Appendix N

Special Circumstance

1. Introduction

In its October 18, 2010 order[1], the Commission defined early replacement as replacement of equipment prior to the end of its prescribed effective-useful life and directed Staff to develop a dual baseline method for estimating the benefits and costs of early replacement that provides consistency between the treatment of savings and costs. The order also directed Staff to provide simplifying lookup tables for early replacement energy savings consistent with the dual baseline concept. The dual baseline methods and lookup tables have been developed and are provided in Appendix M of the Technical Manual.

The October 18, 2010 Order also introduced the concept of "special circumstance" replacements: the replacement of equipment operated by customers who are influenced by initial costs more than by life cycle economics. These customers include those with insufficient capital, a split incentive (such as a landlord incurring cost to provide a tenant benefit), short time horizons, and/or other factors which tend to prevent long range economic decision-making regarding the installation of high efficiency equipment. The Commission applied the concept of special circumstance replacements only to commercial and industrial machinery and multifamily central systems,[2] and only to equipment well past its prescribed effective useful life. The order specifically excluded lighting equipment from special circumstance replacement.

The Commission established a general outline for determining eligibility for special circumstance replacement treatment including:

1. Equipment age significantly exceeds its effective useful-life;
2. Energy consumption significantly exceeds that of current high efficiency models;
3. There is a history of significant repair or replacement with used equipment;
4. The prospective next repair or replacement is likely to be much less expensive than replacement with new higher efficiency machinery.

The order directed Staff to develop more detailed criteria and a method for adapting dual baseline screening for early replacement to special circumstance replacements, with consultation with the Evaluation Advisory Group (EAG) which includes the program administrators (PAs). In dual baseline analysis, the savings for the first baseline are calculated against the replaced equipment, while the savings for the second baseline are calculated against the current standards/codes minimums or, in the absence of such, common practice.

[1] Case 07-M-0548, Energy Efficiency Portfolio Standard (EEPS), Order Approving Consolidation and Revision of Technical Manuals (issued October 18, 2010).

[2] What "multifamily central systems" includes is clarified in detail in the Case 07-M-0548, Energy Efficiency Portfolio Standard (EEPS), Order Approving Modifications to the Technical Manual (issued July 18, 2011), pps 15 - 16.

In its July 18, 2011 order,[3] the Commission approved Staff's proposals regarding detailing the first two criteria for eligibility:[4]

> **Age Rule**: The equipment to be replaced must be aged at least 125% of its prescribed effective-useful life in cases where the age of the equipment can be determined to this extent.[5] If the equipment is determined to be less than 125% of its EUL, it's not eligible for SC treatment regardless of consumption or any other factor
>
> **Energy Use Rule**: Applies **only** in cases in which the age of the existing equipment cannot be determined relative to 125%; existing equipment of most types must consume at least 20% more energy than the new high efficiency equipment to do the same amount of work, and at least 35% more for chillers.

In the July 18 Order, the Commission also approved Staff's proposal to define the first baseline, the hypothetical period for which the old equipment in place would have continued in use absent the program (the Default Functional Period or DFP) as 25% of the program efficient measure's EUL.[6]

The July 18, 2011 order also directed Staff to post directions and lookup tables for Special Circumstance replacement as a counterpart to those in Appendix M for early replacement. For the interim period, PAs were permitted to use the tables in Appendix M for Special Circumstances for costs.[7] However, Appendix N includes tables for special circumstance replacement which PAs must now use.

For equipment that qualifies as special circumstance, the dual baseline method described in Appendix M will be applied for special circumstance TRC screening. The dual baseline situation that characterizes the special circumstance situation, illustrated in Figure 1, involves a customer who replaces fully functioning equipment aged at least 25% beyond its official EUL. The equipment hypothetically would have continued to function for some period of time, the DFP. However, the customer is induced by the program to replace this existing equipment with more efficient equipment. It is assumed that at the end of the DFP, absent the program, the customer would have installed equipment that would meet the existing efficiency code or appliance standard, or common practice (referred to as the *code/standard equipment*).

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[3] Ibid.

