IPART
New South Wales

Independent Pricing and Regulatory Tribunal

Method Guide
Metered Baseline Method

Clause 8.5 – Method 1: Baseline per unit of output

Clause 8.6 – Method 2: Baseline unaffected by output

Clause 8.7 – Method 3: Normalised baseline

Energy Savings Scheme
April 2016

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V1.0	Initial release – following gazettal of ESS Rule amendment No. 2	15 January 2015
V1.1	Links to Application Forms updated to reflect update to ESS website	15 July 2015
V2.0	Updated to reflect amendments to the ESS Rule	April 2016

Contents

1 About this document

The NSW Energy Savings Scheme (**ESS**) seeks to reduce energy consumption in NSW by creating financial incentives for organisations to invest in energy saving projects.

The other objects of the ESS are to:

- assist households and businesses to reduce energy consumption and energy costs
- make the reduction of greenhouse gas emissions achievable at a lower cost, and
- reduce the cost of, and need for, additional energy generation, transmission and distribution infrastructure. [1]

Electricity retailers and other mandatory participants (**Scheme Participants**) are obliged to meet energy saving targets. Energy savings can be achieved by installing, improving or replacing energy saving equipment. Persons that become Accredited Certificate Providers (**ACPs**) can create energy savings certificates (**ESCs**) from these activities and then sell those ESCs to Scheme Participants. The Independent Pricing and Regulatory Tribunal of NSW (**IPART**) is both the Scheme Administrator and Scheme Regulator of the ESS.[2]

This document provides guidance about how the Metered Baseline Method (**MBM**) of the ESS operates, some of the key requirements that must be met when using the method, and how to calculate energy savings for a Recognised Energy Saving Activity (**RESA**) and create ESCs. This document should be used by:

- applicants seeking accreditation as a certificate provider, to assist them in completing their application,[3] and
- those persons who are already ACPs, to assist them in accurately calculating energy savings using this method.

This guide includes information about the following MBM sub-methods:

- Method 1 - Baseline per Unit of Output (clause 8.5 of the ESS Rule[4])
- Method 2 - Baseline Unaffected by Output (clause 8.6 of the ESS Rule)
- Method 3 – Normalised Baseline (clause 8.7 of the ESS Rule).

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1 *Electricity Supply Act 1995*, section 98(2)

2 *Electricity Supply Act 1995*, sections 153(2) and 151(2)

3 A full explanation of the application process is provided in the Application Guide http://www.ess.nsw.gov.au/How_to_apply_for_accreditation. Please ensure you read this document and the Application Guide in full before applying for accreditation.

4 *Energy Savings Scheme Rule of 2009*, as amended from time to time.

Separate guides are available for the following sub-methods:

- NABERS (clause 8.8 of the ESS Rule),[5] and
- Aggregated Metered Baseline (clause 8.9 of the ESS Rule).[6]

1.1 Legislative requirements

This document is a guide only and is not legal advice. The legal requirements for ACPs participating in the ESS are set out in:

- Part 9 of the *Electricity Supply Act 1995* (**Act**)
- Part 6 of the *Electricity Supply (General) Regulation 2014* (**Regulation**), and
- the *Energy Savings Scheme Rule of 2009* (**ESS Rule**).

ACPs are also required to meet any additional accreditation conditions as set out in their Accreditation Notice.

The **ESS Rule was amended** on 15 April 2016. The information in this document reflects the requirements of the ESS Rule as amended and should be referred to for all implementations from that date. Where changes have been made to a section of this document as a result of amendments to the ESS Rule, the section is highlighted and marked with the following symbol: ⚐

Note that the previous version of the ESS Rule may still be used to calculate energy savings arising from an implementation with an implementation date before 15 April 2016, provided that:

- no previous applications to register ESCs in respect of that implementation have been made prior to 15 April 2016, and
- the application to register ESCs in respect of those energy savings is made on or before 30 June 2016.

ACPs who intend to calculate energy savings under the previous version of the ESS Rule should refer to version 1.1 of this document.[7]

2 Method overview

MBM is typically used for activities in industrial or commercial premises where:

- energy savings result in a significant reduction in site energy consumption that is readily identifiable through metering, and

5 Refer: www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/NABERS_Baseline
6 Available at: www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Metered_Baseline
7 Available here: http://www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Document_archive

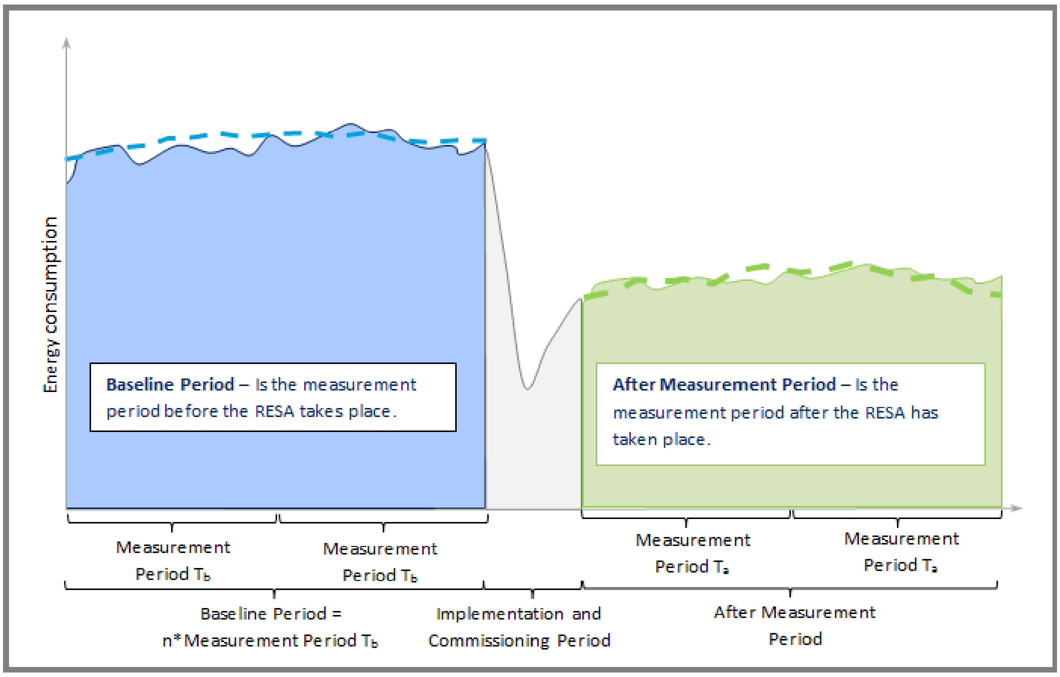
- representative historical site energy consumption data is available.

MBM uses measurements of energy consumption before and after the implementation. The difference in energy consumption between these two periods is used to calculate the net energy savings from the RESA for each energy source.

Throughout this document, references to 'energy' refer to electricity, or gas, or both.

Figure 2.1 below illustrates the timeline of a typical project using MBM and the different measurement periods.

Figure 2.1 Schematic timeline of an MBM project



The **baseline period** is the period **before** the implementation. It establishes the baseline energy consumption of the site. It is made up of one or more **measurement periods**[8] $\mathbf{T_b}$ (eg, one day, one month or one year). The duration of the measurement periods T_b becomes the base time unit from which net energy savings calculations will be made.

The **implementation and commissioning period** is the time period in which the new processes or end user equipment are installed and tested.

The **after measurement period** is the period **after** the implementation. It establishes the new levels of energy consumption and is the period over which net energy saving calculations will be made. The after measurement period

8 "T_b" – Acronym to identify the words "Time period before".

includes as many **measurement periods**[9] $\mathbf{T_a}$ the expected lifetime of the energy savings will allow.

When determining the length of the measurement periods T_b, you should consider that measurement periods T_a must be of the same duration.

MBM relies on the remainder of the site operating as it did before the implementation. It should not be used where changes (other than from the implementation) are anticipated during the time ESCs will be created because the results will not reasonably reflect the energy savings resulting from the implementation.

MBM applies a **confidence factor** to reduce the upfront estimated energy savings, corresponding to their certainty. This is determined based on the size of the energy savings relative to the unexplained variance in the baseline.

Energy savings can be calculated for a maximum of 10 years after the end date of the baseline measurement period. Further information about this requirement is provided in section 3.3.

3 Requirements that must be met

The information below is guidance about the requirements of the method. This is not an exhaustive list of requirements, and you should ensure that you are familiar with your obligations under the Act, Regulation, ESS Rule and any conditions of your accreditation.

Evidence boxes

Recommended evidence that could be used to support energy savings for each implementation is highlighted in these boxes.

Evidence must be collected and retained to support the creation of ESCs from the calculated energy savings. You must have the evidence at the time you apply to register ESCs. Your evidence may be audited at any time.

If the RESA involves multiple implementations, or takes place at multiple sites, the required evidence must be collected and retained for each implementation.

3.1 Energy saver

Only an ACP who is the 'energy saver' for the particular implementation can calculate energy savings using MBM. You can be either:

9 "T_a" – Acronym to identify the words "Time period after".

- **the original energy saver** – which, under MBM, is the person who is liable (contractually or otherwise) to pay for the energy consumption at the site at the implementation date,[10] or
- **the nominated energy saver** – which is someone the original energy saver has nominated as the energy saver by completing a Nomination Form using the method-specific template.[11]

An ACP that is the original energy saver must be accredited as an ACP prior to the implementation date in order to create ESCs from an implementation.

