# Energy Efficiency “E3 Calculator” Tool

# Quick Guide and Equation Reference for 2013-2014 v1c4

This document provides a brief guide to the user inputs and outputs. This is followed by a detailed presentation of the equations used by the Calculator Tool. The last section presents a discussion of the data management issues and steps taken in developing the inputs for the tool.

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# Summary of Revisions

Version 3c

* Rebate entries modified to be more explicit between transfer payments and administrative costs.
* Net to gross ratios can now be entered directly in Column I. Previously the user needed to select a Program Type and the Calculator would use NTG values that were preloaded in a lookup table.
* Output descriptions updated to reflect measures installed in the year, rather than measures in place during a specific quarter of the year.

Version 4a

* Revise calculation of TRC to comply with Shareholder Incentive Decision, ordering paragraph 14. TRC Cost = Admin$ + NTG\*Meas$ + (1-NTG) \* (Rebate$ + OtherInc$ + DirectI$)

Version 5

* Modify to allow use for 2010-2012 program planning
	+ Change first year of implementations to 2010
	+ Change present value calculations to discount to the beginning of 2010
	+ Change PG&E and SDG&E calculators to use annual installations

Version 6 (Model 2013-14 v1b)

* Modify for Dual baselines
* Incorporation of Installation Rate and Gross Realization Rate.

Version 6c (Model 2013-2014 v1c)

* New NTG Lookup Table
* Market Effect Multipliers
* Treatment of excess incentives

Version 6d (Model 2013-2014 v1c2 up to v1c4)

* Revise Cost Market Effect so it only applies to Gross measure cost and any excess incentives. TRC Cost = Admin + Rebate +Incent + DI + NTG\* ParticipantCost + MarketEffect\*(Meas$ + Excess). Where Participant cost is after all rebates and incentives, and cannot be negative due to incentives to others or DI costs.
* Add Goal Attainment table that calculates first year savings consistent with utility goals, and recognize decay effects for second baselines and measure end of life.

# Inputs Summary

|  |  |  |
| --- | --- | --- |
| Item | Location | Comment |
| Proposer Name | Cell D4 | Text field |
| Program Name | Cell D5 | Text field |
|  |  |  |
| Contact Information | D9:D13 | Text fields |
| Market Sectors | E14:E15 | Text fields. Only used for PG&E reporting. Do not affect calculations. |
| Program Budget |  |  |
| Administrative Costs: Overhead and G&A | G3:I3 | Annual cost. Entered in nominal dollars. Assumed to be incurred at the beginning of the year. |
| Administrative Costs: Other Admin Costs | G4:I4 | Annual cost. Entered in nominal dollars. Assumed to be incurred at the beginning of the year. |
| Market/Outreach | G5:I5 | Annual cost. Entered in nominal dollars. Assumed to be incurred at the beginning of the year. |
| Direct Implementation:ActivityInstallationHardware & materialsRebate processing and inspection | G7 to G10 | Annual cost. Entered in nominal dollars. Assumed to be incurred at the beginning of the year. These cell entries are for non-incentive related costs. Incentive and rebate information is entered on a per-measure basis or in cells N4:P4. |
| Total Incentives and Rebates | G11:I11 | Not a user entry. Sum of values in Cells N4 to P8 |
| EM&V | G12 | Entered in nominal dollars. |
| Costs recovered from other sources. | N12:P12 | Entered in nominal dollars.  |
| User Input Incentive | N4:P4 | We recommend that users NOT use this input. Entered in nominal dollars. Use this cell for incentives and rebates that are not calculated on a per unit installed basis, and should be treated like administrative costs. These costs are not treated like transfer payments, and are assumed to NOT reduce the Measure costs entered in column L. |
| Rebate | N5 to P5 | Not a user entry. Rebate to end use customer or its assignee. Nominal and present value totals based on rebates per unit entered in column M. Note that the value shown in column I is in nominal dollars, and column J is a present value (to reflect the expected timing of the payments). Nominal values are used for program budget reporting and PV is used for the cost effectiveness and levelized cost calculations.  |
| Direct Install Labor | N6 to P6 | Not a user entry. Nominal and present value totals based on rebates per unit entered in column O. See above for further discussion of nominal and PV dollars. |
| Direct Install Materials | N7 to P7 | Not a user entry. Nominal and present value totals based on rebates per unit entered in column P. See above for further discussion of nominal and PV dollars. |
| Upstream Payments | N8 to P8 | Not a user entry. Nominal and present value totals based on rebates per unit entered in column N. See above for further discussion of nominal and PV dollars. |
| Market Effects Adjustments |  |  |
| Adjustment Type | U3 | Dropdown indicates the market effect values to be usedNone: No market effect adjustmentUniform: Use the values from T8:U10 for all measuresCustom: Use the values from columns AO:AT |
| Uniform market effect adjustments | T8:U10 | Benefits adjustments will affect NTG-Therms, NTG-kWh, and NTG-kW. Costs adjustments will affect NTG-Costs. Adjustments are summed to the Total Factors in T11:U11. The adjusted NTG are NTG\*(1+Total Factor).  |