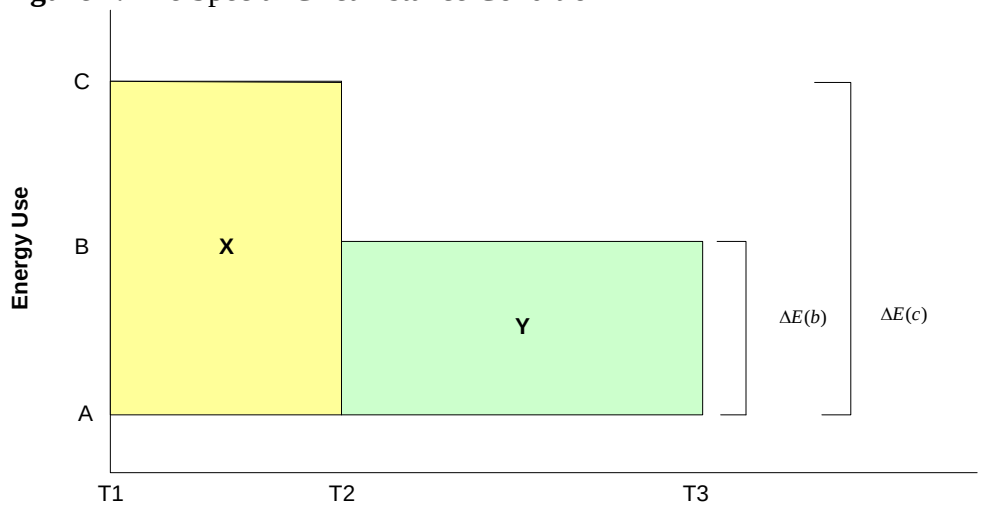
[4] While the first two require definition of "significant," the third and fourth do not require or lend themselves to additional detail. The Commission also approved Staff's proposed relationship between the first two, i.e., energy consumption is considered only if age relative to 125% cannot be determined.

5 It is not necessary to determine the exact age of the equipment as long as it can be determined to be at least 125% of the effective-useful life.

[6] The Order also included a comprehensive list of measures and associated EULs that should be used in cases where the special circumstance measure matches a measure in the Order. In cases where there is no match, PAs must propose and document the EUL.

7 Program administrators were required to research and calculate their own **savings** ratios and to use the second set of tables (not the DEER-based tables), as consumption of the old equipment in place may differ between early and special circumstance replacement -- the baseline existing equipment is pre EUL versus 125% past it, potentially with widely varying efficiency. For costs, the comparison is between current high efficiency versus standards/code or common practice in any case.

Figure 1. The Special Circumstance Condition



$\Delta E(c)$ = C - A
$\Delta E(b)$ = B - A

C = Energy use of pre-existing equipment
B = Energy use of equipment that meets code
A = Energy use of the efficient equipment rebated through program
T1 = Date on which new efficient equipment is installed
T2 = Date on which existing equipment was expected to have failed
T3= Date on which the new efficient equipment is expected to fail
T3 – T1 = Expected effective useful life (EUL) of the new efficient equipment
T2 – T1 = Expected period of time in which the pre-existing equipment would have continued to function, referred to as the default functional period (DFP)
T3 – T2 = Expected remaining EUL of the new efficient equipment

Energy savings in this example would consist of two portions. The customer would have experienced the ***full*** savings represented by the line segment C-A for the DFP period T2-T1, Area **X**. At the end of the DFP, the savings for the period T3-T2 would be reduced to ***incremental*** savings represented by the line segment B – A, area **Y**. To carry out these calculations, information on the energy use of code/standard equipment is required. Information on energy use of the existing equipment and the high efficiency equipment provided through the program is also required, but much more available and routinely needed.

The costs also have to be calculated in a manner consistent with the special circumstance case. In normal replacement situations, one would use the incremental cost that is defined as the cost of the new efficient equipment minus the cost of the code/standard equipment. In the special circumstance case, the incremental cost is calculated in a slightly different manner which recognizes that, in the absence of the program, the customer would not have purchased any equipment until the future end of the DFP.

Thus, one would first have to determine the full cost of the new efficient equipment at T1 *and* the full cost of the code/standard equipment (both including the installation labor) at T2 (assuming no change in real costs). The incremental costs would then be calculated as the cost of the new efficient equipment installed now (left column in Figure 2) minus the present value (PV) of the cost that is avoided in the future for the code/standard equipment (right column Figure 2). Figure 2 presents a case in which the DFP is 4 years and, absent the program, the code/standard

equipment would have been installed in the fifth year. This calculation differs from the normal/end of life replacement incremental cost in adding the time value of money for spending the money earlier.