A nominated energy saver must have a documented procedure for obtaining the nomination from the original energy saver. The nomination is taken to occur on the date that it is signed by both the **original energy saver** and **nominated energy saver.** To create ESCs from an implementation, a nominated energy saver must be:

- **accredited** as an ACP **prior to** the implementation date and before the nomination is made,[12] and
- **nominated** by the original energy saver **on or before** the implementation date.

Box 3.1 Evidence of the energy saver

The original energy saver can be evidenced by:

- An energy bill showing the name and address of the original energy saver. The address listed on the energy bill must match the implementation address. The energy bill must be current as of the implementation date.
- Where the energy bill does not match the implementation address (eg, it is addressed to a PO Box) additional documentation must be provided linking the energy bill to the implementation address.
- Other documentation showing that the original energy saver is liable for the energy used. The documentation must show:
  - the address of the implementation, and
  - the party responsible for paying the energy costs, as at the implementation date.

Examples of such documents include a tenancy agreement stating that the tenant is responsible for the energy used, or an internal company invoice showing responsibility for energy costs.

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10 *ESS Rule,* cl 8.5.3, 8.6.3 and 8.7.3
11 The nomination form is available at: http://www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Metered_Baseline_Methods
12 The ESS website provides information on applying to become an ACP at: www.ess.nsw.gov.au/How_to_apply_for_accreditation.

3.2 Implementation and implementation date

An implementation is the delivery of an energy saving activity (called a 'RESA' in the ESS Rule)[13] at a site. For MBM, the implementation date is the earlier of:

- the start date of the first after measurement period,[14] or
- the date on which the reduction of energy consumption commenced due to the implementation (ie, the date when the implementation was completed and normal operations commenced). [15]

Box 3.2 Evidence of the implementation date

The implementation date can be evidenced by:

- tax invoices evidencing completion of works and equipment installed, or
- a completion or commissioning report (if available).

If normal operations are to commence after a commissioning period, details of the commissioning process should be included in the nomination form or in formal project documentation.

It is not appropriate for a commissioning period to be claimed solely for the purpose of delaying the implementation date to meet the additionality requirements of clause 6.2 of the ESS Rule.

3.3 Lifespan of the baseline

Clause 8.3A of the ESS Rule limits the period over which energy savings can be calculated using MBM.

Depending on the date you were (or will be) accredited, and the end date of your baseline measurement period, you will generally only be able to calculate energy savings for up to a maximum of ten years. More precisely:

- where your accreditation date with respect to the RESA is on or after 15 April 2016, you may only calculate energy savings for up to a maximum of 10 years from the end date of the baseline measurement period
- where your accreditation date with respect to the RESA is before 15 April 2016 and the end date of the baseline measurement period is less than or equal to 10 years before 15 April 2016, energy savings may only be calculated for a maximum of 10 years from the end date of the baseline measurement period, and

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13 A RESA must meet all of the criteria set out in clause 5.3 and 5.4 of the *ESS Rule*.

14 The first **after** measurement period is the first period for which an ACP intends to create ESCs.

15 *ESS Rule*, cl 8.5.2, 8.6.2 and 8.7.2

- where your accreditation date with respect to the RESA is before 15 April 2016 and the end date of the baseline measurement period is more than 10 years before 15 April 2016, energy savings may only be calculated for a period that is, as a maximum, equal to the length of the period from the end date of the baseline measurement period to 15 April 2016.

3.4 Measurement of energy consumption

3.4.1 Defining the RESA measurement boundary

You must provide a detailed description of the site and the RESA measurement boundary. This means you must:

- explain how the energy metering is done at the site
- identify the parts of the site included within the RESA boundary, and
- explain how you differentiate between what is inside and outside the RESA boundaries.

To set the boundary, you must consider your ability to track future changes to the site and its operations within the RESA boundary. You must be able to identify any effects of changes to the site, outside the RESA boundary, that may affect the RESA. If these 'interactive effects' are significant, you must consider expanding the RESA boundary.

Electricity and gas metering must be able to discretely measure reductions in energy consumption as a result of the RESA, and may act as a de facto RESA boundary. Note that it is possible that a reduction in electricity consumption may increase gas consumption or vice versa.

Sub-metering may be used to effectively reduce the size (boundary) of the site considered for baseline calculations, thereby increasing the accuracy of the baseline and hence the 'confidence factor'. It is possible that an audit of electricity and gas metering arrangements will be required in order to confirm the RESA boundary.

Box 3.3 Evidence of the RESA boundary

You must demonstrate that you have adequate metering in place to define the RESA boundary. This must be evidenced by an electrical line diagram or piping and instrumentation diagram (P&ID) showing the location of the meter(s) used in measuring the electricity or gas consumption.

3.4.2 Metering equipment

Metering equipment is important in providing reliable measurement of energy consumption data **before** and **after** the implementation of your RESA. You must use utility meters or other metering equipment acceptable to the Scheme Administrator.[16]

When applying for accreditation, applicants must describe the metering equipment on site, including:

- an outline of current processes for the testing and calibration of the metering equipment, and
- the persons responsible for these processes.

It is highly recommended that the same meters are used for the before and after measurement periods; otherwise the calculations will need to be adjusted based on the different accuracy.[17]

Meters should be calibrated as recommended by the equipment manufacturer, against relevant standards and following procedures of recognised measurement authorities.

For multi-site applications, applicants must explain how they will make sure the metering equipment at each site is acceptable, that there is a process in place for testing and calibration of the metering equipment at each site and that the responsible persons will follow the process.

16 *ESS Rule,* cl 8.4

17 Chapter 8.11 of the IPMVP Volume 1 provides further guidance relating to metering equipment and issues.

Box 3.4 Evidence of the metering equipment

The adequacy of the electricity metering equipment must be evidenced with:

- provision of the metering equipment details, including:
  - meter application, eg, AC Electric Power (watts) or AC Energy (watt-hours),
  - meter category, eg, true RMS watt meter or watt-hour meter, and
  - meter type, eg, digital meter that measures watts and/or watt-hours and uses digital sampling (IEEE 519-1992) to properly measure distorted waveforms.

The adequacy of the gas metering equipment must be evidenced with:

- provision of the metering equipment details, including:
  - meter application, eg, volumetric or mass flow meter,
  - meter category, eg, intrusive or non-intrusive meters, and
  - meter type, eg, turbine flow meters.
- Information to be provided for all types of meters must include:
  - meter make and model number,
  - other details, such as whether any recent audits of metering equipment have been undertaken, and
  - calibration records including the testing and calibration process and responsibilities and the last calibration date and validation date.

Documentation can include manuals, photographs, etc.

3.4.3 Fuel switching

Under the ESS Rule, an activity involving fuel switching from electricity to gas, or from gas to electricity may be used to create ESCs, provided the activity meets certain requirements. Among other things, the fuel switching activity:

- must increase the efficiency of energy consumption at the site, and
- must not increase greenhouse gas emissions.[18]

For these purposes, greenhouse gas emissions must be calculated using electricity savings, gas savings and full fuel cycle emissions factors and equations from the current version of the National Greenhouse Accounts Factors.[19]

Further information about fuel switching activities, including examples, is provided in Appendix D of this document.

3.4.4 Measuring net energy savings

The number of ESCs that can be created from a project is calculated using Equation 1 of the ESS Rule (see section 6 of this document). **If an implementation**

[18] *ESS Rule*, cl 5.3 and 5.4.

[19] *ESS Rule*, cl 5.4(j). Further information is available here: http://www.environment.gov.au/

reduces electricity consumption and increases gas consumption, or reduces gas consumption and increases electricity consumption, you must calculate both electricity savings and gas savings when calculating the number of ESCs to be created from a project.[20]

In the circumstances described above, electricity and gas consumption must both be measured for the baseline measurement period and the after implementation measurement period. The electricity savings and gas savings calculated from these measurements may be positive or negative and both must be used in the calculation of the number of ESCs.

Measurements of gas must be made in accordance with the requirements set out in either:

- the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*,[21] or
- the National Measurement Institute standard for gas meters *NMI R 137 Gas Meters*.[22]

Gaseous fuels that are eligible in the ESS are liquefied petroleum gas, and fuels listed in Schedule 1, Part 2 of the *National Greenhouse and Energy Reporting (Measurement) Determination* (Cth).[23]

3.5 Recycling requirements

ACPs are responsible for ensuring that lighting equipment removed or replaced during an implementation is disposed of appropriately. Furthermore, if the implementation:

- is in a Metropolitan Levy Area (ie, an area with a postcode listed in Table A25 of the ESS Rule), and
- has an implementation date on or after 15 May 2016,

  any lighting end-user equipment containing mercury must be recycled in accordance with the recycling requirements of a recycling program such as 'Fluorocycle' or equivalent. **[24]**

20 *ESS Rule*, cl 8.5.1(e), 8.6.1(c) and 8.7.1(c)

21 Available at: www.legislation.gov.au/Details/F2013C00661

22 Available at: www.measurement.gov.au/Pages/Gas-Meters-Comment-Sought-on-NMI-R-137.aspx

23 *ESS Rule*, cl 10 – definition of 'Gas'

24 *ESS Rule*, cl 5.3A(b)

4 MBM sub-methods

If you apply for accreditation to calculate energy savings from a project using MBM, the Scheme Administrator has to agree that the MBM sub-method you are proposing to use is the most appropriate for your RESA.[25] As part of the application process, applicants are required to provide:

- sufficient information to justify using the relevant sub-method, and
- the required evidence specified in this guide.

