

Aggregate Metered Baseline Method (AMB); Residential or Commercial	Activity No.
	FLEX1

1. ACTIVITY SPECIFIC DEFINITIONS

Activity Specification

1 Proposed AMB Energy Savings Calculation Method

Energy Savings for eligible activities specified in Clause 2 shall be calculated using the method specified in this Clause. Energy savings shall then be applied in accordance with the activity specification set out in Clause 2.

1.1 Calculation of Energy Savings under the Aggregated Metered Baseline method

Step (1) – For each Population, adjust the Control Group and the Treatment Group for Attrition at the end of each Implementation Period, in accordance with clause 2.2. The number of Sites in the Treatment and Control Groups will be designated N_T and N_C respectively.

Step (2) – Calculate the *Observed Energy Savings*, $ES_{observed}$, in GJ final energy consumption, over the Implementation Period using one of the following methods:

- (a) Option 1 (Time-Aggregated Energy Consumption During the Implementation Period) as detailed in clause 1.2; or
- (b) Option 2 (Time-Aggregated Energy Consumption During the Implementation and Pre-Implementation Periods - Difference in Differences) as detailed in clause 1.3; or
- (c) Option 3 (Regression Modelling) as detailed in clause 1.4.

Step (3) – Calculate Counted Energy Savings, $ES_{counted}$, over the Implementation Period using the Method detailed in clause 1.5.

For Sites with Measured Energy Consumption data for part of an Implementation Period due to Attrition, the date of Attrition is considered the last date of the Implementation Period for those given Sites.

Step (4) - Calculate *final Energy Savings* in GJ of final energy consumption, by subtracting the effect of *Counted Energy Savings* from the *Observed Energy Savings*, ensuring the result is non-negative:

$$Energy\ Savings = \max(0, ES_{observed} - ES_{counted})$$

1.2 Step 2 Option 1 Calculation of Observed Energy Savings from Time-Aggregated Energy Consumption During the Implementation Period

Step (1) - Calculate the mean daily energy use of the Treatment Group (E_T) over the Implementation Period:

$$E_T = \frac{(\sum_s E_s)}{(\sum_s D_s)}$$

where:

- s indexes over Sites in the Treatment Group
- E_s is the Measured Energy Consumption for Site (s) in the Treatment Group over the Implementation Period, measured in accordance with clause 2.3; and
- D_s is number of days of Measured Energy Consumption at Site (s) in the Treatment Group over the Implementation Period

Step (2) - Calculate the mean daily energy use of the Control Group (E_C) over the Implementation Period:

$$E_C = \frac{(\sum_s E_s)}{(\sum_s D_s)}$$

where:

- s indexes over Sites in the Control Group
- E_s is the Measured Energy Consumption for Site (s) in the Control Group over the Implementation Period, measured in accordance with clause 2.3; and
- D_s is number of days of Measured Energy Consumption at Site (s) in the Control Group over the Implementation Period

Step (3) - Using the Treatment Group measurements, the Control Group measurements and the standard error for the Control Group mean, perform the following hypothesis test:

$$H_0 : E_C \leq E_T$$

$$H_{alt} : E_C > E_T$$

$$\text{Calculate } t = \frac{(E_C - E_T)}{\left(sd * \sqrt{\frac{fpc_T}{N_T} + \frac{fpc_C}{N_C}} \right)}$$

Reject H_0 (and accept H_{alt}) if $t > T_{(p=0.95)}$

where:

- sd is the standard deviation calculated on the Control Group
- $T_{(p=0.95)}$ is the value from standard T tables with $(N_C - 1)$ degrees of freedom. For degrees of freedom exceeding 2400 use the value of 1.6449. Note that 0.95 values of the T statistic are from the upper 5% points of the distribution;
- fpc_C is an optional finite population correction for estimating the Population mean from the Control Group, where:
 - if used $fpc_C = (N - N_C)/(N - 1)$; or
 - if not used $fpc_C = 1$; and
- fpc_T is an optional finite population correction for estimating the Population mean from the Treatment Group, where:
 - if used $fpc_T = (N - N_T)/(N - 1)$; or
 - if not used $fpc_T = 1$, and
- N is the number of sites in the Population.

If able to reject H_0 , proceed to step (4). Otherwise, E_C is taken to be less than or equal to E_T and $ES_{observed}$ is taken to be zero.