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| **Program Inputs** (Inputs begin in Row 17) |
| Program Name | Col A | Not a user entry. Hidden text field used in reporting information to the Energy Division. |
| Measure Name | Col B | Text field |
| DEER RunID | Col C | Numeric field corresponding to DEER database. |
| Climate zone | Col D | Select from drop-down list. Cannot be left blank. Used to determine the impacts and costs for the measure. ‘System’ applies the generation and T&D avoided costs from the climate zone with the lowest average generation and transmission avoided capacity cost over 25 years. Note that Climate zone 3 has been subdivided into two subzones. Climate zone 3A is for San Francisco and the Peninsula. Climate Zone 3B is for the East Bay. See the attachment for a complete listing of Cities and Climate Zones. |
| Target Sector | Col E | Select from the Drop Down list. This entry is used to determine whether to use a residential or non-residential TOU correction factor where applicable. For the PG&E, SCE and SoCalGas tools, this entry is also used to limit the measure end use shapes listed in the drop down entries in Column F. This entry is not used to constrain measure end use shapes in the SDG&E model, although it is used for reporting purposes. |
| Measure End Use Shape | Col F | Select from the drop-down list. Note that the list of measures can vary depending upon the Target Sector selected in Column E. For PG&E, SCE, and SoCal Gas, this entry will determine if a measure could receive a TOU correction factor adjustment. Having one of the following end use shapes is a necessary, but not sufficient, condition to qualify for the TOU correction adder. In order to receive a TOU correction factor adjustment, a measure must also have a positive entry in column Z *% Eligible for TOU AC Adjustment.*PG&E: 26 = Res. Central Air Conditioning22 = Res. Ht. Pump Cooling29 = Res. New Const. Cooling33 = Res. Insul. Cen. A/C35 = Res. Ceil. Insul. HP Cooling37 = Res. Wall Insul. HP Cooling39 = Res. Flr. Insul. HP Cooling45 = Res. Dir. Assist. Evap. Cooler3 = Commercial HVAC SCE: AC-NCNew\_AC-Ret; AC\_Cooling-RCHeatPump\_ThroughWall-RCPackage\_AC-NC<65K\_AC\_Split-NC<65K\_AC\_Pckg-NC65K-135K\_Air\_AC-NC65K-135\_Wtr\_AC-NC>135K\_Air\_AC-NC>135K\_Wtr\_AC-NC<65K\_EvapCool-NCEvap\_Cooling-RetNew\_HtPmp-RetReplace\_Chiller-RetWtr\_Cool\_Chiller-NCSoCal Gas: AC\_CoolingAC>135K\_Air\_AC>135K\_Wtr\_ACNew\_ACNew\_HtPmpReduce\_Cooling\_Load |
| CZ, Sector, Measure combination found? | Col G | Not a user input. If FALSE, then recheck the measure end use shape drop down list to verify that you have selected a valid measure. Typically, the FALSE warning will appear when the user selects a measure based on a certain Sector, but then changes the Sector without updating the measure choice.*Note: This column is not used in SDG&E’s tool.* |
| Expected Useful Life for New/ROB, RUL for retrofit. | Col H | Enter the expected useful life for new construction or replace on burnout measures. For early replacement of retrofit measures, enter the remaining useful life of the extant device.  |
| Program Type | Col I | Select from drop-down list. This entry is used to determine the Net-to-Gross ratio, based on values in the Program Manual. Version 3c modification: users can now directly enter numeric values in this column.This entry always applied to kWh savings, and is also assumed to apply to Therms, kW, and measure cost unless the user enters alternate values in columns AI through AK. |
| Unit Definition | Col J | Not used by the spreadsheet. For informational purposes only. |
| Program Type | Col K | Not used by the spreadsheet. For informational purposes only. |
| Gross Measure Cost | Col L | For new construction (NEW) and replace on burnout (ROB) applications, this is the cost of the efficient equipment less the cost of the standard efficiency equipment. Use value in DEER as applicable (adjusted for inflation as needed). Include initial capital costs, including sales tax, ongoing O&M costs including fuel, removal costs less salvage value, and value of customers time in arranging for installation (if significant). For early replacement or retrofit (RET) applications, this is the full cost of the efficient equipment plus installation costs.For direct install programs, enter the sum of Direct Install Labor and Direct Install Materials (Col O + Col P)*Note that the E3 Calculator does not inflate any of the costs in columns L through Q. If the nominal cost of the measure is expected to change over the implementation period, the user can enter an adjusted cost value such that the present value of the adjusted cost is the same as the present value of the expected annually varying costs.* |
| Rebate to end use customer or its assignee | Col M | Per unit dollar rebates paid to the participant or its assignee by the sponsoring agency.  |
| Incentives to entities other than the end use customer or its assignee | Col N | Per unit incentives. Also referred to as upstream incentives. Note that if the sum of incentives to others and Direct Install costs exceed the Gross Measure cost, the exceedance will be treated like an admin cost. It will not be used to reduce participant costs, and will not be treated as a transfer payment.  |
| Direct Install Labor | Col O | Per unit labor provided to the participant by the proposed Program.  |
| Financial Incentive: Direct Install Materials | Col P | Per unit materials provided to the participant by the proposed Program.  |
| Gross Participant Cost  | Col Q | Not a user entry. Equals the Gross measure cost less the incentives in columns M, N, O, and P. . This treatment corrects the application of the net-to-gross ratio to conform to the ALJ ruling in the Shareholder incentive proceeding. |
| Gross Unit Annual Electricity Savings | Col R | Annual net kWh reduction attributable to the installation of one unit of the measure. If a measure has an EUL less than one year, the annual net kWh reduction should reflect the savings assuming that the device were in place for a full year. |
| Electric Rate Schedule | Col S | Select from drop-down list. Used to determine revenue loss for RIM test. |
| Demand Scale Factor | Col T | Not a user input. Indicates “kWh” if capacity savings are calculated using annual kWh reductions, or “kW” if capacity savings are calculated using summer peak kW reductions. |
| User entered kW savings per unit | Col U | Summer peak period kW reduction attributable to installation one unit of the measure. Used for reporting kW reductions. Also used for cost effectiveness calculations if Col T indicates “kW.” Otherwise, the cell is grayed out, indicating that the value is not used for the cost-effectiveness calculations.  |
| Gross Unit Annual Gas Savings | Col V | Annual net therms reduction attributable to the installation of one unit of the measure. |
| Gas Sector | Col W | Select from the drop-down list. Used to determine the gas avoided costs to apply to the measure. |
| Gas Rate Schedule | Col X | Select from drop-down list. Used to determine revenue loss for RIM test.  |
| Gas Savings Profile | Col Y | Select from the drop-down list. Used to determine the gas avoided costs to apply to the measure. 1. Summer Only: All gas savings occur in April through September.
2. Winter Only: All gas savings occur in October through March
3. Annual: Gas savings occur uniformly throughout the year.
 |
| Total Life | Col Z | Total EUL for RET measures. Can be left blank for NEW or ROB measures. However, do not enter a value of “0” |
| Incremental Cost | Col AA | Incremental cost (relative to the standard efficiency default device) in nominal dollars at the time the measure is first installed (not at the end of the original device RUL) |
| Measure Cost Change | Col AB | Percent annual incremental cost escalation. Applied to Col AA for the RUL number of years. |
| Early Retrofit incremental kWh savings | Col AC | Savings of the efficient measure relative to the standard efficiency device that would have otherwise been installed at the end of the original device’s RUL. Annual kWh savings. |
| Early Retrofit incremental kW savings | Col AD | Savings of the efficient measure relative to the standard efficiency device that would have otherwise been installed at the end of the original device’s RUL. Peak kW savings |
| Early Retrofit incremental Therm savings | Col AE | Savings of the efficient measure relative to the standard efficiency device that would have otherwise been installed at the end of the original device’s RUL. Annual Therm savings. |
| Combustion Type | Col AF | Determines the rate of emission savings per MMBTU of reduced natural gas usage from gas conservation. (lbs of CO2, NOX, and PM-10). Not a user input for PG&E. Not used for SCE. Select from a drop down list for SDG&E and SoCalGas. Res Furnace is used as a default if there is no user selection.  |
| Effective Useful Life | Col AG | For PG&E and SCE, determined by the spreadsheet, based on Measure Type. For SDG&E and SoCal Gas, the numeric value is entered directly in this column. |
| Net –to-Gross Ratio - kWh | Col AH | Determined by the spreadsheet, based on Program Type or the numeric user entry in column I. This value is used to convert gross kWh to net kWh. Also used as a default for other NTG values. |
| Net-to-Gross Ratio – Therms | Col AI | Determined by the spreadsheet, based on Program Type or the numeric user entry in column I. This value is used to convert gross therms to net therms.  |
| Net-to-Gross Ratio – kW | Col AJ | User input for NTG Ratio for capacity. If left blank, the NTG kWh value is used |
| Net-to-Gross Ratio – Therms (override) | Col AK | User input for NTG Ratio for therms. If left blank, the NTG therm from Col AI is used |
| Net-to-Gross Ratio – Costs | Col AL | User input for NTG Ratio for program costs. If left blank, the NTG kWh value is used |
| Installation Rate | Col AM | Percent of incented measures that are installed. Default = 100% |
| Gross Realization Rate | Col AN | Percent of expected savings that are achieved per installed measure. Default = 100% |
| Market Effects Adjustments for Benefits | Col AO to Col AQ | Benefits adjustments will affect NTG-Therms, NTG-kWh, and NTG-kW. Adjustments are summed to the Total Factor in Column AU. The adjusted NTG are NTG\*(1+Total Factor). |
| Market Effects Adjustments for Costs | Col AR to Col AT | Costs adjustments will affect NTG-Costs. Adjustments are summed to the Total Factor in Column AV. The adjusted NTG are NTG\*(1+Total Factor). |
| % Eligible for TOU AC Adjustment | Col AW | ~~User input between 0 and 100%, with 100% for those cases where the entire measure receives the AC TOU correction factor. Note that the measure will not receive a correction factor adjustment for PG&E, SCE, or SoCalGas if the measure end use shape does not qualify (see discussion for Col F above).~~ TOU Correction factors are set to 1.0, so this input no longer has any effect. |
| **Installation Schedule** |  |  |
| Installations by Year | Col AX to Col BH | The annual installations are assumed to occur uniformly over the 4 quarters in each year. If these cells are grayed-out, then enter installations on a quarterly basis  |
| Installations by Quarter | Col BJ to Col DA. | Not a user entry if grayed-out. |
| Total Number of Units | Col DB | Not a user entry. |
| Comments | Col DC | For informational purposes only. Not used in the calculations. |

# Output

## Notes on the Tests and Outputs

#### Total Resource Cost Test (With externalities)

|  |  |
| --- | --- |
| Item | Comment |
| Tax Credits (TC) | No explicit input for tax credits.  |
| Levelized benefits per kWh  | Uses Net discounted kWh to correspond to Net benefits (NTG ratio adjusted) |