Each of the sub-methods is described briefly below. The decision tree provided in figure 4.1 is designed to assist applicants to determine which of the three MBM sub-methods, or if the Project Impact Assessment with Measurement and Verification Method[26] may be most appropriate for their proposed RESA. ACPs and applicants should refer to the relevant Appendix and the ESS Rule for further information about the sub-method applicable to their project.

4.1 Method 1 – baseline per unit of output

The MBM baseline per unit of output sub-method (Method 1) should be used to calculate energy savings where energy consumption is strongly linked to output from a site (eg, electricity consumption from aluminium smelting electricity consumption).

Further information about Method 1 is provided in Appendix A - Method 1 – Baseline per unit of output.

4.2 Method 2 – baseline unaffected by output

The MBM baseline unaffected by output sub-method (Method 2) should be used to calculate energy savings where consumption is not linked to output from a site. For example, when a RESA is implemented at a production site for which the energy consumption remains similar regardless of whether 1 or 1,000 units are produced.

This method may also be used at sites in which a service is provided (eg, in schools, hospitals, retail stores and hotels) where the amount of energy used remains reasonably constant regardless of the number of people using the service.

Further information about Method 2 is provided in Appendix B - Method 2 – Baseline unaffected by output.

[25] *ESS Rule*, cl 6.5A

[26] *ESS Rule*, cl 7A

4.3 Method 3 – normalised baseline

The MBM normalised baseline sub-method (Method 3) should be used where an explainable variation to energy consumption at the site can be removed through normalisation against some other factor(s). That is, variations to your energy baseline can be removed to create a normalised baseline.

Variables used to normalise the energy consumption must correspond to specific activities or situations that cause the change in the total electricity energy consumption. For example:

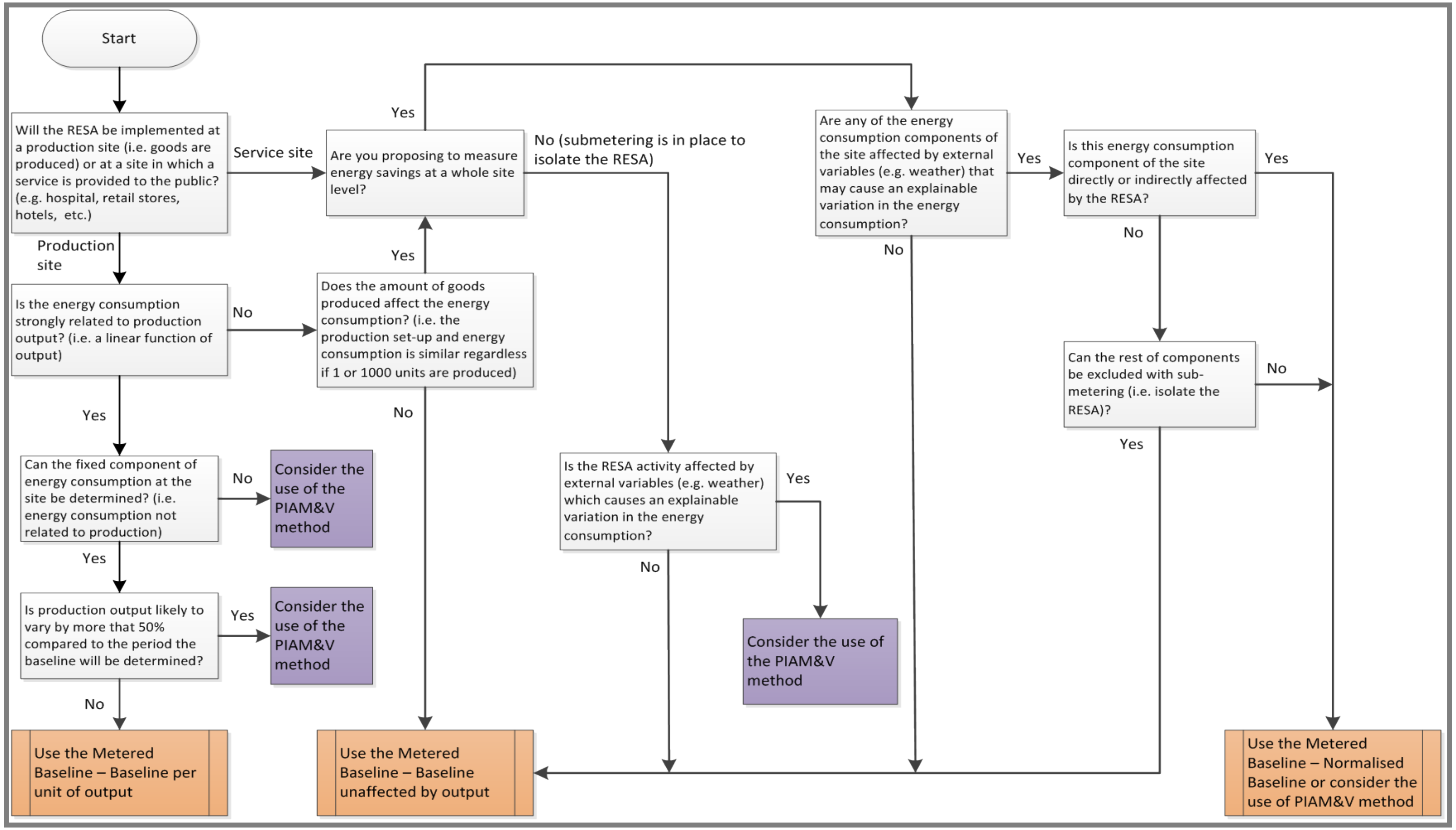
- variations in ambient conditions (ie, energy consumption is strongly related to outside temperature and therefore the consumption will change from one period to another), or
- variations in production processes or production inputs at certain times of the year (ie, where seasonal produce varies and takes more energy to process, or where part of the plant is shut down for the same period every year).

You should be able to justify that the factors are a cause of the variation in the baseline(s) and not the result of spurious correlation. For example, reduced production could be caused by a reduction in sales dropping off and this in turn would result in less electricity energy consumed. This is not considered relevant when determining a normalisation factor.

Further information about Method 3 is provided in Appendix C - Method 3 – Normalised Baseline.

An example of how Method 3 may be applied in practice is provided in the Fact Sheet: Normalised Baseline available on the ESS website at: www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Metered_Baseline_Methods.

Figure 4.1 Decision tree for selecting an appropriate MBM sub-method



5 Calculating energy savings

Each of the MBM sub-methods provides specific steps for calculating energy savings. Detailed information about how to calculate energy savings using each of the sub-methods included in this guide is provided in Appendices A, B and C. Under the ESS Rule, energy savings comprise both 'electricity savings' and 'gas savings'.

Applicants and ACPs should refer to the ESS Rule and the Appendix of this guide applicable to their selected sub-method to:

- understand how the energy savings calculations must be performed
- develop the calculation spreadsheet[27] required to be submitted with an application and used to calculate energy savings on an ongoing basis, and
- identify the evidence you must collect when implementing this method.

6 Calculating and creating ESCs

Once energy savings have been calculated for an implementation using the relevant sub-method, Equation 1 of the ESS Rule is used to calculate the number of ESCs that may be created from the energy savings calculated in relation to an implementation.

Note that ESCs can only be created where Equation 1 has a result that is greater than zero.

Equation 1

$$\textit{Number of Certificates} = \Sigma_{Implementations}\ \textit{Electricity Savings x Electricity Certificate Conversion Factor} + \textit{Gas Savings x Gas Certificate Conversion Factor}$$

6.1 Applying to register ESCs

Certain information must be submitted to us before an ACP applies to register ESCs created from energy savings arising from an implementation or implementations.[28] ACPs are to provide the required information by completing an Implementation Data Sheet[29] and submitting it through the ESS Portal.[30] The Implementation Data Sheet will include a calculation of the number of ESCs to be created in accordance with Equation 1 in the ESS Rule. This calculation involves:

27 When developing a calculation spreadsheet, all formulae should be clearly identified and referenced.

28 *ESS Rule*, cl 6.8

29 The implementation data sheet is available from the ESS Website at: http://www.ess.nsw.gov.au/Registry/Registering_certificates

30 Information and access to the portal can be found here: www.ess.nsw.gov.au/ESS_Portal

- multiplying the electricity savings arising from the implementation or implementations by the certificate conversion factor for electricity (1.06)[31]
- multiplying the gas savings arising from the implementation or implementations by the certificate conversion factor for gas (0.39),[32] and
- adding the two figures together.

The result is the total number of ESCs that ACPs can apply to register from the implementation or implementations. If the result is not a whole number, it is rounded down to the nearest whole number.

There are no restrictions on how many implementations can be bundled together in the same Implementation Data Sheet. However:

- ACPs must apply to register all ESCs included in an Implementation Data Sheet in a single application
- ACPs cannot split energy savings calculated from a single implementation across two or more Implementation Data Sheets, and
- each Implementation Data Sheet must only include the calculation of energy savings that are taken to have occurred in the same calendar year (commonly referred to as 'vintage').