Step (4) - Calculate the Observed Energy Savings, $ES_{observed}$, in GJ final energy consumption, over the Implementation Period:

$$ES_{observed} = (E_C - E_T) * \left(\sum_s D_s \right)$$

where:

- s indexes over Sites in the Treatment Group; and
- D_s is number of days of Measured Energy Consumption at Site (s) in the Treatment Group over the Implementation Period

1.3 Step 2 Option 2 - Calculation of Observed Energy Savings from Time-Aggregated Energy Consumption During the Implementation and Pre-Implementation Periods – Difference in Differences

Step (1) - Calculate the change in mean daily energy use (C_s) between the Implementation Period and the Pre-Implementation Period for each Site in the Population:

$$C_s = \frac{E_{s,i}}{D_{s,i}} - \frac{E_{s,p}}{D_{s,p}}$$

where:

- $E_{s,i}$ is the Measured Energy Consumption for each Site (s) over the Implementation Period, measured in accordance with clause 2.3;
- $E_{s,p}$ is the Measured Energy Consumption at each Site (s) over the Pre-Implementation Period, measured in accordance with clause 2.3;
- $D_{s,i}$ is the number of days of Measured Energy Consumption at Site (s) over the Implementation Period; and
- $D_{s,p}$ is the number of days of Measured Energy Consumption across Site (s) over the Pre-Implementation Period and must cover the same period of time in a previous year as $D_{s,i}$.

Step (2) - Calculate the mean change in energy use of the Treatment Group (C_T) between the Implementation Period and the Pre-Implementation Period:

$$C_T = (\sum_s C_s) / N_T$$

where:

- s indexes over Sites in the Treatment Group; and
- N_T is number of Sites in the Treatment Group.

Step (3) - Calculate the mean change in energy use of the Control Group (C_C) between the Implementation Period and the Pre-Implementation Period as follows:

$$C_C = (\sum_s C_s) / N_C$$

where:

- s indexes over Sites in the Control Group; and
- N_C is number of Sites in the Control Group

Step (4) - Using the Treatment Group measurements, the Control Group measurements and the standard error for the Control Group mean difference, perform the following hypothesis test:

$$H_0 : C_C \leq C_T$$

$$H_{alt} : C_C > C_T$$

$$\text{Calculate } t = (C_C - C_T) / \left(sd * \sqrt{\frac{fpc_T}{N_T} + \frac{fpc_C}{N_C}} \right)$$

$$\text{Reject } H_0 \text{ (and accept } H_{alt}) \text{ if } t > T_{(p=0.95)}$$

where:

- sd is the standard deviation calculated on the change in daily energy consumption between the Implementation Period and the Pre-Implementation Period for each Site in the Control Group;
- $T_{(p=0.95)}$ is the value from standard T tables with $(N_C - 1)$ degrees of freedom. For degrees of freedom exceeding 2400 use the value of 1.6449. Note that 0.95 values of the T statistic are from the upper 5% points of the distribution;
- fpc_C is an optional finite population correction for estimating the Population mean from the Control Group, where:
 - if used $fpc_C = (N - N_C) / (N - 1)$; or
 - if not used $fpc_C = 1$; and
- fpc_T is an optional finite population correction for estimating the Population mean from the Treatment Group, where:
 - if used $fpc_T = (N - N_T) / (N - 1)$; or
 - if not used $fpc_T = 1$, and
- N is the number of sites in the Population.

If able to reject H_0 , proceed to step (5). Otherwise, C_C is taken to be less than or equal to C_T and $ES_{observed}$ is taken to be zero

Step (5) – Calculate the *Observed Energy Savings*, $ES_{observed}$, in GJ final energy consumption, over the Implementation Period:

$$ES_{observed} = (C_C - C_T) * \left(\sum_s D_s \right)$$

where:

- s indexes over Sites in the Treatment Group; and
- D_s is the number of days of Measured Energy Consumption at Site (s) in the Treatment Group over the Implementation Period.

1.4 Step 2 Option 3 - Calculation of *Observed Energy Savings* from Regression Modelling

Step (1) - Calculate the mean daily energy use ($DE_{s,i}$) for each Site in the Population for the Implementation Period:

$$DE_{s,i} = E_{s,i} / D_{s,i}$$

where:

- $E_{s,i}$ is the Measured Energy Consumption for Site (s) over the Implementation Period, measured in accordance with clause 2.3; and
- $D_{s,i}$ is the number of days of Measured Energy Consumption at Site (s) over the Implementation Period

Step (2) - Calculate the mean daily energy use ($DE_{s,p}$) for each Site in the Population for the Pre-Implementation Period:

$$DE_{s,p} = E_{s,p} / D_{s,p}$$

where:

- $E_{s,p}$ is the Measured Energy Consumption for each Site (s) over the Pre-Implementation Period, measured in accordance with clause 2.3; and
- $D_{s,p}$ is the number of days of Measured Energy Consumption at Site (s) over the Pre-Implementation Period.

