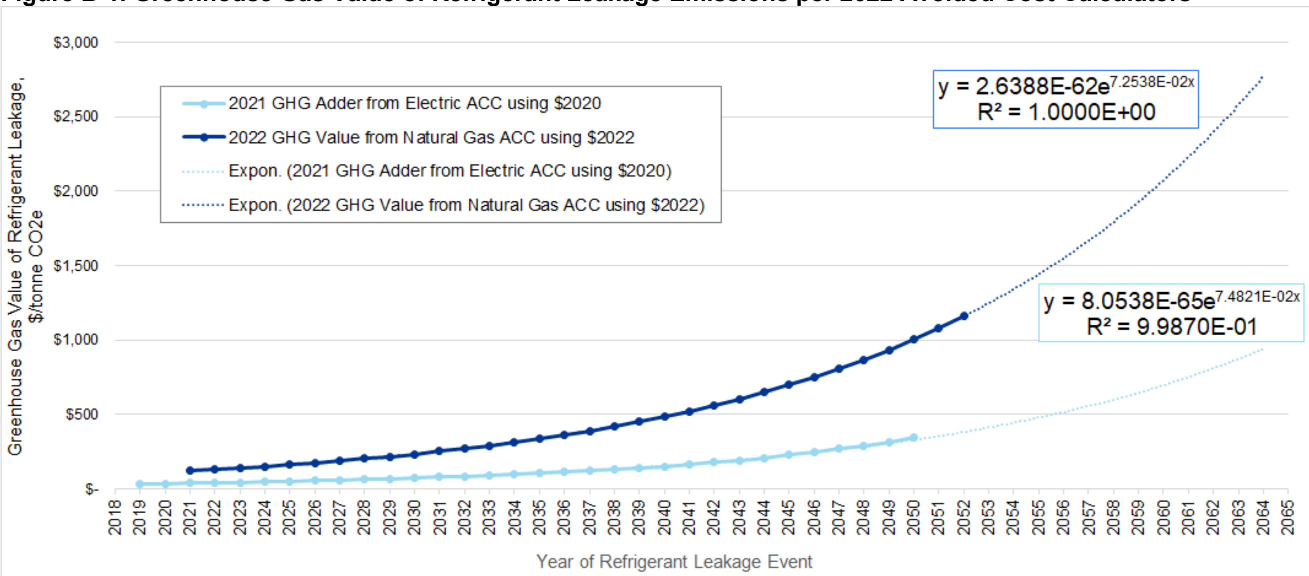
Please note, for natural gas to electric measures, there could be scenarios where mixed fuel (electricity + natural gas) is substituted with one new fuel (electricity) and the increase in substituted fuel (gas to electricity) is outweighed by the savings from electricity part of the mixed fuel, resulting in decreased kWh. In such a scenario, kWh savings will require non-IOU fuel analysis.

[6] Monthly or hourly analysis as required by Energy Efficiency Savings Eligibility at Sites with non-IOU Supplied Energy Sources—Guidance Document. Version 1.1 November 6, 2015

APPENDIX B. Extrapolated Avoided Costs for RACC

Since equipment effective useful life values (EULs) have been extended beyond the previous cap of 20 years to up to 30 years, it is possible that refrigerant leakage emissions for the counterfactual standard practice equipment will require avoided costs that have not been forecasted nor approved. In these instances, extrapolated values will be used. An example of such extrapolated values that were used for 2024-2025 measure packages is provided in Figure B-1.

Figure B-1. Greenhouse Gas Value of Refrigerant Leakage Emissions per 2022 Avoided Cost Calculators



Note: The extrapolated GHG values from the 2022 Natural Gas ACCs—shown in the chart for years beyond 2052—are only approved for use in the RACC-FSC_v3.0 workbook. They are not approved for use in other applications.

Given the very high R-squared values of the fitted curve, this specific application of these extrapolated values has the approval of the CPUC. The use of these extrapolated values is not approved, however, for use in other applications.

APPENDIX C. Connecting RACC-FSC to DEER Database

Multiple DEER database tables are connected to the RACC-FSC_v3.# workbook so that they are available to stakeholders and can be easily updated without needing to reissue the workbook as frequently. Questions can be sent to: DEERsupport@dnv.com.

The DEER database is a PostgreSQL database. Since DEER tables are updated as warranted by new EM&V studies or stakeholder requests, they may require periodic refreshing. It is recommended that users sign up for alerts to the DEER database webpage within the DEER Module of the CEDARS website. Updates to these tables will be announced as they occur at https://cedars.sound-data.com/deer-resources/deer-database/deer-change-log/.

First-time DEER Database Access Instructions for Windows Computers

To learn about PostgreSQL Office Database Connection (ODBC) drivers, go to https://odbc.postgresql.org/.

1. Download the most appropriate version of the available files from https://www.enterprisedb.com/downloads/postgres-postgresql-downloads. If your computer has 64-bit Office installed, be sure to download the zip file with its name appended by "-x64." While most users have 32-bit Office installed. This can be confirmed by, in Excel, going to **Account > About Excel**. If the version title doesn't contain "64-bit" somewhere, then it is most likely a 32-bit installation.
2. Unzip the downloaded zip file and run the .msi file appropriate for your Office installation.
3. From the Windows Start menu, launch Windows Administrative Tools > ODBC Data Source Administrator.
   a. Select the "User DSN" tab (rather than the "System DSN" tab that runs along the top of the dialog box.
   b. Click the "Add" button.
   c. Select PostgreSQL Unicode from the dropdown menu.
   d. Populate the "PostgreSQL Unicode ODBC Driver (psqlODBC) Setup" dialog box as shown in Table 6.

Table C-6. Recommended Field Contents in PostgreSQL Unicode ODBC Driver

Left Column Fieldname	Contents	Right Column Fieldname	Contents
Data Source	PostgreSQL35W	**Description**	PostgreSQL
Database	DEER	**SSL Mode**	Allow
Server	cpucexante.cwuiixjcexyp.us-east-1.rds.amazonaws.com	**Port**	5432
User Name	sptviewer	**Password**	deereddev

   e. Click the "Test" button. Doing so should return: "Connection successful" message.
   f. Click the "Save" button.

Updating DEER Database Table(s) in RACC-FSC_v3.#

Within the RACC-FSC_v3.# workbook, go to **Data > Queries & Connections** and click on the **Refresh All** button.
While the DEER tables are refreshing, the following status will be shown on the lower left corner of your Excel window:

Running background query … (Click here to cancel)

Updates are typically completed in under one minute.

About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.