When determining how many implementations to bundle in the same Implementation Data Sheet, ACPs should consider:

- the ESC creation limit specified in their Accreditation Notice, as they must be able to register all the ESCs in the bundle at the same time, and
- the cost of registering the ESCs.[33]

More information on applying to register the creation of ESCs can be found on our website.

7 Required records

ACPs are required to keep records in respect of a RESA, including records of:

- the location in which the RESA occurred
- the energy savings arising from that RESA
- the methodology, data and assumptions used to calculate those energy savings, and
- any other records specified by notice in writing by the Scheme Administrator.[34]

31 *The Act,* s 130(1)(a). This may be amended by regulations: see *the Act*, s 130(3).

32 *The Act,* s 130(1)(b). This may be amended by regulations: see *the Act*, s 130(3).

33 The ESC registration fee must be paid in a single payment for all ESCs registered in a single bundle. Payment for a single bundle cannot be split into two payments. Refer: www.ess.nsw.gov.au/Registry/Registering_certificates

ACPs must retain records for at least six years, in a form and manner approved by the Scheme Administrator. Each ACP's Accreditation Notice may include a condition requiring that the ACP's record keeping arrangements are consistent with the ESS Record Keeping Guide.[35]

The boxes throughout this document outline the information you are required to keep as a record of the energy savings from your project. The records required for each sub-method are specified in the Appendices to this guide. You must collect the required documents for each implementation of your activity.

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34 *Electricity Supply (General) Regulation 2014*, cl 46

35 Available at: http://www.ess.nsw.gov.au/Accredited_Certificate_Providers/Record_keeping_arrangements

8 Glossary

Term	Definition
ACP	Accredited Certificate Provider
After Measurement Period	A time period after the implementation, which can consist of one or more measurement periods T_a (depending on the lifetime of the equipment that is the subject of the implementation).
Baseline Period	A time period before the implementation, which can consist of one or more measurement periods T_b.
Confidence Factor	A factor applied to the energy savings calculations, which determines unexplained variance in the baseline energy consumption.
Electricity savings	The reduction of the amount or equivalent amount of electricity consumption (in MWh) arising from the implementation, may be negative for fuel switching activities.
End-user equipment	The electricity or gas consuming equipment, processes and systems and other equipment or products that cause, control or influence the consumption of electricity or gas.
ESCs	Energy Savings Certificates
ESS	Energy Savings Scheme
ESS Rule	Energy Savings Scheme Rule of 2009
Fixed Consumption	The consumption of electricity or gas at the site that does not vary with changes in output.
Gas	Any fuel listed in National *Greenhouse and Energy Reporting (Measurement) Determination 2008* (Cth) Schedule 1 Part 2—Fuel combustion—gaseous fuels or liquefied petroleum gas.
Gas Savings	The reduction of the amount of gas combusted for stationery energy (in MWh) arising from the implementation, may be negative for fuel switching activities.
Implementation	The delivery of a RESA at a particular site.
Implementation and Commissioning Period	The time period in which the new process or end user equipment is installed and tested to verify it functions according to its design specifications.
Implementation date	The earlier of the start date of the first measurement period T_a or the date on which the reduction of energy consumption commenced due to the implementation.
IPART	Independent Pricing and Regulatory Tribunal
IPMVP	International Performance Measurement and Verification Protocol, published by the Efficiency Valuation Organization
Measurement Period	A time period before or after the implementation, which is the duration of time over which measurement of energy consumption is undertaken for the purposes of calculating energy savings.
Measurement Period T_b	A time period before implementation that is representative of energy use on the site in the absence of the implementation. It is the base unit from which baseline calculations are made.

Term	Definition
Measurement Period T_a	A time period after implementation that must be of the same duration as the measurement period T_b.
MWh	Megawatt-hour (unit of energy)
Output	The number of units of output or production during each time period.
PIAM&V Method	The Project Impact Assessment with Measurement and Verification Method, as defined in clause 7A of the ESS Rule.
Regression Analysis	A statistical process for estimating the relationships among variables. It includes many techniques for modelling and analysing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables (eg, the relationship between energy consumption and production).
RESA	Recognised Energy Saving Activity
Site	The location of the end-user equipment affected by a RESA, as defined by an address, or a) a unique identifier, as specified for the relevant Implementation that identifies the affected end-user equipment, or b) determined by a method accepted by the Scheme Administrator.

Appendices

A Method 1 – Baseline per unit of output

This Appendix is about Method 1 – Baseline per unit of output. It provides information for Applicants and ACPs about:

- the criteria that must be addressed to use Method 1 to calculate energy savings from a project, and
- the steps required to calculate energy savings using Method 1.

A.1 Criteria for Method 1

This method should be used if **energy consumption is strongly linked to output**.

In order to calculate savings using this method certain criteria identified in clause 8.5.1 of the ESS Rule must be satisfied. These criteria are described below.

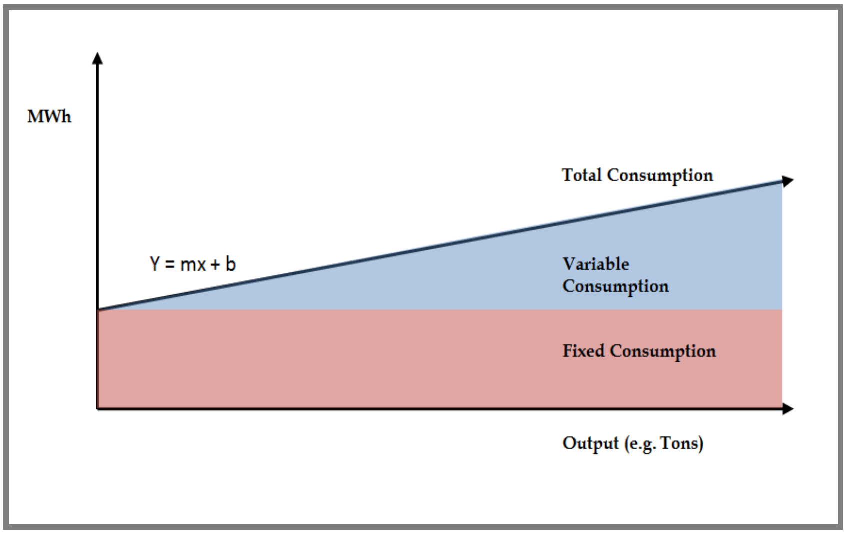
A.1.1 The energy consumption for the site is a linear function of output

A linear regression model must be developed to verify that the relationship between the energy consumption and the output at the site is linear. The model should be presented as an x-y scatter graph, with energy consumption on the y-axis and output on the x-axis. The equation of the line should be clearly stated on your graph. A statistical analysis must be conducted (including, but not limited to, the R^2 value) to demonstrate that the relationship is reasonable. Statistically an R^2 value equal to or higher than 0.75 indicates a good correlation.[36]

Figure A.1 below represents the relationship between energy consumption and output, with consumption (y) being a function of output (x).

36 Refer to Section B2.2.1 "Coefficient of determination (R^2)" in Appendix B of the "*International*

Figure A.1 Graph of energy consumption versus output



A.1.2 The fixed energy consumption, which is the consumption of energy for the site that does not vary with variations in output, can be measured or estimated

This fixed energy consumption is the proportion of energy consumption that would remain constant if the relevant site (eg, a production plant) were not to produce anything for a given period of time. This can be determined by estimating or extrapolating back to zero output from measurements taken during plant downtime or can be estimated mathematically from multiple periods.

The fixed energy consumption must:

- be a reasonable reflection of the consumption that is unaffected by output
- lead to energy savings calculations that are reasonable, and
- be measured over a period before the implementation and commissioning period of the RESA commences (the duration of which is equal to the measurement period).

A.1.3 The variable energy baseline is calculated using data from periods immediately preceding the implementation date

This may be up to a maximum of five years and must exclude any periods that are not representative of the long term site consumption due to factors including plant shutdown or major maintenance. Where this is not possible, due to data unavailability or other reasons, a baseline may be set using other periods acceptable to the Scheme Administrator.

A.1.4 The output at the site for the after measurement period must not have changed by more than 50% from the average output over the baseline period

Verification that the output has not varied by more than 50% from the average output over the period during which the variable energy baseline period is measured.

Box A.1 Evidence to justify the use of the MBM – Baseline per unit of output method – Method 1

The following evidence must be collected if the MBM – Baseline per unit of output method is used to calculate energy savings:

- a linear regression model to verify that the relationship between the energy consumption and the output at each site is linear
- an explanation of the 'fixed' electricity or gas consumption is determined at each site, or the calculation itself, and
- a process that will be used to check that the output has not varied by more than 50% from the average output over the baseline period, for each site.

A.2 Calculating Energy Savings using Method 1

Clause 8.5 of the ESS Rule describes the MBM - Baseline per unit of output method (Method 1), and steps through the calculation of energy savings for this method.

This section follows the steps and formulae contained in method 1, and will assist with:

- developing the calculation spreadsheet to be submitted as part of an application for accreditation, and
- identifying evidence that must be collected when implementing this method.

All formulae used should be clearly stated and referenced from the ESS Rule or other relevant source allowable under the ESS Rule in the calculation spreadsheet.