## Outputs

| Item | Location | Comment |
| --- | --- | --- |
| Total Program Budget | D4 to G4 | Total of all program budget items, including rebates and incentives. D4 is total nominal dollars, E4 is the NPV.  |
| Net Participant Cost | E6 | Present value of participant costs after reductions for rebates and eligible incentives to others and direct install costs, and multiplied by Net to Gross Ratio. The Net Participant Cost is not reduced for incentives to others and direct installation costs that exceed the Gross Measure Cost. |
| **Program Impacts** |  |  |
| Annual Net kWh | C10:C12 | Sum across all measures of their annual kWh savings adjusted for their net-to-gross ratio. Based on total units installed. For those measures with useful lives less than one year, the Annual Net kWh is multiplied by the EUL For dual baseline measures, the Annual Net kWh reflects the weighted average annual savings over the entire life of the measure.This metric does not reduce annual kWh for measures that are installed after the 1st quarter in a year.  |
| Lifecycle Net kWh | D10:D12 | Sum across all measures of their lifecycle kWh savings, adjusted for their net-to-gross ratios. Lifecycle savings = Annual kWh \* Measure Life (in yrs) \* Net-to-gross ratio.\* Total units installed. (See *Lifecycle\_kWh*). |
| Annual Net Therms | E10-E12 | Sum across all measures of their annual therm savings adjusted for their net-to-gross ratio. . For those measures with useful lives less than one year, the Annual Net Therms is multiplied by the EUL (See *Annual\_Therms*)For dual baseline measures, the Annual Net Therms reflects the weighted average annual savings over the entire life of the measure. |
| Lifecycle Net Therms | F10:F12 | Sum across all measures of their lifecycle therm savings, adjusted for their net-to-gross ratios. Lifecycle savings = Annual therms \* Measure Life (in yrs) \* Net-to-gross ratio.\* Total units installed. (See *Lifecycle\_Therms*). Note: *This metric is NOT based on the units in place during the third quarter of year 4.*therms. |
| Net July-Sept Peak (kW) | G10:G12 | Sum across all measures of their average July through September coincident peaks. Based on measures installed in the calendar year (even if the measure is not installed until after September)Coincident peak is defined as the load during the five highest system load hours in each month. (See Equation *CP\_KW\_N\_TOT[Smr]*). Value is adjusted for the net to gross ratio, and weighted for dual baselines.  |
| Net Dec-Feb Pk (kW) | H10:H12 | Sum across all measures of their average December, January, and February coincident peaks. Based on measures installed in the calendar year. Coincident peak is defined as the load during the five highest system load hours in each month. (See Equation *CP\_KW\_N\_TOT[Wtr]*). Value is adjusted for the net to gross ratio and weighted for dual baselines. |
| User Entered kW | J10:J12 | Sum across all measures installed in the corresponding years, multiplied by their user entered peak grid kW savings (INPUT column U) adjusted for their net-to-gross ratio and weighted for dual baselines.  |

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| **Cost Effectiveness (Lifecycle Present Value Dollars)** |
| **Program TRC** |
| TRC Cost | C17 | Total Program Budget + Net participant cost – Rebates. (See TOTCostTRC) |
| TRC Benefits: Electric | D17 | Sum of net electric present value benefits for all measures installed over the three years. “Net” indicates the gross benefits are multiplied by the Net-to-Gross ratios. (See *NetPVBenTOT[E]*) |
| TRC Benefits: Gas | E17 | Sum of net gas present value benefits for all measures installed over the full implementation period. “Net” indicates the gross benefits are multiplied by the Net-to-Gross ratios. (See *NetPVBenTOT[G]*) |
| Benefit – Cost NPV | G17 | TRC Benefits Electric +TRC Benefits Gas – TRC Cost |
| B/C Ratio | H17 | (TRC Benefits Electric + TRC Benefits Gas) / TRC Cost. Note that the B/C Ratio is an approximation because any supply costs associated with increased are treated as negative benefits rather than as a cost as in the Standard Practice Manual |
| **PAC (Program Administrator Cost Test)** |
| PAC Cost | C18 | Total program budget. (See TOTCostPAC) |
| PAC Benefits:Electric | D18 | Same as TRC test |
| PAC Benefits: Gas | E18 | Same as TRC test |
| Incentives | F18 | NA. Already included in PAC Cost above  |
| PAC Benefit - Cost NPV | G18 | PAC Benefits Electric +PAC Benefits Gas – PAC Cost  |
| PAC B/C Ratio | H18 | (PAC Benefits Electric + PAC Benefits Gas) / PAC Cost. Note that the B/C Ratio is an approximation because any costs associated with increased usage are treated as negative benefits rather than as a cost as in the Standard Practice Manual |
| **RIM (Ratepayer Impact Measure Test)** |
| RIM Cost | C19 | Total bill reductions plus Total Program Budget(See TOTCostRIM) |
| RIM Benefits:Electric | D19 | Same as TRC test |
| RIM Benefits: Gas | E19 | Same as TRC test |
| RIM Benefit - Cost NPV | G19 | RIM Benefits Electric + RIM Benefits Gas – RIM Cost  |
| RIM B/C Ratio | H19 | (RIM Benefits Electric + RIM Benefits Gas) / RIM Cost. Note that the B/C Ratio is an approximation because any costs associated with increased usage are treated as negative benefits rather than as a cost as in the Standard Practice Manual |

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| **Levelized Cost and Benefit (discounted present values)** |
| Discounted kWh(all tests) | C26:C28 | Discounted lifecycle avoided kWh, adjusted for Net-to-gross ratio for each measure. (*See kWhD[N])* |
| Discounted Therms (all tests) | D30:D32 | Discounted lifecycle avoided therms, adjusted for Net-to-gross ratio for each measure. (*See ThD[N])* |
| TRC Levelized Cost | E26, E30 | (TRC Benefits) less the (TRC Benefits – Costs) (See LC[TRC][E], LC[TRC][G]) |
| PAC Levelized Cost | E27, E31 | (PAC Benefits) less the (PAC Benefits – Costs) (See LC[PAC][E], LC[PAC[G]) |
| RIM Levelized Cost: Electric | E28 | RIM Cost \* [RIM Electric Benefit /(RIM Electric Benefit + RIM Gas Benefit)] / Discounted kWh (See LC[RIM][E]) |
| RIM Levelized Cost: Gas | E32 | RIM Cost \* [RIM Gas Benefit /(RIM Electric Benefit + RIM Gas Benefit)] / Discounted kWh (See LC[RIM][G]) |
| TRC Levelized Benefits | F26, F30 | TRC benefits (by fuel type) divided by the TRC discounted kWh or Therms. (See LB[TRC][E], LB[TRC][G]) |
| PAC Levelized Benefits | F27, F31 | PAC benefits (by fuel type) divided by the PAC discounted kWh or Therms. (See LB[TRC][E], LB[TRC][G]) |
| RIM Levelized Benefits | F28, F32 | RIM benefits (by fuel type) divided by the RIM discounted kWh or Therms. (See LB[TRC][E], LB[TRC][G]) |
| TRC Levelized Benefit - Cost | F26, F30 | Sum over all measures of TRC benefits less the allocated TRC costs for each measure. For each measure, unit costs (net IMC) are allocated between electric and gas in proportion to the benefits by fuel for that measure. The remaining program costs are allocated to each measure based on each measure’s share of the total electric and gas benefits. Once allocated to each measure, the remaining program costs are allocated to electric and gas in proportion to the benefits by fuel for that measure. (See LBC[TRC][E][WA], LBC[TRC][G][WA]) |
| PAC Levelized Benefit - Cost | F26, F30 | Sum over all measures of PAC benefits less the allocated PAC costs for each measure. For each measure, unit costs (per unit rebates, direct install labor, and direct install materials) are allocated between electric and gas in proportion to the benefits by fuel for that measure. The remaining program costs are allocated to each measure based on each measure’s share of the total electric and gas benefits. Once allocated to each measure, the remaining program costs are allocated to electric and gas in proportion to the benefits by fuel for that measure. (See LBC[PAC][E][WA], LBC[PAC][G][WA]) |
| RIM Levelized Benefit - Cost | F27, F31 | RIM Levelized Benefit – RIM Levelized Cost. (Also, see LBC[RIM][E][WA], LBC[RIM][G][WA]) |

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| **Emissions Reductions** |
| Electric Reductions | C36:E47 | Units implemented in the year, times the annual emission reduction (due to reduced electricity consumption) for the measure, adjusted for the net-to-gross ratio. (See Emission[E][?]) |
| Gas Reductions | F36:G47 | Units implemented in the year, times the annual emission reduction (due to reduced gas consumption) for the measure, adjusted for the net-to-gross ratio. (See Emission[G][?]) |
| Lifecycle Electric Reductions | C51:E61 | Units implemented in the year, times the annual emission reduction (due to reduced electricity consumption) for the measure, times the expected useful life of the measure, adjusted for the net-to-gross ratio. (See Emission[E][?]) |
| Lifecycle Gas Reductions | F51:G61 | Units implemented in the year, times the annual emission reduction (due to reduced gas consumption) for the measure, times the expected useful life of the measure, adjusted for the net-to-gross ratio. (See Emission[G][?]) |