Figure 2. Incremental Cost Calculation for Special Circumstance Cases with a DFP of Four Years

Year	PV With Program	PV Without Program
1	Full Cost of High Efficient Equipment	0
2	0	0
3	0	0
4	0	0
5	0	Full Cost of Code/Standard Equipment

2. The Ratio Approach to the Dual Baseline with the Lookup Tables

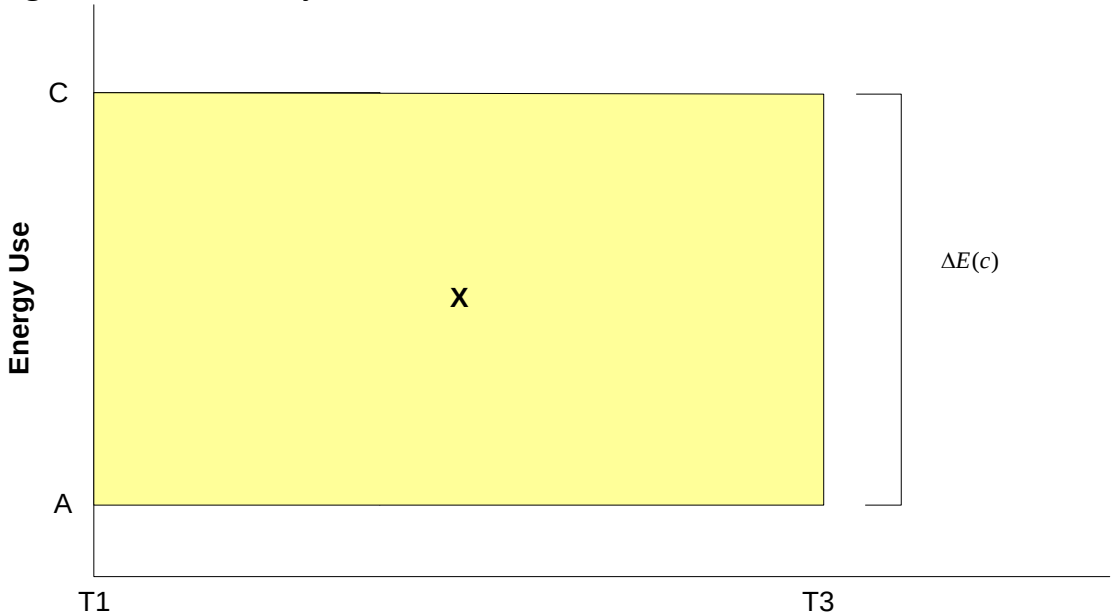
As in Appendix M, this approach focuses on the ratio of incremental energy savings to full energy savings[8] and the ratio of incremental costs to full costs. These ratios, shown at the top of the columns in Tables N-1 through N-2, determine the factors that PAs can use to adjust the savings and cost data. These first two tables require the program administrators to provide their own incremental costs and savings ratios (based on the code/standard equipment). To use these tables, PAs must match the ratios that they have calculated to the nearest corresponding ratios in these tables

To use Table N-1 for benefits, PAs will need to calculate the full annual savings as the annual energy use of the old equipment in place minus the annual energy use of the high efficiency equipment. These full savings are then counted for each year of the EUL as is represented as area *X* in Figure 3. For each year of the EUL (T3 – T1) of the new equipment, the full kWh or therm savings are converted to dollar benefits by multiplying them by the Commission's avoided costs estimates for that year[9].

[8] The savings values ratios are not area present values but are rather the line segments in Figure 1 on the vertical axis: (B – A) divided by (C – A).

[9] The tables are not territory-specific, but statewide. This is because only the LRAC growth rates matter, not the absolute values, and the growth rates for the various zones are almost identical in the LRACs in use.

Figure 3. Inflated Lifecycle Benefits



$\Delta E(c)$ = C - A

C = Energy use of pre-existing equipment

A = Energy use of the efficient equipment rebated through program

T1 = Date on which new efficient equipment is installed

T3 = Date on which the new efficient equipment is expected to fail

T3 – T1 = EUL of new efficient equipment

As a preliminary step in using Table N-1, and valid only for that purpose, the PAs will calculate this "inflated lifecycle benefits" for kWh, peak kW, and/or therms as the present value of the stream of full savings benefits for the EUL of the new equipment.[10]

In cases of special circumstance under the ratio approach, it is these inflated lifecycle benefits that must be adjusted using the appropriate *inflated lifecycle benefits adjustment factor*. For a given measure with a given EUL/DFP and ratio of incremental savings to full savings, the inflated lifecycle benefits adjustment factor is the ratio (presented as a percentage) of the present value of the dual baseline lifecycle benefits (X+Y) illustrated in Figure 1 to the present value of the inflated lifecycle benefits illustrated in Figure 3.