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

A.2.1 Step 1 – Selecting the measurement period

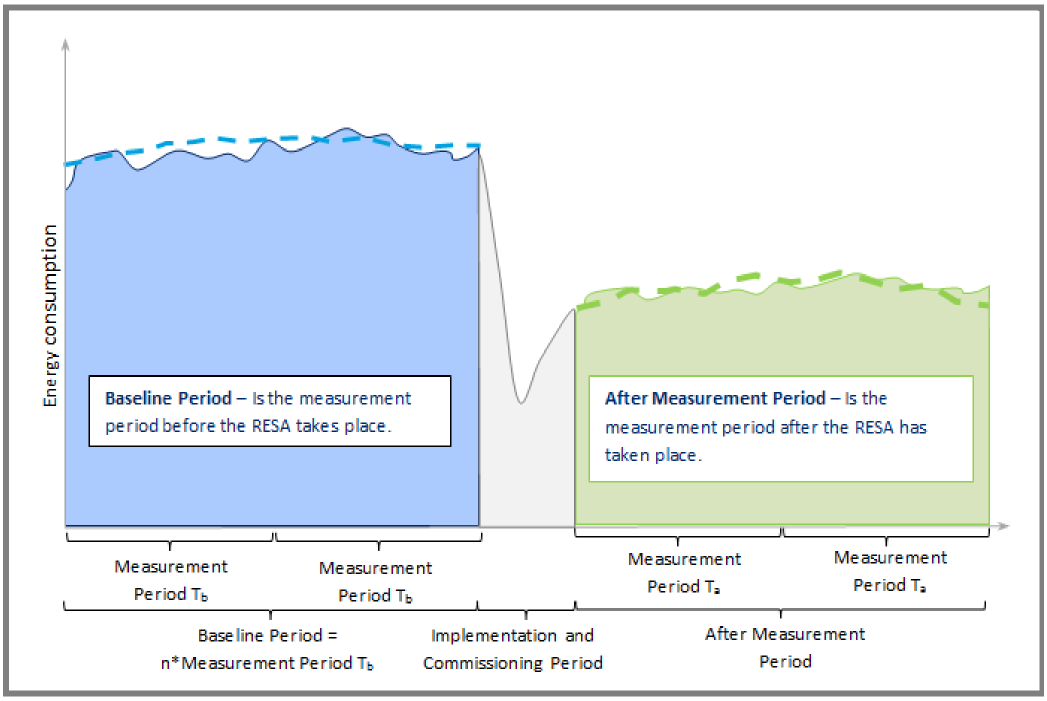
Step 1 requires you to select the measurement period that will be the duration of time over which all measurements in this method will be taken.[37]

The measurement period must be defined for the calculations by defining the following discrete periods:

- the baseline period, which is made up of one or many measurement periods T_b before the implementation,
- the implementation and commissioning period, and
- the after measurement period, which will be made up of as many measurement periods T_a after the implementation as the expected RESA lifetime will allow.

Figure A.2 provides a schematic timeline of the measurement period and its components.

Figure A.2 Schematic timeline of an MBM RESA's measurement period



As noted in Section 3.1 of this document, the implementation date must be after the accreditation date. As such, any application for accreditation must be made before the implementation and commissioning period.

37 Consider conditions in clauses 8.3 and 8.5.1(d) for the variable baseline when determining the measurement period.

Box A.2 Supporting evidence and information for the selected measurement periods

Records must be kept to justify the use of the proposed baseline period, the after measurement period and the length of the measurement periods T_b and T_a. The evidence provided must support the rationale for the:

- baseline period that has been selected
- number of measurement periods T_b the baseline period comprises
- after measurement period (ie, the RESA expected lifetime), and
- number of measurement periods T_a that the expected RESA lifetime will allow.

Sections A.2.1.1 to A.2.1.6 of this guide provide further information that will assist in determining appropriate measurement periods.

A.2.1.1 Determining the baseline period

The **baseline period** is the total period consisting of *n* measurement periods T_b before the implementation.

The baseline period must exclude any time periods that are not representative of normal operating conditions of the site (eg, plant shutdown or major maintenance).

Determining the baseline period is a critical element for all ACPs using MBM to calculate energy savings. As such, we may require additional information from those applying to use MBM, regarding how the baseline has been, or will be, determined including evidence to support calculations of the baseline period or the measurement periods T_b.

Box A.3 Supporting evidence for the baseline period

Evidence will need to be collected for each site that is the subject of an implementation, including:

- supporting documents for the measurement periods T_b to justify use of the proposed baseline period
- rationale for why the measurement periods T_b have been selected, and
- how many '*n*' measurement periods T_b have been or will be used as the basis for the baseline period calculations.

The baseline energy consumption is calculated using data from periods immediately preceding the implementation date, up to a maximum of five years. Where this is not possible, due to data unavailability or other reasons, the baseline energy consumption may be set using other periods acceptable to the Scheme Administrator.[38]

An alternative baseline period may be appropriate if:

- it can be demonstrated that periods immediately preceding the implementation date are not suitable, and
- appropriate evidence for this can be provided.

Requests will be considered on a case by case basis.

A.2.1.2 Measurement periods T_b

The **measurement period T_b** is a defined period **before** implementation of the RESA that is representative of energy use at the site. It becomes the base unit from which baseline calculations are made.

One or more measurement periods T_b will constitute the baseline period. The measurement periods T_b must be:

- a minimum of one (1) day and a maximum of one (1) year, or
- a regular cycle of energy consumption that can be multiplied (by an integer number) to represent the energy consumption before the implementation.

The measurement periods T_b from before the implementation of the RESA must be defined and must be representative of energy use.

A.2.1.3 Implementation and commissioning period

The **implementation and commissioning period** is the time period in which the new process or end user equipment is installed and tested to verify if it functions according to its design specifications. When the performance of the new end user equipment or process is deemed satisfactory, normal operations are considered to have commenced.

A.2.1.4 Determining the after measurement period

The **after measurement period** is the period over which energy savings calculations can be made. This period is the duration of the expected lifetime of the RESA (eg, new equipment expected lifetime) and it comprises as many measurement periods T_a as the expected RESA lifetime will allow. Refer to section 3.3 for information about the allowable lifespan of the baseline.

38 *ESS Rule*, cl 8.5.1(d)

A.2.1.5 Measurement period T_a

The **measurement period T_a** is a defined period **after** implementation of the RESA that must be of the same duration as the measurement period T_b.

A.2.1.6 Measurement periods and ESC creation

The intended frequency of ESC creation should be considered when determining the T_b and T_a measurement periods, as actual measurements for an entire measurement period T_a will need to be undertaken before ESCs can be created.

For example, if the measurement periods T_b are for one year, then data will also need to be collected for one year for the measurement period T_a before any ESCs can be created.

However, the length of the measurement periods T_b and T_a is likely to impact on the **confidence factor** approved as part of an application for accreditation. Shorter measurement periods T_b and T_a are likely to decrease the confidence factor and result in a decrease in the total number of ESCs that can be created.

A.2.2 Step 2 – Determining the energy savings

Once the measurement periods have been determined, the next step is to:

1. complete steps 2A to 2D of method 1 for each energy source for the baseline measurement periods T_b, and
2. complete steps 2E to 3 of method 1 for each energy source for each measurement period T_a after implementation for which ESCs will be created (this will occur after accreditation).

These steps are explained in more detail in the sections below.

A.2.2.1 Step 2A - Determine the fixed consumption (in MWh)

The **fixed consumption** is the proportion of energy consumption that would remain constant if the production plant were to be taken off-line for a given period of time. As the fixed consumption is not expected to change as a result of the RESA, it is based solely on the period *before* implementation of the RESA.

Fixed consumption may be estimated and extrapolated from energy consumption measured during periods when the plant was offline. Alternatively, fixed consumption can be estimated or determined mathematically from multiple periods. It must be a reasonable reflection of the consumption unaffected by output, and lead to energy savings calculations that are reasonable. The fixed consumption is determined and applied to all the proposed measurement periods T_b contained within the baseline period.

Box A.4 Supporting evidence of how fixed consumption is derived or measured

Evidence of how the figure accounting for the fixed consumption has been derived or measured with the results of:

- any sub-metering equipment on site, or
- an extrapolation from energy bills.

A.2.2.2 Step 2B – Calculate the variable consumption (in MWh/units of output)

For calculating the **variable consumption T_b** for each measurement period T_b the following inputs are needed:

- the total consumption T_b (in MWh), and
- the output T_b (number of units of output).

Each of these components is outlined below.

Total Consumption T_b for the site

The total consumption of the site corresponds to the total metered amount of energy consumed at the site before the implementation for each of the defined measurement periods T_b.

Box A.5 Supporting evidence for how total consumption is calculated or measured

Evidence to support the figures for total energy consumption with the results of:

- any sub-metering equipment on site, or
- data provided by the energy retailer (using the utility's revenue grade meters).

Determining the output T_b for the site

Output T_b (or production) is the number of units of production output for each of the measurement periods T_b.

Details of the output from the site (within the RESA boundary) must be included as an input into Step 2B of method 1. To do this, details of the total output from the site **before** the implementation for each of the defined measurement periods T_b must be recorded.

The **Output T_a**, which is the output from the site after the implementation, will be an ongoing input to the calculation methodology and will need to be input for each measurement period T_a .