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| **Reductions based on total annual installations** |
| Annual Net kWh | C67:C78 | Sum of # of measures installed in the year \* Annual kWh reduction per measure \* Net-to-gross ratio |
| Lifecycle Net kWh | D67:D78 | Sum of # of measures installed in the year \* Annual kWh reduction per measure \* Net-to-gross ratio \* Measure expected useful life |
| Annual Net Therms | E67:E78 | # of measures installed in the year \* Annual Therm reduction per measure \* Net-to-gross ratio |
| Lifecycle Net Therms | F67:F78 | Sum of # of measures installed in the year \* Annual Therm reduction per measure \* Net-to-gross ratio \* Measure expected useful life. |
| Net July-Sept kW (OnPeak) | G67:G78 | Sum of # of measures installed in the year \* Annual summer peak reduction per measure \* Net-to-gross ratio(See IMP\_MO[X]) |
| Net Dec-Feb (kW) | H67:H78 | Sum of # of measures installed in the year \* Annual winter peak reduction per measure \* Net-to-gross ratioCoincident peak is defined as the load during the five highest system load hours in each month. (See Equation *CP\_KW\_N\_TOT[Wtr]*). Value is adjusted for the net to gross ratio. |
| User Entered kW | J67:J78 | Sum across all measures installed in the corresponding years, multiplied by their user entered peak grid kW savings (INPUT column U) adjusted for their net-to-gross ratio.  |
| Net Annual NCP (kW) | K67:K78 | Maximum monthly NCP reduction in the year less the maximum monthly NCP reduction in the prior year. See Monthly Impacts section. |
| **Net Impacts by Sector** |  | Same information as the Net Impacts Summary section, except segmented by customer sector instead of year of installation.  |
| **Net Impacts by CPUC End Use Categories** |  | Same information as the Net Impacts Summary section, except segmented by end use categories instead of year of installation. Note that after consultation with the IOUs, the categories were modified slightly. The detailed process categories were abandoned in favor of a single “Process”; and Domestic Hot Water was made a category distinct from Water Heating. |
| **Net Impacts by Climate Zone** |  | Same information as the Net Impacts Summary section, except segmented by location instead of year of installation.  |
| **Persistent reductions in the summer or winter** | C158:D169 | Peak reductions tracked, not by the year of installation, but by the amount of peak load reduction that has been installed and not reached the end of its expected useful life in the 3rd of 4th quarter of each year. |
| **Monthly Impacts** |  | All impacts are based on the devices that would be in place in that month. All measures are assumed to be installed on the first say of the quarter (no ramp-up). (see *IMP\_MO[x]*). Note that the NCP values will not match what is shown in the Program Input section As some measures will have maximum reductions in different months, the NCP reductions in any particular month will be lower than the annual NCP reduction (which uses the maximum reduction for each measure, regardless of when that reduction occurs) |

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| **Program Impacts (Gross)** |
| Annual Gross kWh | N10:N12 | Sum across all measures of their annual kWh savings. Based on total units installed. For those measures with useful lives less than one year, the Annual Net kWh is multiplied by the EUL (See *Annual\_kWh*)If a program has units that have short useful lives such that they “fail” prior to the end of the implementation period, the maximum annual kWh savings actually attained in any year will be lower than what is shown here.In addition, this metric does not reduce annual kWh for measures that are installed after the 1st quarter in a year.  |
| Lifecycle Gross kWh | O10:O12 | Sum across all measures of their lifecycle kWh savings. Lifecycle savings = Annual kWh \* Measure Life (in yrs) \* Total units installed. (See *Lifecycle\_kWh*). |
| Annual Gross Therms | P10:P12 | Sum across all measures of their annual therm savings. For those measures with useful lives less than one year, the Annual Net Therms is multiplied by the EUL (See *Annual\_Therms*) |
| Lifecycle Gross Therms | Q10:Q12 | Sum across all measures of their lifecycle therm savings. Lifecycle savings = Annual therms \* Measure Life (in yrs)\* Total units installed. (See *Lifecycle\_Therms*). Note: *This metric is NOT based on the units in place during the third quarter of year 4.*therms. |
| User Entered kW | J10:J12 | Sum across all measures installed in the corresponding years, multiplied by their user entered peak grid kW savings (INPUT column U).  |

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| **Emissions Reductions (Gross)** |
| Electric Reductions | N37:P47 | Units implemented in the year, times the annual emission reduction (due to reduced electricity consumption) for the measure. (See Emission[E][?]) |
| Gas Reductions | O37:R47 | Units implemented in the year, times the annual emission reduction (due to reduced gas consumption) for the measure. (See Emission[G][?]) |
| Lifecycle Electric Reductions | N51:P61 | Units implemented in the year, times the annual emission reduction (due to reduced electricity consumption) for the measure, times the expected useful life of the measure. (See Emission[E][?]) |
| Lifecycle Gas Reductions | O51:R61 | Units implemented in the year, times the annual emission reduction (due to reduced gas consumption) for the measure, times the expected useful life of the measure. (See Emission[G][?]) |

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| **Reductions based on total annual installations (Gross)** |
| Annual Net kWh | N67:N78 | Sum of # of measures installed in the year \* Annual kWh reduction per measure  |
| Lifecycle Net kWh | O67:O78 | Sum of # of measures installed in the year \* Annual kWh reduction per measure \* Measure expected useful life |
| Annual Net Therms | P67:P78 | # of measures installed in the year \* Annual Therm reduction per measure. |
| Lifecycle Net Therms | Q67:Q78 | Sum of # of measures installed in the year \* Annual Therm reduction per measure \* Measure expected useful life. |
| User Entered kW | R67:R78 | Sum across all measures installed in the corresponding years, multiplied by their user entered peak grid kW savings (INPUT column U).  |

## Output by Measure

|  |  |  |
| --- | --- | --- |
| **Net Impacts by Measure** | Cols B through I | Same information as the Impacts Summary section, except segmented by measure instead of year of installation.  |
| **Levelized Benefits less Costs** |
| w/ allocated Admin | Cols L,M,P,Q | Same information as in the Output Tab for levelized results, but reported by measure. |
| No Allocated Admin – TRC | Cols J,K | Only includes net participant costs and rebates and incentives that are entered on a per-measure basis in costs. Lump sum program costs and other lump-sum admin costs are not included. (See *LBC[TRC][E][NA], LBC[TRC][G][NA])* |
| No Allocated Admin - PAC | Cols N,O | Includes per unit costs for 1) rebates, 2) direct install labor, 3) direct install materials, and 4) upstream payments. Other rebates and incentives (entered as a lump sum on the Input tab), as well as other program and admin costs are not included. (See *LBC[PAC][E][NA], LBC[PAC][G][NA])* |

|  |
| --- |
| **Benefit Cost Ratios** |
| TRC – No allocated admin | Col R | Measure present value net benefit / present value net cost. Cost is net participant cost and rebates and incentives that are entered on a per-measure basis. |
| PAC – No allocated admin | Col S | Measure present value net benefit / present value net cost. Cost is per-unit rebate and incentive costs. |
| TRC w/ allocated admin | Col T | Measure present value net benefit / present value net cost. Cost is net incremental measure cost plus allocated admin costs. |
| PAC w/ allocated admin | Col U | Measure present value net benefit / present value net cost. Cost is per-unit rebate and incentive costs plus allocated admin costs. |

# Batch Processing

A “Process Files” button is located on the INPUT and CONTROL tabs. These buttons activate Excel Visual Basic macros that facilitate the separation of calculator input and outputs from the main calculation spreadsheet. (Note, details for the batch processing section may differ slightly for each IOU, as small modifications are ongoing to accommodate specfic IOU batch processing needs.)

Pressing the button calls up the following dialog box



### Processing Choice

**Let me select one file to import.** Select this option to check the calculations for one file

Process steps are:

1. Open a file selection dialog box for the user to select the file to import (Source file)
2. Open the selected source file, and copy data from the INPUT tab of the input file
3. Past the INPUT data into the Master Calculator file
4. Close the source file

**Let me select one or more files to process**. Select this option to batch process one or more source files that are in the same folder. Batch process refers to importing data from the source file and exporting the results back to that same file.

Process steps are:

1. Open a file selection dialog box for the user to select the files to import (Source files). Use the shift key of the control key to select more than one file.
2. Open the selected source file, and copy data from the INPUT tab of the input file
3. Past the INPUT data into the Master Calculator file
4. Calculate the program results for the imported data, and copy the results in the OUTPUT and OUTPUT BY MEASURE tabs back to the source file.
5. If the user has input a suffix (see *Names for Processed Files* on the dialog box above) then append this suffix to the end of the original source file name and save the combined input and output tabs as the new name.
6. If the user have not entered a suffix, save the combined input and output tabs using the original name (overwrite the original file)
7. Close the source file, and repeat starting at step 2.

**Batch process the files listed on the Control tab.** Select this option to batch process one or more source files that reside in various folders. Batch process refers to importing data from the source file and exporting the results back to that same file.