Step (3) - Create the evaluation data set consisting of one observation for each Site in the Population containing $DE_{s,i}$, $DE_{s,p}$, T_s and other appropriate explanatory variables, where:

- T_s is a variable taking the value 1 if a Site (s) is in the Treatment Group and 0 if it is in the Control Group; and
- $OtherVariables_s$ is the vector of other appropriate explanatory variables.

Step (3B) – For cases where there are Sites with Measured Energy Consumption data for part of an Implementation Period due to Attrition, create another variable $W_{s,m}$, where:

- $W_{s,m}$ is a variable taking the value 1 if the Site (s) has Measured Energy Consumption during time period m and 0 otherwise. $m = 1 \dots NTP$; and
- NTP is the number of non-overlapping and exhaustive time periods for the implementation.
- The time periods are to be allocated so that each time period has (as close as is possible) the same number of Sites subject to Attrition during that period.

Step (4) - Estimate the average treatment effect per day ($\hat{\beta}$) by estimating the following regression via Weighted Least Squares (WLS) and weighting by $D_{s,i}$:

$$DE_{s,i} = \alpha + \beta T_s + \delta DE_{s,p} + \sum \lambda_m W_{s,m} + \sum \gamma_k OtherVariables_{s,k} + \varepsilon_s$$

where:

- α is the intercept;
- β is the treatment effect;
- δ is the impact of Pre-Implementation Period energy consumption;
- λ_m accounts for time period (m) variation;
- γ_k is the effect of the k th other explanatory variable; and
- ε_s is the error term.

Step (5) – Using the estimated treatment effect (denoted as $\hat{\beta}$) and its standard error perform the following hypothesis test:

$$H_0: \hat{\beta} \geq 0$$

$$H_{alt}: \hat{\beta} < 0$$

Calculate $t = \hat{\beta} / se(\hat{\beta})$

Reject H_0 (and accept H_{alt}) if $t < T_{(p=0.05)}$

where:

- $se(\hat{\beta})$ is the standard error of $\hat{\beta}$; and
- $T(p=0.05)$ is the value from the standard T table with $(N_T + N_C - 2)$ degrees of freedom. For degrees of freedom exceeding 2400 use the value of -1.6449 . Note that 0.05 values of the T statistic are from the lower 5% points of the distribution.

A negative value for $\hat{\beta}$ indicates a reduction in energy usage. Therefore, if able to reject H_0 , proceed to step (6). Otherwise, $\hat{\beta}$ is taken to be non-negative and $ES_{observed}$ is taken to be zero.

Step (6) – Calculate the *Observed Energy Savings*, $ES_{observed}$, in GJ final energy consumption, over the Implementation Period:

$$ES_{observed} = -\hat{\beta} * \left(\sum_s D_s \right)$$

where:

- s indexes over Sites in the Treatment Group; and
- D_s is the number of days of Measured Energy Consumption at Site (s) in the Treatment Group over the Implementation Period.

1.5 Estimation of Counted Energy Savings (Step 3)

Step (1) – Estimate the *Lifetime Energy Savings*, $LES_{s,a}$, from each *Other Activity* (a) implemented in each Site (s) in the Population, within the Implementation Period.

Where:

- *Other Activity* (a) means any energy savings activity offered to the population for which REES credits are claimed under another method by the Obligated Retailer in accordance with the provisions of clause 2.2.1(j).

Step (2) – Calculate the Energy Savings, $ES_{s,a}$, for each Site s due to each *Other Activity* a during the Implementation Period:

$$ES_{s,a} = LES_{s,a} * \left(\frac{Overlap_a}{Lifetime_a} \right)$$

where:

- $Lifetime_a$, in years, is the Lifetime of the Energy Savings for each *Other Activity* (a); and
- $Overlap_a$, in years, is the length of time of the Implementation Period that overlaps with the Lifetime of the Energy Savings for each *Other Activity* (a).
- If the *Other Activity* (a) had one or more Energy Savings calculated using the Metered Baseline Method, then the Lifetime of the Energy Savings is the length of the Measurement Period of that calculation.
- The calculation of the duration of overlap must take account of Attrition of Sites.