In each case, the output (eg, litres, tonnes, pieces, etc.) must be specified in the same way in the T_b and T_a measurement periods.

Box A.6 Supporting evidence for output

Evidence must be collected for the output amount at the site:

- a detailed explanation of how you measured or calculated the production output or units of production, and
- evidence to support this (eg, electronic product inventories, stock control, loading dock records).

Calculate the variable consumption T_b

Once the above two parameters for '*n*' measurement periods T_b have been calculated, along with the fixed consumption, the variable consumption T_b (in MWh / unit of output) for each of the measurement periods T_b, using the formula in Step 2B of method 1 can be calculated.

$$\textit{Variable Consumption}_{Tb} = (\textit{Total Consumption}_{Tb} - \textit{Fixed Consumption})/\textit{Output}_{Tb}$$

A.2.2.3 Step 2C – Calculate the variable baseline (in MWh/units of output)

The variable baseline is calculated as per Step 2C of Method 1 in the ESS Rule and is measured in MWh /unit of output. It is the average of all the variable consumption values calculated in Step 2B for the entire baseline period.

$$\textit{Variable Baseline} = \{\sum_{T=1}^{n} \textit{Variable Consumption}_{Tb}\} / n$$

A.2.2.4 Step 2D - Calculate the baseline variability (in MWh/units of output).

The baseline variability (in MWh/units of output) is calculated based on the highest and lowest values of energy used per unit of output over the baseline period. It is the unexplained variance in the baseline for each measurement period T_b.

The baseline variability will differ based on the number of measurement periods T_b used to calculate the baseline consumption.

Step 2D of Method 1 of the ESS Rule prescribes how to calculate baseline variability, depending on the nominated number of measurement periods T_b.

- If more than two measurement periods T_b are used in the calculations, the difference between the maximum variable consumption T_b and minimum variable consumption T_b recorded across all your measurement periods T_b should be halved, as follows:

$$\textit{Baseline Variability} = (\text{maximum } \textit{Variable Consumption}_{Tb} - \text{minimum } \textit{Variable Consumption}_{Tb}) / 2$$

- If two or less measurement periods T_b are used in the calculations, the baseline variability is 10% of the variable baseline.

A.2.2.5 Step 2E - Calculate reduced consumption (in MWh)

Step 2E of Method 1 of the ESS Rule should be used to calculate the Reduced Consumption for each measurement period T_a .

$$\textit{Reduced Consumption} = (\textit{Output}_{Ta} \times \textit{Variable Baseline} + \textit{Fixed Consumption}) - \textit{Total Consumption}_{Ta}.$$

Where:

- T_a denotes a time period, after the implementation date, the duration of which is equal to the measurement period T_b
- Total consumption T_a (in MWh) is the consumption of energy for the site measured by metering that consumption over a measurement period T_a, and
- Output T_a is the number of units of output during the time period T_a (as explained in section A.2.2.2 above).

This step must be repeated for each energy source for each measurement period T_a.

A.2.2.6 Step 2F - Calculate confidence factor

The confidence factor reflects the degree of uncertainty in the calculations, information and assumptions that are used and is calculated using Step 2F of method 1.

$$\textit{Confidence Factor} = 1 - (\textit{Baseline Variability} / \textit{Variable Baseline})$$

A.2.2.7 Step 2G – Calculate energy savings (in MWh)

To calculate the energy savings (in MWh) resulting from implementation of the RESA, perform the following calculation specified in Step 2G of Method 1 of the ESS Rule.

If measuring electricity consumption:

Electricity Savings = *Reduced Consumption* x *Confidence Factor* x *Regional Network Factor*

Where the *Regional Network Factor* is the value from Table A24 of the ESS Rule corresponding to the postcode of the address of the site or sites where the implementation took place.

If measuring gas consumption:

Gas Savings = *Reduced Consumption* x *Confidence Factor*

A.2.3 Step 3 – calculate net energy savings

The final step is to calculate the net energy savings from the implementation.

It is possible that an implementation designed to achieve electricity savings may increase gas consumption or vice versa. The energy savings of one energy source may be outweighed by the increased consumption of the other and result in negative net energy savings. The following formula is used to determine this.

If *Electricity Savings* x *Electricity Certificate Conversion Factor* + *Gas Savings* x *Gas Certificate Conversion Factor* < 0, then *Electricity Savings* = 0 and *Gas Savings* = 0

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

For the calculation of ESCs, refer to Section 6 of this guide.

B Method 2 – Baseline unaffected by output

This Appendix is about Method 2 – Baseline unaffected by output. It provides information for Applicants and ACPs about:

- the criteria that must be addressed to use Method 2 to calculate energy savings from a project, and
- the steps required to calculate energy savings using Method 2.

B.1 Criteria for Method 2

This method should be used to quantify energy savings where **energy consumption is independent of output** from a production or service site.

To use this method clause 8.6.1(a) of the ESS Rule must be met, in that **the consumption of all energy sources from the site must be independent of output**.

This method should be used when a RESA is implemented at a production site and the energy consumption at that site remains similar regardless of whether 1 or 1,000 units are produced.

This method may also be used at sites at which a service is provided (eg, in schools, hospitals, retail stores and hotels), where the amount of energy used remains reasonably constant regardless of the number of people using the service.

If this method is to be used for a RESA implemented at a production facility, a linear regression model must be developed to verify that there is no statistically relevant relationship between **electricity or gas consumption and output at the site**.

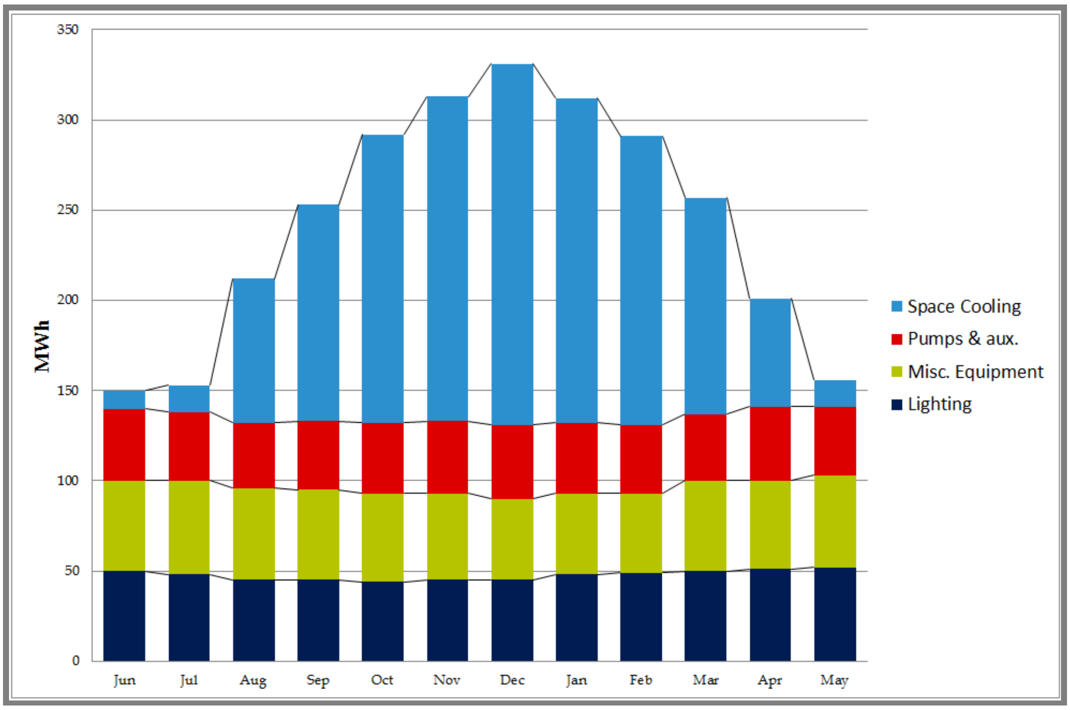
However, in both scenarios (production or service site), depending on the implementation boundary, it will need to be verified that there are no external variables that may cause a variation in the energy consumption at the site, such as weather.

The following example provides additional guidance to understand the requirement.

Example

Figure B.2 below shows a typical electricity load curve at a particular site.

Figure B.2 Electricity Consumption (MWh) – load curve for building in temperate climate zone



In this example, the electricity consumption related to **'Space Cooling'** is heavily affected by the weather (ie, the load increases in the warmer months). Under this scenario, there are three possible options:

1. If the RESA involves upgrades to the space cooling equipment, the MBM – Normalised Baseline method (refer Appendix C) would be appropriate.
2. If the RESA:

- does not involve upgrades to the space cooling equipment, and
- the electricity consumption of the end-user equipment the subject of the RESA cannot be isolated with sub-metering,

  the MBM – Normalised Baseline method (refer Appendix C) would be appropriate.

3. If the RESA:

- does not involve upgrades to the cooling equipment, and
- the electricity consumption of the end-user equipment the subject of the RESA can be isolated with sub-metering,

  then the MBM – Baseline unaffected by output method may be appropriate.