Process steps are:

1. Open the selected source file, using the path and filename information in the CONTROL tab.
2. Copy data from the INPUT tab of the input file
3. Past the INPUT data into the Master Calculator file
4. Calculate the program results for the imported data, and copy the results in the OUTPUT and OUTPUT BY MEASURE tabs back to the source file.
5. If the user has input a suffix (see *Names for Processed Files* on the dialog box above) then append this suffix to the end of the original source file name and save the combined input and output tabs as the new name.
6. If the user have not entered a suffix, save the combined input and output tabs using the original name (overwrite the original file)
7. Close the source file, and repeat starting at step 1.

**Just export the current program.** Select this option to create a small INPUT and OUTPUT file using the data currently in the Master Calculator.

Process steps are:

1. Copy the INPUT data to a new worksheet
2. Copy the OUTPUT and OUTPUT BY MEASURE tabs to the new worksheet.
3. Prompt the user to save the new worksheet with just the input and output data.

### Input File Rows

Select the maximum number of measures allowed in the source spreadsheet

# Control Tab

The control tab is used by the Process Files macro button for batch processing. The user can enter directory path and filename information into this file for unattended batch processing of files in multiple directories. Note that the default is to overwrite these source files with the processed INPUT/OUTPUT file unless a file suffix is specified in the batch processing dialog box.

We recommend that you make a duplicate of your files and directories and run the batch processor on these file to avoid accidental loss of the original files.

|  |  |  |
| --- | --- | --- |
| Number of Files to Process | D11 | Number of files to process through the Calculator file.  |
| Directory Paths | C15:C94 | Directory path for the INPUT files to process |
| FileNames | D15:D94 | Name of the file to process. |
| Process Status | B15:B94 | Indicates whether the file is processed successfully |

# Equations

## Net-to-Gross Ratios

**Net-to-gross ratio for energy**

NTGM = NTG[kWH]M + (MEBInside, M + MEBOutside, M + MEBNon-Part, M)

Where

NTG[kWh]M  = Net to gross ratio for kWh for measure M, from INPUT tab

MEBInside, M = Market Effect Benefits adjustment for participants inside, for Measure M

MEBOutside, M = Market Effect Benefits adjustment for participants outside, for Measure M

MEBNon-Part, M = Market Effect Benefits adjustment for non-participants, for Measure M

**Net-to-gross ratio for natural gas**

NTG\_ThM = NTG[Th]M + (MEBInside, M + MEBOutside, M + MEBNon-Part, M)

Where

NTG[Th]M  = Net to gross ratio for therms for measure M, from INPUT tab. If there is no input for NTR[Th], then NTG[kWh] is used.

MEBInside, M = Market Effect Benefits adjustment for participants inside, for Measure M

MEBOutside, M = Market Effect Benefits adjustment for participants outside, for Measure M

MEBNon-Part, M = Market Effect Benefits adjustment for non-participants, for Measure M

**Net-to-gross ratio for electricity demand**

NTG\_kWM = NTG[kW]M \*+(MEBInside, M + MEBOutside, M + MEBNon-Part, M)

Where

NTG[kW]M  = Net to gross ratio for kW for measure M, from INPUT tab. If there is no input for NTR[kW], then NTG[kWh] is used.

MEBInside, M = Market Effect Benefits adjustment for participants inside, for Measure M

MEBOutside, M = Market Effect Benefits adjustment for participants outside, for Measure M

MEBNon-Part, M = Market Effect Benefits adjustment for non-participants, for Measure M

**Net-to-gross ratio for costs**

**NTG[Cost] is still used for converting gross participant costs to “raw” net participant costs. Onto the “raw” net participant costs are added the market effect participant costs. The market effect participant costs are the ME\_CM \* (Gross Measure Cost + Excess Incentive Cost)**

NTG[Cost]M  = Net to gross ratio for costs for measure M, from INPUT tab. If there is no input for NTR[Cost], then NTG[kWh] is used.

ME\_CM = MECostInside, M + MECostOutside, M + MECostNon-Part, M

Where

MECostInside, M = Market Effect Costs adjustment for participants inside, for Measure M

MECostOutside, M = Market Effect Costs adjustment for participants outside, for Measure M

MECostNon-Part, M = Market Effect Costs adjustment for non-participants, for Measure M

## Weighted Average Net July-Sept Peak (CP\_kW\_N\_TOT[Smr])

Net July-Sept Peak is an average monthly coincident peak value. The coincident peak is itself, the average of the loads during the five highest PG&E system loads for the month. These average peak loads are then averaged for July through September. “Net” refers to the peak estimate being reduced by the Net-to-Gross ratio. This peak load estimate is derived in two ways, depending on whether hourly end use data or H-factor information is used for the end use shape.

The values are weighted for dual baseline measures. Dual baseline measures typically provide relatively high initial savings relative to in-place inefficient technologies. However absent the EE program, at some point in the future, that in-place device would have failed and been replaced with a new standard efficiency device. After the end of that original device’s remaining useful life (RUL) the savings from the EE measure would be relative to the standard efficiency new device, not the old inefficient original device. The weighted average peak values reflect the average savings over the life of the measure, weighted by the RUL as a fraction of the total expected useful life (EUL) of the EE measure.

**

Where

IN\_CM,Q = # of cumulative units of measure M installed in year y.

*For end use shapes with hourly loads:*

**

*Where*

kWh\_\_wtd\_AM = Weighted average annual kWh reduction for measure M

 = (kWh\_AM[1] \* RULM + kWh\_AM[2] \* (EULM-RULM)) / EULM

kWh\_AM = Annual kWh savings relative to [1] first baseline or [2] second baseline

RUL = Remaining useful life of original in-place device replaced by measure M

EUL = Expected useful life of EE measure M

NTG\_kWM = Net –to-Gross ratio for kW for measure M, adjusted for market effects

IR = Installation Rate for measure M

GRR = Gross realization rate for measure M

m = months 7, 8 and 9

CP\_kW\_FactorS,m = Coincident peak factor for end use shape S (corresponding to measure M) and month m.

*CP\_kW\_FactorS,m* = Average peak load from month m divided by total annual end use load. The average peak load for shape *S* is the average end use load during the five highest system loads for the month adjusted to the chronology of the hourly end use load shapes.



*For end use shapes that use TOU-factors:*

*\*IRM \* GRRM*

*Where*

kW\_wtd\_SmrM = Summer peak kW reduction for measure M. For measures that have a kW demand scaler, this value is a user input. For measures that have a kWh demand scaler, this value equals the Summer peak kW TOU factor times the annual kWh reduction for the measure. The scaler is weighted for dual baseline measures

 (DmdScalerM[1] \* RULM + DmdScalerM[2] \* (EULM-RULM)) / EULM

1 = Coincidence factor (1 by assumption)

NTG\_kWM = Net-to-Gross ratio for kW for measure M, adjusted for market effects

IR = Installation Rate for measure M

GRR = Gross realization rate for measure M

## Weighted Average Net Dec-Feb Peak (CP\_kW\_N\_TOT[Wtr])

Net Dec-Feb Peak is an average monthly coincident peak value. It is calculated the same as the Net July-Sept Peak, except that it used December, January, and February peaks, rather than July – September.

**

Where

IN\_CM,Q = # of cumulative units of measure M installed in year y

*For end use shapes with hourly loads:*

**

*Where*

kWh\_\_wtd\_AM = Weighted average annual kWh reduction for measure M

 = (kWh\_AM[1] \* RULM + kWh\_AM[2] \* (EULM-RULM)) / EULM, where [1] is for savings up through the RUL and [2] is for savings from the RUL through the EUL.

NTG\_kWM = Net –to-Gross ratio for kW for measure M, adjusted for market effects

IR = Installation Rate for measure M

GRR = Gross realization rate for measure M

m = months 12, 1, and 2

CP\_kW\_FactorS,m = Coincident peak factor for end use shape S (corresponding to measure M) and month m.

*For end use shapes that use H-factors:*

*\* IRM \* GRRM*

*Where*

kW\_wtd\_WtrM = Winter peak kW reduction for measure M. For measures that have a kW demand scaler, this value is a user input. For measures that have a kWh demand scaler, this value equals the peak kW TOU factor times the annual kWh reduction for the measure. The scaler is weighted for dual baseline measures

 (DmdScalerM[1] \* RULM + DmdScalerM[2] \* (EULM-RULM)) / EULM

1 = Coincidence factor (1 by assumption)

NTG\_kWM = Net-to-Gross ratio for measure M, adjusted for market effects

IR = Installation Rate for measure M

GRR = Gross realization rate for measure M

## Weighted Average Noncoincident Peak (Net NCP)

*For End Use shapes with hourly loads:*

*NCP\_FM.m = Max normalized end use hourly load in month m*

*Normalized end use hourly loads sum to 1.0 over the 8760 observations.*

*Net NCP*  = ΣM [(IN\_CM,y) \* kWh\_wtd\_AM \* NTG\_kWM IRRM\*GRRM\* Maxm = 1 to 12(NCP\_FM,m) ]

where

IN\_CM,Q = # of cumulative units of measure M installed in year y

kWh\_wtd\_A = Weighted average annual kWh reduction for the measure

NTG\_kWM = Net –to-Gross ratio for kW for measure M, adjusted for market effects

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

NCP\_FM.m = Noincident Peak factor for measure M in month m.