Step (3) - Calculate the average Energy Savings, $ES_{T,all Other Activities}$ and $ES_{C,all Other Activities}$, due to all *Other Activities* (a) for all Sites in the Treatment Group and Control Group respectively, over the Implementation Period:

$$ES_{T,all Other Activities} = \frac{\sum_{s \text{ in Treatment Group}, a} ES_{s,a}}{N_T}$$

and

$$ES_{C,all Other Activities} = \frac{\sum_{s \text{ in Control Group}, a} ES_{s,a}}{N_C}$$

where:

- The summation is over all Sites (s) in the Treatment Group (for $ES_{T,all Other Activities}$) and Control Group (for $ES_{C,all Other Activities}$), respectively, and all *Other Activities* that overlap with the Implementation Period; and
- The N_T and N_C are the number of Sites in the Treatment Group and Control Group respectively for Implementation Period.

Step (4) - Calculate the *Counted Energy Savings*, $ES_{counted}$, from *Other Activities* due to participation in the program:

$$ES_{counted} = (ES_{T,all Other Activities} - ES_{C,all Other Activities}) * N_T$$

Step (5) – Ensure the *Counted Energy Savings*, $ES_{counted}$, are non-negative:

$$ES_{counted} = \max(0, ES_{counted})$$

2 Proposed AMB Method Specification

Energy Savings for eligible activities shall be calculated using the method specified in Clause 1. Energy savings shall then be applied in accordance with the activity specification set out in this Clause.

2.1 Activities for which savings can be calculated using this method

2.1.1 Energy savings can be determined for Activity or Activities aimed at reducing normalised end-use energy consumption, which meet the following conditions:

- Activity or Activities for which energy savings are to be calculated using this method, known as the Treatment, are to be offered exclusively to sites in a Treatment Group.
- The Treatment cannot include the installation of solar PV or other on-site electricity generation system
- The treatment can include fuel switching that reduces normalised end use energy.

2.2 Selection and management of Sites where activities are offered

2.2.1 A number of Sites must be identified and assigned to a Population, and every Site in that Population must be allocated to either a Treatment Group or a Control Group prior to the Implementation Date. Additionally:

- a Site may choose to join the Population, but once in the Population, must be allocated to the Treatment Group or the Control Group using an Unbiased Selection method;

- (b) An Unbiased Selection Method is any method in which each site has an equal chance of being allocated to either the treatment or control group, including but not limited to random selection;
- (c) persons at Sites must not be informed explicitly that they have been allocated to the Treatment Group or the Control Group;
- (d) once a Site has been allocated to the Treatment Group and the Implementation Date has occurred, energy customers at that Site may be offered a choice as to whether they wish to receive the goods and services component of the Treatment;
- (e) if a Site chooses not to receive the goods and services component of the Treatment, that Site must be retained in the Treatment Group for measurement purposes, except where clauses 2.2.1 (g) and 2.2.1 (h) apply;
- (f) the Population should not be targeted with the offer of goods and services aimed at increasing energy use with the intent of creating a greater difference in Measured Energy Consumption between the Control Group and Treatment Group;
- (g) a Site must be removed from the Population, and hence Treatment Group or Control Group, if no Measured Energy Consumption data are available for that Site during the Implementation Period;
- (h) all Sites with Measured Energy Consumption data for only part of an Implementation Period due to Attrition, must be:
 - (i) removed from the Population; or
 - (ii) included in the Population until the last date Measured Energy Consumption data are available for a given Site; and
- (i) if data for a Pre-Implementation Period are used, the Obligated Retailer must specify prior to the Implementation Date a period for which the data are available for the total Population.
- (j) the treatment group may be offered activities for which credits are claimed under another REES method, only if:
 - (i) Such activities are declared to the Commission; and
 - (ii) The annualised savings from these activities are excluded from savings determined under this method, in accordance with calculation step 3 in Clause 1.1.

2.3 Measured Energy Consumption

2.3.1 Measurement Energy Consumption means the sum of the normalised Measurement Energy Consumption data for electricity consumption and normalised Measurement Energy Consumption data for onsite natural gas consumption for a Site.

Measurement Energy Consumption

$$= \left(\sum_f \text{Measurement Energy Consumption}_f * \text{Normalisation Factor}_f \right)$$

where:

- f indexes over each of the fuel types used by the population (electricity and gas)
- *Measurement Energy Consumption* is the Measurement Energy Consumption for fuel type (f) as described in Clause 2.3.2 and 2.3.3 below.
- *Normalisation Factor_f* is the REES normalisation factor for fuel type (f), which is 1 for electricity and 0.369 for reticulated gas.