Depending on the implementation boundary, scenarios 2 and 3 the Project Impact Assessment with Measurement & Verification (PIAM&V) may also be suitable.[39]

Box B.1 Evidence to justify the use of the MBM – Baseline unaffected by output method – Method 2

To be able to use the MBM – Baseline unaffected by output method the following evidence musty be collected:

- For a production site: a linear regression model to verify that the relationship between energy consumption and output at the site is not statistically relevant.
- For a service site: evidence that verifies that energy consumption remains reasonably constant regardless of the amount of people serviced.
- For either production or service site cases: a process or an analysis which demonstrates that no external variables affect the energy consumption at each site.

B.2 Calculating Energy Savings using Method 2

Clause 8.6 of the ESS Rule describes the MBM - Baseline unaffected by output method (method 2), and steps through the calculation of energy savings.

This section follows the steps and formulae contained in method 2, and will assist with:

- developing calculation spreadsheets, and
- identifying evidence requirements.

All formulae used should be clearly stated and referenced (from either the ESS Rule or other relevant source allowable under the ESS Rule) in calculation spreadsheets.

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

B.2.1 Step 1 – Selecting the measurement period

Step 1 requires the selection of a measurement period that will be the duration of time over which all measurements in this method will be taken.[40]

39 Refer: http://www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Project_Impact_Assessment_with_MV

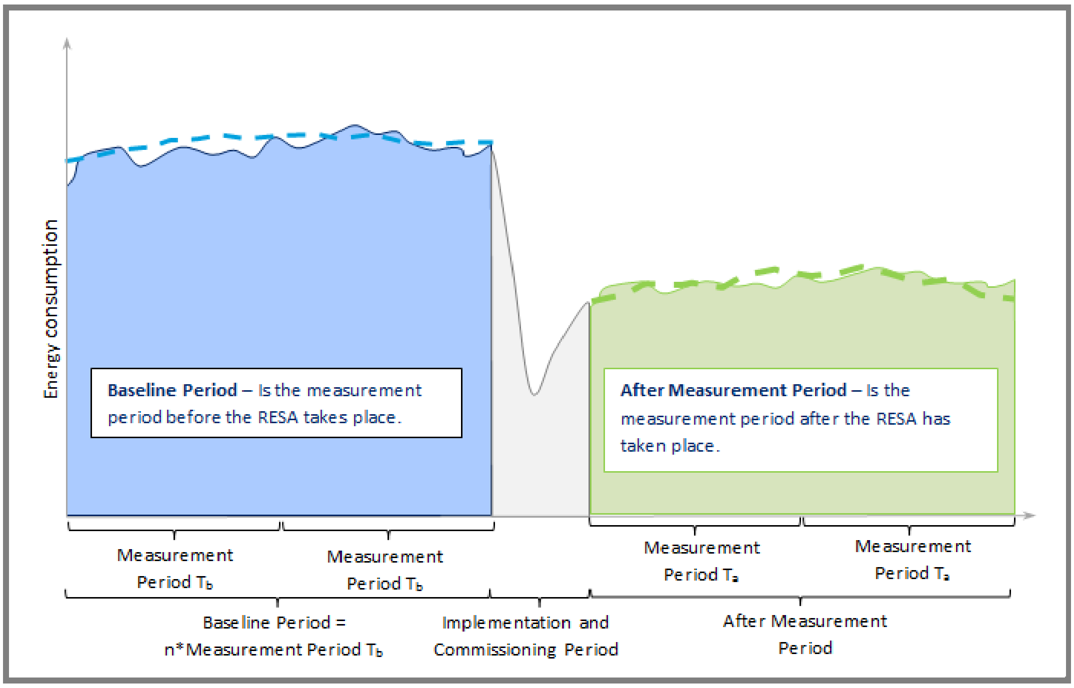
40 Consider conditions in clauses 8.3 and 8.6.1(b) of the ESS Rule for the baseline when determining the measurement period.

The measurement period used for calculations must be defined using the following discrete periods:

- the baseline period, which is made up of one or many measurement periods T_b before the implementation
- the implementation and commissioning period, and
- the after measurement period, which will be made up of as many measurement periods T_a after the implementation as the expected RESA lifetime will allow (up to a maximum of 10 years).

Figure B.3 provides a schematic timeline of the measurement period and its components.

Figure B.3 Schematic timeline of an MBM RESA's measurement period



As noted in section 3.1 of this document, the implementation date must be after the accreditation date. As such, any application for accreditation must be made before the implementation and commissioning period.

Box B.2 Supporting evidence and information for the selected measurement periods

Evidence to justify the use of the proposed baseline period, the after measurement period and the length of the measurement periods T_b and T_a must support the rationale for the:

- baseline period that has been selected
- number of measurement periods T_b the baseline period comprises
- after measurement period (ie, the RESA expected lifetime), and
- number of measurement periods T_a that the expected RESA lifetime will allow.

Appendices B.2.1.1 to B.2.1.6 of this guide provide further information that will assist in determining appropriate measurement periods.

B.2.1.1 Determining the baseline period

The **baseline period** is the total period consisting of *n* measurement periods T_b before the implementation.

The baseline period must exclude any time periods that are not representative of normal operating conditions of the site (eg, plant shutdown, major maintenance).

Determining the baseline period is a critical element for all ACPs using MBM. As such, additional information of how the baseline has been determined may be required.

Box B.3 Supporting evidence for the baseline period

The following evidence must be collected for each implementation:

- supporting documents for the measurement periods T_b to justify use of the proposed baseline period
- rationale for why these measurement periods T_b have been selected, and
- how many '*n*' measurement periods T_b have been or will be used as the basis for the baseline period calculations.

The baseline energy consumption is calculated using data from periods immediately preceding the implementation date, up to a maximum of five years. Where this is not possible, due to data unavailability or other reasons, the baseline energy consumption may be set using other periods acceptable to the Scheme Administrator.[41]

41 *ESS Rule*, cl 8.6.1(b)

An alternative baseline period may be appropriate if:

- it can be demonstrated to the Scheme Administrator that periods immediately preceding the implementation date are not suitable, and
- appropriate evidence for this can be provided.

Requests will be considered on a case by case basis.

B.2.1.2 Measurement periods T_b

The **measurement period T_b** is a defined period **before** the implementation that is representative of energy use at the site. It becomes the base unit from which baseline calculations are made.

One or more measurement periods T_b will constitute the baseline period. The measurement periods T_b must be:

- a minimum of one (1) day and a maximum of one (1) year, or
- a regular cycle of energy consumption that can be multiplied (by an integer number) to represent energy consumption before the implementation.

Measurement periods T_b must be defined from before the implementation of the RESA that are representative of energy use.

B.2.1.3 Implementation and commissioning period

The **implementation and commissioning period** is the time period in which the new process or end user equipment is installed and tested to verify if it functions according to its design specifications. When the performance of the new end user equipment or process is deemed satisfactory, normal operations are considered to have commenced.

B.2.1.4 Determining the after measurement period

The **after measurement period** is the period over which energy savings calculations can be made. This period is the duration of the expected lifetime of the RESA (eg, new equipment expected lifetime) and it comprises as many measurement periods T_a as the expected RESA lifetime will allow. Refer to section 3.3 for information about the allowable lifespan of the baseline.

B.2.1.5 Measurement period T_a

The **measurement period T_a** is a defined period **after** the implementation that must be of the same duration as the measurement period T_b.

B.2.1.6 Measurement periods and ESC creation

When determining T_b and T_a measurement periods, the frequency with which ESCs will be created should be consider, as actual measurements for an entire measurement period T_a will need to be undertaken before ESC creation.

For example, if measurement periods T_b of one year are used, then data for one year for the measurement period T_a will need to be collected before ESC creation.

However, the length of the measurement periods T_b and T_a is likely to impact on the **confidence factor** approved as part of the application for accreditation. Shorter measurement periods T_b and T_a are likely to decrease the confidence factor and result in a decrease in the total number of ESCs that can be created.

B.2.2 Step 2 – Determining the energy savings

Once the measurement periods are determined, the next steps are:

1. complete steps 2A and 2B of method 2 for each energy source for the baseline measurement periods T_b, and
2. complete steps 2C to 3 of method 2 for each energy source for each measurement period T_a after the implementation .

These steps are explained in more detail in the sections below.

B.2.2.1 Step 2A - Calculate the baseline (in MWh)

For calculating the **baseline,** the **total consumption T_b** (in megawatt-hours ie, MWh) of the site will need to be determined.

The total consumption T_b of the site corresponds to the total metered amount of energy consumed at the site before the implementation, for each of the defined measurement periods T_b.

The total metered amount of energy consumed at the site before the implementation, for each of the nominated measurement periods T_b.

Box B.4 Supporting evidence of how total consumption is calculated or measured

Evidence must be collected to support the figures for total energy consumption with the results of:

- any sub-metering equipment on site, or
- data provided by the energy retailer (using the utility's revenue grade meters).

Once the total consumption T_b of the site has been determined, Step 2A of method 2 under clause 8.6 of the ESS Rule is used to calculate the **baseline** using each measurement period T_b.

$$Baseline = \{\sum_{T=1}^{n} Total\ Consumption_{\ Tb}\} \ /\ \mathrm{n}$$

B.2.2.2 Step 2B - Calculate baseline variability (in MWh)

The **baseline variability** is calculated based on the highest and lowest values of energy used in the baseline period. It is the unexplained variance in the baseline for each measurement period T_b.

The baseline variability calculation will differ based on the number of measurement periods T_b contained within the baseline period.