M = Measure

m = month

S = End Use shape

*For end use shapes that use H-factors:*

*NCP\_FM.m* = kW\_SmrM,\*Max (kW H-factor, for summer or winter) \* NTG\_kWM\*IRM\*GRRM

Where

Summer is April through October, Winter is the other months.

## Weighted Average User Entered Peak by Year (UserkW[t])



Where

IN\_CM,y = # of cumulative units of measure M installed in year

UserkW\_Wtd = User entered kW reductions per installed measure (prior to adjustment for GRR) weighted for dual baselines

NTG\_kWM = Net –to-Gross ratio for kW for measure M, adjusted for market effects

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M



Where

UserkW[] = User entered kW reductions per installed measure (prior to adjustment for GRR). [1] is for single of first baseline, [2] is for second baseline.

## Weighted Average CEC Peak (Net CEC)

Net CEC (KW) = ΣM [(IN\_CM,y) \* kWh\_wtd\_AM \* NTG\_kWM \*IRM\*GRRM\* (CEC\_F) / 1000]

where

IN\_CM,y = # of cumulative units of measure M installed in year yNTGM = Net –to-Gross ratio for measure *M*

CEC\_F = 0.217 (value prescribed by CEC)

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

## Weighted Average Annual Net kWh (Annual\_kWh)

Annual\_kWh = ΣM ΣQ (INM,y \* kWh\_wtd\_AM \* NTGM \*IRM\*GRRM \* (if EULM > 1, EULM, 1))

Where

INM,y = # of incremental units implemented in year yfor measure *M.*

kWh\_\_wtd\_AM = Weighted average annual kWh reduction for measure M

 = (kWh\_AM[1] \* RULM + kWh\_AM[2] \* (EULM-RULM)) / EULM, where [1] is for savings up through the RUL and [2] is for savings from the RUL through the EUL.

NTGM = Net –to-Gross ratio for kWh for measure M, adjusted for market effects

## Lifecycle Net kWh (Lifecycle\_kWh)

Lifecycle\_kWh = ΣM ΣQ (INM,y \* kWh\_wtd\_AM \* NTGM \*IRM\*GRRM \* LM)

Where

LM = End use measure life in years.

## Weighted Average Annual Net Therms (Annual\_Therms)

*For PG&E, SoCal and SDG&E:*

Annual\_Thermsy = ΣM (INM,y \* Th\_wtd\_AM \* NTG\_ThM\*IRM\*GRRM \* (if EULM > 1, EULM, 1)

Where

Th\_\_wtd\_AM = Weighted average annual therm reduction for measure M

 = (Th\_AM[1] \* RULM + Th\_AM[2] \* (EULM-RULM)) / EULM, where [1] is for savings up through the RUL and [2] is for savings from the RUL through the EUL.

Th\_AM = Annual therm reductions for measure M

NTG\_ThM = Net –to-Gross ratio for therms for measure M, adjusted for market effects

## Lifecycle Net Therms (Lifecycle\_Therms)

Lifecycle\_kWhy = ΣM (INM,y \* Th\_AM \* NTG\_ThM \*IRM\*GRRM \* LM)

Where

LM = End use measure life in years.

NTG\_ThM = Net –to-Gross ratio for therms for measure M, adjusted for market effects

# Cost Effectiveness (Lifecycle Present Value Dollars)

## Cost

### TRC Cost *(TOTCOSTTRC)*

*TOTCostTRC =* Program\_Budget[PV]+ Net\_Part\_Cost[PV]

*Where*

Program\_Budget[PV] = Sum of user inputs for Administrative, Marketing/Outreach, Direct Implementation (including per measure rebate payments, upstream incentives, and direct install labor and materials), EM&V, and Performance Award



LumpSumAdmin = Program admin costs that are entered as an annual lump sum, rather that on a per-unit-installed basis. Lump sum admin costs include 1) Overhead and G&A, 2) Other Admin Costs, 3) Marketing/Outreach, 4) direct implementation, and 5) User input incentive (no rebates).

IncentivesA,M = Cost-per-unit incentive costs for cost type A and measure M. Cost types are 1) Incentives to entities other that the end-use customer or its assignee, 2) Direct install labor, 3) direct install materials, and 4) rebates to the end use customer or its assignee.

Net\_Part\_Cost[PV] = Net participant cost (present value)



INM,Q = # of measures implemented in quarter *Q.*

NTG\_C = Net –to-Gross ratio for costs for measure M

ME\_CM = Total market effect for costs for measure M

Q’ = Number of quarters of implementation.

PCM = Participant cost for measure M.

 = Meas$ - Rebate$ -Incent$-DI$ + ExcessIncent$

Meas$ = Measure cost, with adjustments for dual baseline measures as needed

$Meas\$=FullCost-\left[if RUL>0 then (FullCost-IncrCost)\left(\frac{1+\frac{i}{4}}{1+\frac{r}{4}}\right)^{RUL\*4}, else 0\right]$

FullCost = Full cost of the new measure, including installation costs

IncrCost = Incremental cost of the new measure compared to a standard measure. Include installation costs only to the extent that installation costs are higher than would have been for a standard efficiency measure.

i = Cost escalation (inflation) for the measure (%/yr)

RUL = Remaining useful life of the original measure replaced by the dual baseline efficiency measure. (yrs)

Rebate$ = Rebates to end users and their assignees

Incent$ = Incentives to others (midstream and upstream)

DI$ = Direct install labor and materials provided for the measure.

ExcessIncent$ = Excess incentive cost is the larger of:
(1) 0, or
(2) Incent$ + DI$ - Meas$
Note that for dual baseline measures (RUL>0), the Meas$ will likely be far less than the initial FullCost of the measure.

### PAC Cost *(TotCostPAC)*

TotCostPAC = Program\_Budget[PV]

### RIM Cost *(TotCostRIM)*

Where

Q’ = Number of quarters of implementation for this program.

NTG\_CM = Net –to-Gross ratio for costs for measure M, adjusted for market effects

BillDiscountE = Gross electricity bill reduction for participant



BillDiscountG = Gross natural gas bill reduction for participant. Uses same functional form as BillDiscountE.

Where

y = Year of implementation. First year of program cycle = 1.

y’ = Year counter beginning in the year of implementation

RULM = Remaining useful life in years.

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

## Lifecycle Benefit

### Electric TRC Benefits *(NetPVBenTOT[E])*



Where

 PVBenNet[E] = Present value net electricity benefits

 

NTGM = Net –to-Gross ratio for kWh savings measure *M*, adjusted for market effects.

NTG\_kWM = Net –to-Gross ratio for kW savings measure *M*, adjusted for market effects.



r = annual discount rate

Q = quarter, beginning in January

Q’ = Number of quarters of implementation.

INM,Q = # of incremental of measures implemented in quarter *Q*

PV[Gen]M,Q = Present value of avoided generation costs for measure *M on a dollar per installed measure basis* corresponding to the climate zone for measure *M*, installed by quarter *Q*

PV[TD]M,Q = Present value of avoided T&D costs for measure *M a dollar per installed measure basis,* corresponding to the climate zone for measure *M*, installed by quarter *Q*

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M





For hourly end use shapes:



h = hours in the quarter, *Q*

*t =* year corresponding to quarter Q plus n-1 years.

kWEU,h,CZ = Normalized load for end use *EU* during hour *h* in climate zone *CZ*

EU = End use selected to correspond to measure *M*

CZ = Climate zone specified for the measures *M*

AC[Gen]h,t = Avoided cost of generation ($/kWh) in the climate zone corresponding to the measure for hour *h* in year *t.*  This value includes environmental costs.

DmdScaler\_wtd = Demand Scaler weighted for dual baselines.

 = (DmdScalerM[1] \* RULM + DemandScalerM[2] \* (EULM-RULM)) / EULM

DmdScaler[] = Demand scaler. 1 = savings relative to first baseline, 2 = savings relative to second baseline.

* + - Equals kWh\_AM for those measures that are based on hourly shapes of use TOU demand factors that are normalized to energy (like PG&E residential).
		- Equals User Entered kW Savings (input column U) for other measures.