Under the Commission requirement of consistent treatment of savings and costs, the full costs[11] must also be adjusted downward. Using research on the costs of standard/code equipment, a PA can calculate the ratios of incremental costs to full costs and obtain the *full cost adjustment factors* from Table N-2. If a PA cannot obtain or chooses not to seek the data necessary to

[10] Usually, the ratio of incremental kWh savings to full kWh saving would be the same as the ratio of incremental peak kW demand reduction to full peak kW demand reduction, which implies using the same ratio and adjustment factor for both. However, with some measure types, such as cooling, PAs may benefit from calculating different ratios of incremental to full for kWh and kW. A PA can choose to use higher 0.05 increment kW ratios if it can calculate and document them with retention.

[11] Full costs include the capital cost of the new efficient equipment plus installation cost.

calculate the cost ratios, it can use the ratios and adjustment factors from Tables M-11 through M-19 in Appendix M in cases in which the measures match.

Note that all documentation for PA costs and savings estimates and ratios must be retained for possible Staff or ex post evaluator review.

3. Look-Up Tables

Tables N-1 and N-2 have been prepared so that PAs can obtain the Inflated Lifecycle Benefit and the Full Cost adjustment factors. For Inflated Lifecycle Benefits Adjustment Factors, PAs must calculate their own savings ratios. If PAs are able to calculate their own ratios of incremental costs to full costs, they may prefer to use Table N-2. However, as discussed above, in some cases PAs may use the tables in Appendix M to obtain cost ratios and adjustment factors.

For Tables N-1 and N-2, a PA should identify the 0.05 increment ratios that are closest to those it developed. The ratios range from 0.95 to .05 in increments of 0.05, and there are no measure designations.

Note that ratios of 1.0 and 0.0 are not included in the tables. For some measures, the efficiency of the old in place unit is still the common practice or no new standards have been adopted, i.e., the baseline for the full savings and the incremental savings are the same. As a result, the ratio of incremental to full savings is near 1.0, meaning that a PA can claim the full savings for the entire EUL of the new equipment (areas X and Y in Figure 4). Therefore, the lookup tables do not apply. For other measures, the high efficiency equipment subsidized by the program is consistent with current code or standards. For these measures, the incremental savings are zero and thus the ratio of incremental to full savings is 0.0.This means that a PA can claim full savings for only the RUL (area X in Figure 5), after which the high-efficiency replacement would have occurred anyway. Therefore, the lookup tables do not apply.

Figure 4. Efficiency of the Old In Place Unit Is Still the Common Practice Or No New Standards

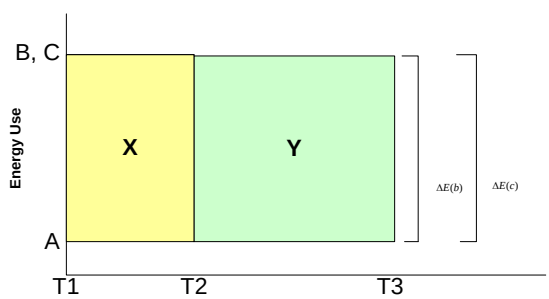
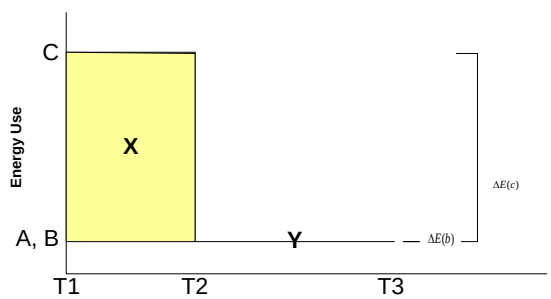


Figure 5. High Efficiency Equipment Subsidized by the Program Is Consistent with Current Code Or Standards



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T1 = Date on which new efficient equipment is installed
T2 = Date on which existing equipment was expected to have failed
T3= Date on which the new efficient equipment is expected to fail
T3 – T1 = Expected effective useful life (EUL) of the new efficient equipment
T2 – T1 = Expected remaining useful life (RUL) of the pre-existing equipment
T3 – T2 = Expected remaining EUL of the new efficient equipment

To use the tables, a PA must gather the following four pieces of information:

1. the EUL of the type of equipment,
2. the DFP of the old equipment in place (just 25% of the EUL),
3. the full savings of the equipment (annual energy use of the old equipment in place minus the annual energy of the high efficiency equipment supported by the program), and
4. the full costs (including installation)

Additionally, a PA will need documented estimates, based on equipment minimally compliant with standards/codes or common practice, of incremental savings and costs in order to calculate:

1. The ratio of incremental savings to full savings, and
2. The ratio of incremental costs to full cost

Again, note that for the costs, PAs can use the Tables in Appendix M where measures match.