2.3.2 Measurement Energy Consumption data for electricity consumption means the metered amount of electricity used by a Site:

- (a) as determined by the metering data held by the Electricity Retailer or Network Service Provider for that Site, pro-rated across the period, as measured and estimated in accordance with the provisions of the National Energy Retail Rules under the National Energy Retail Law, and in accordance with the provisions of the *Electricity (General) Regulations 2012 (SA)*; or
- (b) from a metering arrangement compliant with the accuracy requirements of National Measurement Institute document M6 (Electricity Metres), or another metering benchmark accepted by the Commission, provided that:
 - (i) all metering devices are installed without bias as to whether that Site is in the Treatment Group or Control Group, and by parties who have no knowledge of whether each Site is part of the Treatment Group or Control Group; and
 - (ii) the reading of metering devices and checking, measurement, estimation and pro-rating of data is done without bias as to whether that Site is in the Treatment Group or Control Group, and by parties who have no knowledge of whether each Site is part of the Treatment Group or Control Group.

2.3.3 Measurement Energy Consumption data for onsite natural gas consumption means the metered amount of gas used by a Site:

- (a) as determined by the metering data held by the Energy Retailer or Network for that Site, pro-rated across the period, as measured and estimated in accordance with the provisions of the National Energy Retail Rules under the National Energy Retail Law, and in accordance with the provisions of *Gas Regulations 2012*

	(SA); or
	(b) from a metering arrangement compliant with the accuracy requirements of National Measurement Institute as set out in document R137 (Gas Metres) or another metering benchmark accepted by the Commission provided that: <ul style="list-style-type: none"> (i) all metering devices are installed without bias as to whether that Site is in the Treatment Group or Control Group, and by parties who have no knowledge of whether each Site is part of the Treatment Group or Control Group; and (ii) the reading of metering devices and checking, measurement, estimation and pro-rating of data is done without bias as to whether that Site is in the Treatment Group or Control Group, and by parties who have no knowledge of whether each Site is part of the Treatment Group or Control Group.
2.3.4	For the purposes of calculating Energy Savings, the Measured Energy Consumption for a given Population must be recorded over one or more Measurement Periods, where: <ul style="list-style-type: none"> (a) Implementation Periods and Pre-Implementation Periods are both Measurement Periods; (b) the Implementation Period and the Pre-Implementation Period do not have to be immediately sequential in time; (c) Measurement Periods must not overlap; and (d) each Implementation Period must be at least 3 months and no more than 15 months in length.
2.4	General Requirements
2.4.1	The Obligated Retailer can only modify the methods for subsequent Implementation Periods.
2.4.2	The Implementation Date is the start date of the Implementation Period.
2.4.3	The activity should, wherever reasonable, offer options to use good practice such as recycling and compliance with best practice installation guidelines
2.4.4	Activities should be designed and implemented in a way that minimises risks to service providers and participants, including but not limited to: <ul style="list-style-type: none"> (a) Any equipment offered or installed must comply with appropriate quality and safety standards; and (b) Any installations must be conducted in accordance with relevant installation standards, guidelines and/or manufacturer's instructions.
2.5	Record Keeping
2.5.1	The records that must be kept of the method, data and assumptions used to calculate Energy Savings must include: <ul style="list-style-type: none"> (a) the Addresses of the Sites in the Population and whether they are allocated to the Treatment Group or the Control Group; (b) evidence that Sites were assigned to the Population and were allocated to the Treatment Group and Control Group in accordance with clause 2.2.1; (c) evidence that energy consumption was measured in accordance with clause 2.3; (d) details of the Treatment offered to the Treatment Group, and evidence that is a compliant with clause 2.1; (e) Details of explanatory variables; including any interactions between them have been documented (if Calculation method 1.4 regression modelling method is used); (f) Evidence that Measurement Periods, including Implementation Periods and the Pre-Implementation Periods (if applicable) are compliant with these specifications; (g) information on Sites removed from the Population in accordance with clauses 2.2.1 (g) and 2.2.1 (h), including reasoning for each Site's removal; (h) documentation of reproducible steps and log files for the calculations performed; and (i) any additional requirements as may be Published by the Commission from time to time.
2.5.2	Energy Savings for each Implementation are taken to have occurred on the last date of that Implementation Period. Where required, the Energy Savings for the Implementation will be the sum of estimated Energy Savings for all Sites in a Treatment Group for each Implementation Period.