TOUCorrU,S = [1 + (AC TOU Correction factor) \* percent of the measure that qualifies for the correction factor]. The AC TOU correction factor varies for residential and non-residential sectors . If a measure has an end use that does not qualify for the AC TOU correction factor, TOUCorr is set to 1.0. See Table 7 for AC TOU Correction factors.



AC[TD]h,t,CZ = Avoided cost of T&D ($/kWh) in the climate zone corresponding to the measure for hour *h* in year *t.*

For H-factor end use shapes.

 



where

Q’ = Number of quarters of implementation.

TOU = Time of use period corresponding to the quarter. The three summer periods are used for quarters 2 and 3. The two winter TOU periods are used for quarters 1 and 4.

kWM = Summer on-peak kW reduction for the measure.

HF[kWh]EU,TOU = H-factor for energy share for the EU for the TOU period

AC[Gen]TOU = Simple average of implied hourly net generation avoided costs in the climate zone for the measure during the TOU period in year *t*.

*t =* year corresponding to quarter Q.

AC[TD]TOU,,t = Sum of T&D avoided costs for the measure during the TOU period in year *t*.

HF[kW]EU,TOU = H-factor for peak shape for the EU for the TOU period

### Gas TRC Benefits *(NetPVBenTOT[G])*





Where

NTG\_ThM = Net –to-Gross ratio for natural gas savings for measure M, adjusted for market effects



R = annual discount rate

Q = quarter, beginning in January

INM,Q = # of incremental of measures implemented in quarter *Q*

Th\_AM = Annual gas reduction (in therms) for measure *M*. [1] indicates savings relative to baseline at time of installation. [2] indicates savings relative to second baseline if a dual baseline measure.

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

MCGasS,Q = Avoided gas costs in quarter *Q*. Expressed as $ per annual Therm reduction. S indicates the type of gas reduction profile corresponding to the Measure M. Profile types are 1) annual, 2) summer-only, 3) winter-only. Avoided costs include procurement, environmental and T&D avoided costs. T&D benefits are uniform $/Therm values for the winter months (Nov through Mar). Therefore a gas measure that has all of its reductions in the summer would receive no T&D avoided cost value. A measure with all of its savings in the winter would receive full TD avoided cost value. A measure with year round savings would have the TD $/therm avoided cost reduced by a factor of 2 to reflect that fact that only half of the therm reductions (the half that occurs during the winter) would result in T&D avoided costs.

## Levelized Cost and Benefit

### Discounted Electric Reductions *(kWhD[N])*

kWhD[G] = Discounted avoided kWh – Gross.

kWhD[N] = Discounted avoided kWh – Net



*kWhD[N]M = kWhD[G]M \* NTGM*





INM,Q = # of incremental of measures implemented in quarter Q.

kWh \_AM = Annual kWh reduction for measure M. [1] indicates savings relative to the first baseline, and [2] indicates savings relative to any second baseline.

Q’ = Number of quarters of implementation.

PV(r,L,-1) = The uniform series present worth factor, using an annual discount rate of *r* and *L* number of years.

RULM = Remaining useful life of dual baseline measure.

EULM = EUL for measure (total, not incremental life for dual baseline measures)

NTGM = Net–to-Gross ratio for kWh savings for measure *M*.

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

r = Annual discount rate

### Discounted Gas Reductions *(ThD[N])*

ThD[G] = Discounted avoided therms – Gross.

ThD[N] = Discounted avoided therms – Net.





*ThD[N]M = ThD[G]M \* NTG\_ThM*



Th\_AM = Annual therm reduction for measure M. [1] indicates savings relative to the first baseline, and [2] indicates savings relative to any second baseline.

RULM = Remaining useful life of dual baseline measure.

EULM = EUL for measure (total, not incremental life for dual baseline measures)

IRM = Installation Rate for measure M

GRRM = Gross realization rate for measure M

NTG\_ThM = Net–to-Gross ratio for natural gas savings for measure *M*.

r = Annual discount rate

Q’ = Number of quarters of implementation.

### Levelized Cost

**TRC Levelized Cost ($/kWh) *(LC[TRC][E])***

LC[TRC][E] = LB[TRC][E] – LBC[TRC][E]

Where

LB[TRC][E] = Levelized benefits under the TRC test for electric (defined later)

LBC[TRC][E] = Levelized benefit – cost under the TRC test for electric (defined later)

**PAC Levelized Cost ($/kWh) *(****LC[PAC][E])*

LC[PAC][E] = LB[TRC][E] – LBC[PAC][E]

Where

LB[TRC][E] = Levelized benefits for electric (PAC and TRC benefits are the same)

LBC[PAC][E] = Levelized benefit – cost under the TRC test for electric (defined later)

**RIM Levelized Cost ($/kWh) *(****LC[RIM][E])*



**TRC Levelized Cost ($/Th) *(****LC[TRC][G])*

LC[TRC][G] = LB[TRC][G] – LBC[TRC][G]

Where

LB[TRC][G] = Levelized benefits under the TRC test for gas (defined later)

LBC[TRC][G] = Levelized benefit – cost under the TRC test for gas (defined later)

**PAC Levelized Cost ($/Th) *(****LC[PAC[G])*

LC[PAC][G] = LB[TRC][G] – LBC[PAC][G]

Where

LB[TRC][G] = Levelized benefits for gas (PAC and TRC benefits are the same)

LBC[PAC][G] = Levelized benefit – cost under the TRC test for gas (defined later)

**RIM Levelized Cost ($/Th) *(****LC[RIM][G])*



Where

ThD[N] = Discounted lifecycle therm reductions, adjusted for the Net-to-Gross ratio.

### Levelized Benefits

**TRC Levelized Benefits ($/kWh) *(LB[TRC][E])***

Values are the same for all cost tests.

LB[TRC][E] = NetPVBenTOT[E] / kWhD[N]

LB[PAC][E] = NetPVBenTOT[E] / kWhD[N]

LB[RIM][E] = NetPVBenTOT[E] / kWhD[N]

**TRC Levelized Benefits ($/Therm) *(LB[TRC][G])***

Values are the same for all cost tests.

LB[TRC][G] = NetPVBenTOT[G] / ThD[N]

LB[PAC][G] = NetPVBenTOT[G] / ThD[N]

LB[RIM][G] = NetPVBenTOT[G] / ThD[N]

### Levelized Benefit – Cost

**Levelized Benefits – Costs: Electric, TRC Test, No Admin Costs.** *(LBC[TRC][E][NA])*

 

Where

NA = No Admin. Indicates that the metric does not include admin costs.

EAllocM = Electric allocation for measure *M*.

 = NetPVBen[E]M / (NetPVBen[E]M + NetPVBen[G]M)

IMC\_PV = Net incremental measure cost (present value). This was defined in the Cost section.

**Levelized Benefits – Costs: Gas, TRC Test, No Admin Costs.** *(LBC[TRC][G][NA])*

 

**Levelized Benefits – Costs: Electric, TRC Test, with Admin Costs.** *(LBC[TRC][E][WA])*

 

Where

WA = With Admin. Indicates that the metric does include admin costs.

Admin[TRC] = Total Program Costs excluding rebates and incentives

MAllocM,CZ = Measure allocation.

**Levelized Gas Benefits – Costs: Gas, TRC Test, with Admin Costs.** *(LBC[TRC][G][WA])*

 

**Levelized Benefits – Costs: Electric, PAC Test, No Admin Costs.** *(LBC[PAC][E][NA])*

 

Where

UnitIncM,CZ = Present value Per unit Rebate + per unit direct install labor + per unit direct install materials. Discounting is based on installation schedule. (see TOT\_INC for discounting details)

**Levelized Benefits – Costs: Gas, PAC Test, No Admin Costs.** *(LBC[PAC][G][NA])*

 

**Levelized Benefits – Costs: Electric, PAC Test, with Admin Costs.** *(LBC[RIM][E][WA])*

 

Where

Admin[PAC] = Total Program Costs less the sum of all UnitIncM,CZ (this is done to avoid double counting, as those per-unit costs are included in the “no admin costs” case)

**Levelized Gas Benefits – Costs: Gas, PAC Test, with Admin Costs.** *(LBC[RIM][G][WA])*

 

# Emissions Reductions

### Electric Reductions: CO2 tons per year *(Emission[E][CO2])*



Where

y = year of consideration. First year of program cycle = 1.

Q = Quarter of the year.

INM,Q = # of incremental of measures implemented in quarter *Q.*

NTGM = Net–to-Gross ratio for energy for measure *M*, adjusted for market effects.