3. Table Organization

Table N-1 contains the Inflated Lifecycle Benefit Adjustment Factors while Table N-2 contains the Full-Cost Adjustment Factors.

In Table N-1, the first row is the ratio of incremental savings to full savings while in Table N-2 the first row is the ratio of incremental to full cost. In both tables, the first two columns identify the EULs and corresponding DFPs:

- 25 Years/6
- 20 Years/5
- 14 to 17 Years/4
- 10 to 13 Years/3

The remaining columns present the respective adjustment factors by ratio of

- Table 1: Incremental savings to full savings
- Table 2: Incremental costs to full costs

4. Program-Tracking Database Requirements

The program tracking databases contain information for each measure installation which the PAs are required to maintain for the purposes of current reporting and future impact evaluation, the latter requiring many fields not used for current reporting. The following seven additional required variables, as were first required in Appendix M,[12] are being added by Staff through the Evaluation Advisory Group process[13]:

[12] Note that item #2 above is a correction of item #2 in Section 5 of Appendix M. Furthermore, item #3 is now required in addition to those variables listed in Section 5 of Appendix M. Those using Appendix M should take note of these changes.

[13] Note that for cases of normal replacement and add-on, the variables 2 through 7 should be coded as "n/a" (not applicable).

1. Type of Installation (TRC Approach)[14] ,
2. The *Full Savings (kWh or therms)*,
3. If electric, the on-peak demand reductions associated with the Full Savings,
4. The *Adjusted Full Cost* (full cost multiplied by the full-cost adjustment factor),
5. The *Ratio of Incremental Savings to Full Savings*,
6. The *Ratio of Incremental Costs to Full Costs*, and
7. The *Adjusted EUL* (discussed below).

The Adjusted EUL is defined as that period of years over which the present value benefits of the full savings would approximate the present value dollar benefits of the underlying dual baseline. Figure 6 shows the Adjusted EUL Tx, reduced from the actual EUL T3 such that the lifecycle savings over the period Tx – T1 approximates the lifecycle savings over the period T3 – T1 in Figure 1 (repeated from above). The longer the DFP is, the longer the adjusted EUL, owing to more years at full savings.

Figure 1. Lifecycle Savings: Dual Baseline

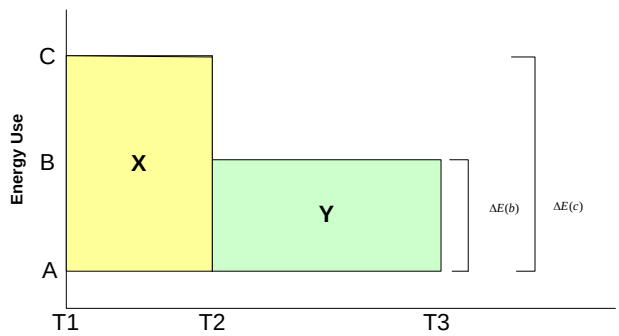

Figure 6: Lifecycle Savings: Approximation to Dual Baseline

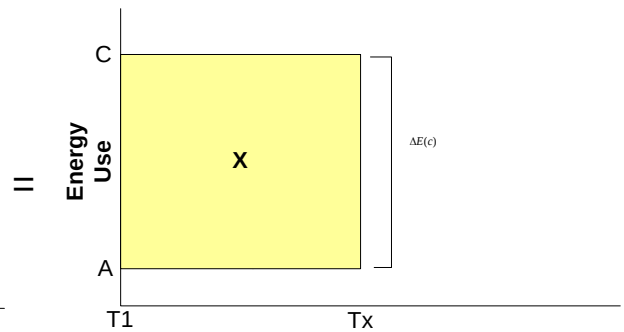

Table N-3 presents the adjusted EULs in years for each possible ratio (in 0.05 increments). In Table N-3, the first row is the incremental to full savings ratio and the first two columns identify the EULs and corresponding DFPs. The adjusted EUL is not used for TRC screening, but only for the program's tracking data base. Table N-3 is organized in the same way as the Table N-1. Note that Tables N-1 through N-3 are also available in Excel.