ER[CO2]M = Emission rate of CO2 in tons per kWh of measure *M*.

NOX and PM-10 equations are the same. Just replace [CO2] with the appropriate indicator. Note that CO2 emission rate is in tons per kWh. NOX and PM-10 are in pounds per kWh.

### Gas Reductions: CO2 tons per year *(Emission[G][CO2])*



Where

y = year of consideration.

Q = Quarter of the year.

INM,Q = # of incremental of measures implemented in quarter *Q.*

NTGM = Net–to-Gross ratio for energy for measure *M*, adjusted for market effects.

ER[CO2]GCT = Emission rate of CO2 in tons per therm, based on the gas combustion type (GCT) specified on the input sheet for the measure.

NOX and PM-10 equations are the same. Just replace [CO2] with the appropriate indicator. Note that CO2 emission rate is in tons per Therm. NOX and PM-10 are in pounds per Therm.

## Monthly Impacts (IMP\_MO[X], IMP\_MO[Th])

For CP, NCP, and monthly kWh.



Note that this calculation is accurate for monthly kWh. Reported values for coincident (monthly five hour peak) and noncoincident peaks will be off to the extent that there are dual baseline measures that have ratios of baseline 1 / baseline 2 energy savings that differ from the corresponding ratios for coincident and noncoincident peak.

Where

IMP\_MO[X] = Monthly impact for metric X. Metrics can be CP, NCP, kWh

kWh\_A[]M = Annual kWh reduction for measure *M*. [1] indicates savings relative to the first baseline, and [2] indicates savings relative to any second baseline.

NTGM = Net–to-Gross ratio for energy for measure *M*, adjusted for market effects.

IMP\_U[X]M.m = Per unit impact for metric X. Value is normalized to total annual kWh reductions.

IN\_C[]M,Q = # of cumulative units of measure M installed by Quarter Q. [1] is for original installations, [2] is for measures from the RUL through the EUL.

Exp\_C[]M,Q = # of units of measure M, installed under this program that have reached [1]the end of their EUL or RUL (for dual baseline measures) prior to Quarter Q, and [2] the end of their EUL for dual baseline measures.

M = Measure

m = Month of the year (1 – 12)

For Monthly Therms



Note that this calculation uses the kWh derating of second baseline savings. kWh\_A[2]/kWh\_A[1] is used as a proxy for Th\_A[2]/Th\_A[1] for computational efficiency.

Where

m = Month of the year (1 – 12)

Th\_A[1] = Annual therm savings. [1] indicates savings relative to the first baseline, and [2] indicates savings relative to any second baseline.

NTG\_Th = Net to gross ratio for natural gas savings, adjusted for market effects.

GasShapeS,m = Allocation factor to assign annual natural gas savings to months. One of three shapes (S) that can be assigned to a measure (annual, summer-only, winter-only).

IN\_C[]M,Q = # of cumulative units of measure M installed by Quarter Q. [1] is for original installations, [2] is for measures from the RUL through the EUL.

Exp\_C[]M,Q = # of units of measure M, installed under this program that have reached [1]the end of their EUL or RUL (for dual baseline measures) prior to Quarter Q, and [2] the end of their EUL for dual baseline measures.

# Reported Savings for Goal Attainment



Where

kWh\_A[1] = Annual kWh savings for single or first baseline. Based on a full year of operation, regardless of actual device EUL or RUL.

kWh\_A[2] = Annual kWh savings for second baseline. Based on a full year of operation, regardless of actual device EUL or RUL.

FullYr[1] = For single baseline: 1 if the EUL >=1, otherwise equals the EUL
For dual baseline: 1 if the RUL >=1, otherwise equals the RUL

FullYr[2] = 1 if (EUL-RUL)>=1, otherwise equals EUL-RUL.

IR = Installation rate

GRR = Gross realization rate

InstallsY,M = Total devices M installed in or prior to year Y, regardless of when they were installed within that year.

DecayY,M = Devices installed prior to year Y, that would be past their EUL or RUL.

2ndInstalls = Devices that are beyond the RUL of their replaced measure

2ndDecay = Dual baseline devices that are beyond their EUL



For single baseline:

 

For dual baseline

 

INM,Q = Devices installed for measure M in quarter Q

For dual baseline (EUL>RUL)





where



 

For kW and Therms, just replace kWh\_A with kW\_A or Th\_ADefinitions

IMP\_MO[X] = Monthly impact for metric X. Metrics can be CP, NCP, kWh

kWh\_AM = Annual kWh reduction for measure *M*.

M = Measure

m = Month of the year (1 – 12)

NTG\_C = Net to Gross Ratio for measure costs, adjusted for market effects

NTG\_kW = Net to Gross Ratio for peak kW savings, adjusted for market effects

NTG = Net to Gross Ratio for kWh savings, adjusted for market effects

NTG\_Th = Net to Gross Ratio for therm savings, adjusted for market effects

Q = Quarter

r = Annual discount rate

Th = Therms

Y = Year

# Sector and End Use Shape Combinations

Table 1: DEER hourly shapes --- apply to all utilities



Added 2011-12: DEER:HVAC\_Eff\_HP DEER:HVAC\_Split-Package\_HP

 DEER:Res\_ClothesDishWasher DEER:Res\_BldgShell\_Ins

Table 2: PG&E Non-Res H-Factor (TOU) based shapes. Sector Name is at the top of the column.



Table 3: PG&E TOU-based Residential Shapes



Table 4: SCE End Use Shapes (Sectors are in Bold)



Table 5: SDG&E End Use Measures (Not limited by sector in the spreadsheet)



Table 6: SoCalGas Shapes



Table 7: AC TOU Correction Factors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PG&E | SCE | SDG&E | SoCalGas |
| Residential | 1 | 1 | 1 | 1 |
| Non-Residential | 1 | 1 | 1 | 1 |

# TRC Cost Formulas: Decision formulation vs E3 Calculator Formulation

## Original formulation (versions prior to v1c)

(1) TRC Cost = Admin + NTG \* (Meas$) + (1-NTG) (Rebate + Incent) (from Decision)

Expanding (1) gives

(2) TRC Cost = Admin + NTG \* Meas$ + Rebate + Incent - NTG\*Rebate – NTG\*Incent

Rearranging (2) gives

(3) TRC Cost = Admin + Rebate + Incent +NTG\*(Meas$ - Rebate - Incent)

Since Participant cost = PartCost = Meas$– Rebate – Incent, (3) can be re-expressed as:

(4) TRC Cost = Admin + Rebate + Incent + NTG\*PartCost (form used in E3 Calculator)

## 2013-2014 Modifications

###  Excess incentives

The 2013-2014 calculators have been revised to prevent Participant Costs from becoming negative due to incentives to others or direct install labor or materials costs. The problem is addressed through the addition of an “excess incentive cost” that essentially increases the Gross Measure cost. (Note that the E3 Calculator will continue to allow negative Participant Costs due to direct rebates to end use customers or their assignees. No adjustment is needed for Rebate costs)

(5) Excess incentive cost = Excess = Max(0,Meas$-Rebate-Incent)

(6) PartCost = Meas$ +Excess –Rebate –Incent

Recognizing this revised definition of participant cost, results in this modification to equation (3):

(7) TRC Cost = Admin + Rebate + Incent +NTG\*(Meas$+Excess - Rebate - Incent)

Carrying the change back to equation (1) would results in a Decision-style formula of:

(8) TRC Cost = Admin + NTG \* (Meas$ + Excess) + (1-NTG) (Rebate + Incent)

### Market Effect Adjustments

The new E3 Calculators include the ability to separately adjust measure benefits and measure TRC costs for market effects such as spillover. Market effects for benefits are applied to all benefit components. Market effects for costs, however, are applied only to (Meas$ + Excess). They are not applied to Rebates or Incentives. This modifies equation (8) into the following:

**(9) TRC Cost = Admin + (NTG +ME\_C)\* (Meas$ + Excess) + (1-NTG) (Rebate + Incent)**

 where ME\_C = Market Effects adjustment for costs.

Equation (9) is revised “Decision-style” formulation of the TRC cost. The E3 Calculator, as mentioned above, uses an equivalent, but different, formulation that focuses on Participant Cost. Rearrainging terms in (9) yields:

(10) TRC Cost = Admin + Rebate + Incent +NTG\*(Meas$+Excess-Rebate –Incent) + ME\_C\*(Meas$+Excess).

Replacing (6) into (10) gives us the final E3 Calculator formula:

**(11) TRC Cost = Admin + Rebate + Incent +NTG\*PartCost + ME\_C\*(Meas$+Excess)**