4. Example

Consider the following example. Suppose a PA finds in place equipment with an EUL of 17 years whose age is determined to be 22 years. The five years over the EUL is greater than 25% of the EUL (17/4 = 4.25 which rounds to 4, which is also the DFP). The equipment is eligible for special circumstance treatment if it also meets criteria #3 and #4. The PA has determined that the ratio of incremental savings to full savings is 0.65 and the ratio of incremental costs to full costs is 0.40. To find the Inflated Lifecycle Benefits Adjustment Factors, the Full Cost Adjustment Factors, and the Adjusted EUL for this measure, the PA must go to Table N-1 and identify the row for measures with an EUL of 17 years and a DFP of 4 years. Next, they must identify the

[14] ER=Early Replacement; NR=Normal Replacement; SC=Special Circumstance; AO=Add On. Add on refers to adding something which replaces nothing. Examples include adding controls to a boiler which had none, or adding insulation where there was none or some. Add-on measures are modeled at full costs and full savings for the length of their EULs. The full savings are reported toward first-year goals.

column with an incremental savings to full savings ratio of 0.65. The value in the intersection of this row and this column is 0.75, which is the Inflated Lifecycle Benefits Adjustment Factor. Using Table N-3, the same procedure would be followed to obtain the Adjusted EUL of 10 years.

To find the Full Cost Adjustment Factor, the PA would go to Table N-2, find the row with a 4 year DFP and the column with a ratio of 0.40. The value in the cell is 0.52, which is the Full Cost Adjustment Factor. As discussed above, in some cases PAs may use the tables in Appendix M to obtain cost ratios and adjustment factors.

The next step is to multiply the inflated benefits by the benefits factor and the full costs by the costs factor. For Total Resources Cost (TRC) analysis, ratio the two products, benefits/costs. For first year savings to report against approved program goals, for special circumstances replacements PAs would use the full savings, the first baseline of the existing equipment versus the high efficiency program measure.

Table N-1. Inflated Lifecycle Benefit Adjustment Factors for PA-Supplied Ratios of Incremental Savings to Full Savings, by DFP, for kWh, kW, and Therm Savings

	DFP	Median Ratio of Incremental Savings to Full Savings																		
		0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
		Inflated Lifecycle Benefit Adjustment Factors																		
25 Year EUL	**6**	42%	42%	47%	52%	52%	56%	60%	64%	64%	68%	71%	75%	78%	81%	84%	86%	91%	94%	96%
20 Year EUL	**5**	42%	42%	47%	47%	53%	53%	58%	63%	63%	67%	72%	76%	76%	80%	84%	87%	91%	94%	97%
17 to 14 Year EUL	**4**	35%	43%	43%	50%	50%	56%	56%	63%	63%	69%	69%	75%	75%	80%	86%	86%	91%	95%	95%
13 to 10 EUL	**3**	32%	41%	41%	41%	50%	50%	58%	58%	66%	66%	66%	73%	73%	81%	81%	87%	87%	94%	94%

Table N-2. Full Cost Adjustment Factors for PA-Supplied Ratios of Incremental Cost to Full Cost, by DFP

	DFP	Median Ratio of Incremental Cost to Full Cost																		
		0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
		Full Cost Adjustment Factors																		
25 Year EUL	**6**	31%	35%	38%	42%	46%	49%	53%	56%	60%	64%	67%	71%	75%	78%	82%	85%	89%	93%	96%
20 Year EUL	**5**	27%	31%	35%	39%	43%	46%	50%	54%	58%	62%	66%	69%	73%	77%	81%	85%	89%	92%	96%
17 to 14 Year EUL	**4**	23%	27%	31%	35%	39%	43%	48%	52%	56%	60%	64%	68%	72%	76%	80%	84%	88%	92%	96%
13 to 10 EUL	**3**	19%	23%	28%	32%	36%	40%	45%	49%	53%	57%	62%	66%	70%	74%	79%	83%	87%	91%	96%

Table N-3. Adjusted EULs, by DFP

	DFP	Median Ratio of Incremental Savings to Full Savings																		
		0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
		Adjusted EULs in Years																		
25 Year EUL	**6**	6	7	7	8	8	9	9	10	10	11	11	12	12	13	14	14	15	16	16
20 Year EUL	**5**	6	6	7	7	8	8	9	10	10	11	12	13	13	14	15	16	17	18	19
17 to 14 Year EUL	**4**	4	5	5	6	6	7	7	8	8	9	9	10	10	11	12	12	13	14	14
13 to 10 EUL	**3**	3	4	4	4	5	5	6	6	7	7	7	8	8	9	9	10	10	11	11