Step 2B of Method 2 of the ESS Rule prescribes how to calculate baseline variability, depending on the number of measurement periods T_b you have nominated:

- If two or more measurement periods T_b are used in the calculations, difference between the maximum total consumption T_b and minimum total consumption T_b, recorded across all your measurement periods T_b should be halved, as follows:

$$Baseline\ Variability = (maximum\ Total\ Consumption_{Tb} - minimum\ Total\ Consumption_{Tb}) \quad /\ 2$$

- If only one measurement period T_b is used in the calculations, the baseline variability is 10% of the baseline.

B.2.2.3 Step 2C - Calculate reduced consumption (in MWh)

Step 2C of method 2 is used to calculate the reduced consumption for each measurement period T_a for the implementation, as follows:

$$Reduced\ Consumption = Baseline - Total\ Consumption_{Ta}$$

Where:

- T_a denotes a time period, after the implementation date, the duration of which is equal to the measurement period T_b, and
- Total Consumption T_a (in MWh) is the consumption of energy for the site measured by metering that consumption over a measurement period T_a.

This step must be repeated for each measurement period T_a.

B.2.2.4 Step 2D - Calculate confidence factor

Step 2D of method 2 is used to calculate the confidence factor, which reflects the degree of uncertainty in the calculations, information and assumptions that are used, as follows:

Confidence Factor = 1 – (*Baseline Variability / Baseline)*

B.2.2.5 Step 2E – Calculate energy savings (in MWh)

Step 2E of Method 2 of the ESS Rule is used to calculate the energy savings (in MWh) resulting from the implementation, as follows:

If measuring electricity consumption:

Electricity Savings = *Reduced Consumption* x *Confidence Factor* x *Regional Network Factor*

Where the *Regional Network Factor* is the value from Table A24 corresponding to the postcode of the address of the site or sites where the implementation took place.

If measuring gas consumption:

Gas Savings = *Reduced Consumption* x *Confidence Factor*

B.2.3 Step 3 – calculate net energy savings

The final step is to calculate the net energy savings from the implementation.

It is possible that an implementation designed to achieve electricity savings may increase gas consumption or vice versa. The energy savings of one energy source may be outweighed by the increased consumption of the other and result in negative net energy savings. The following formula is used to determine this.

If *Electricity Savings* x *Electricity Certificate Conversion Factor* + *Gas Savings* x *Gas Certificate Conversion Factor* < 0, then *Electricity Savings* = 0 and *Gas Savings* = 0

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

C Method 3 – Normalised Baseline

This Appendix is about Method 3 – Normalised Baseline. It provides information for Applicants and ACPs about:

- the criteria that must be addressed to use Method 3 to calculate energy savings from a project, and
- the steps required to calculate energy savings using Method 3.

C.1 Criteria for Method 3

This method should be used where an **explainable variation to energy consumption at the site can be removed** through normalisation against some other factor(s). That is, variation in the energy consumption caused from known changes in the conditions, under which the baseline is determined at the site, can be removed to create a normalised baseline.

If using this method, the criterion identified in clause 8.7.1(a) of the ESS Rule must be met in that:

- the **normalisation variables**, in respect of which the **total consumption** is normalised, are variables corresponding to the specific activities that are a reason for change in total consumption.

Therefore, the normalisation variables should:

- correspond to specific activities or situations that cause the change in the total energy consumption. These causes must be identifiable **physical facts** that affect the energy consumption of the equipment, and
- be expected to change routinely during the 'after' measurement periods, as could be the case with, for example:
  - weather conditions (eg, heating or cooling degree days, or both)
  - substitution of the input mix of a manufacturing process, or
  - periodic or seasonal increases in production.

To evidence this, it must be verified that there is a **statistical correlation** between energy consumption at the site and the normalisation variables that have been identified.

Information from the process or operations affected by normalisation variables could be sourced from plant production logs, metering, meteorology data or other appropriate records. Depending on the complexity of the site, further information such as engineering drawings or more technical information may be necessary in order to meet these requirements.

For further guidance on the development of appropriate normalisation coefficients to account for the variation of **total consumption** refer to the IPMVP, Volume 1.[42]

Box C.1 Evidence to justify the use of the MBM – Normalised Baseline method

To be able to use the MBM – Normalised Baseline method the following evidence must be collected:

- A linear regression model to verify the relationship between energy consumption and the proposed normalisation variable(s) selected for each site. This must include a statistical analysis (including, but not limited to, the R^2 value) to demonstrate that the relationship is reasonable. Statistically, an R^2 value equal to or higher than 0.75 indicates a good correlation.

C.2 Calculating energy savings using Method 3

Clause 8.7 of the ESS Rule describes the MBM - Normalised baseline method (Method 3), and steps through the calculation of energy savings for this method.

This section follows the steps and formulae contained in method 3, and will assist with:

- developing calculation spreadsheets, and
- identifying evidence that must be collected.

All formulae used shall be clearly stated and referenced (from either the ESS Rule or other relevant source allowable under the ESS Rule) in the calculation spreadsheet.

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

C.2.1 Step 1 – Selecting the measurement periods

Step 1 requires the selection of a measurement period that will be the duration of time over which all measurements in this method will be taken.[43]

42 Efficiency Valuation Organisation, 2012 "*International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings - Volume I*", available at http://www.evo-world.org/

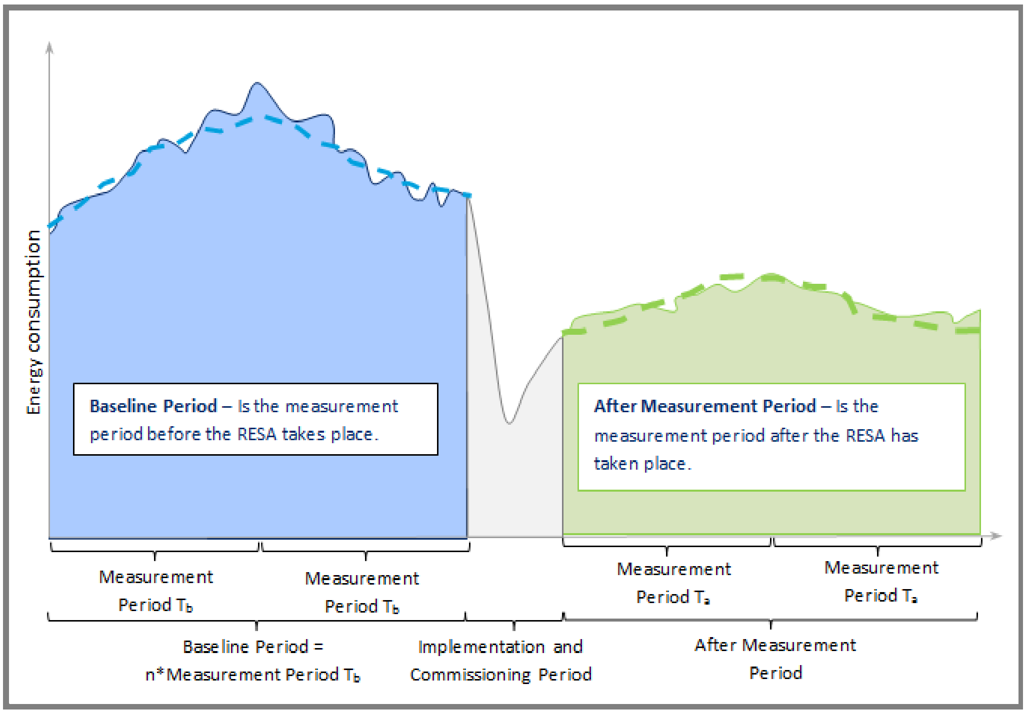
43 Consider clauses 8.3 and 8.7.1(b) of the ESS Rule for the normalised energy baseline when determining the measurement period.

The measurement period used for the calculations must be set by defining the following discrete periods:

- the baseline period, which is made up of one or many measurement periods T_b before the implementation
- the implementation and commissioning period, and
- the after measurement period, which will be made up of as many measurement periods T_a after the implementation as the expected RESA lifetime will allow (up to a maximum of 10 years).

Figure C.8.1 provides a schematic timeline of the measurement period and its components.

Figure C.8.1 Schematic timeline of an MBM RESA's measurement period



As noted in section 3.1 of this document, the implementation date must be after the accreditation date. As such, any application for accreditation must be made before the implementation and commissioning period.

Box C.2 Supporting evidence and information for the selected measurement periods

Evidence must be collected to justify the use of the proposed baseline period, the after measurement period and the length of the measurement periods T_b and T_a, including the rationale for the:

- baseline period that has been selected
- number of measurement periods T_b the baseline period comprises,
- after measurement period (ie, the RESA expected lifetime), and
- number of measurement periods T_a that the expected RESA lifetime will allow.

Appendices C.2.1.1 to C.2.2.6 of this guide provide further information that will assist in determining appropriate measurement periods.

C.2.1.1 Determining the baseline period

The **baseline period** is the total period consisting of *n* measurement periods $\mathbf{T_b}$ before the implementation.

The baseline period must exclude any time periods that are not representative of normal operating conditions of the site (eg, plant shutdown, major maintenance).

Determining the baseline period is a critical element for all ACPs using MBM. As such, additional information of how the baseline has been determined may be required.

Box C.3 Supporting evidence for the baseline period

Evidence for each implementation must be collected:

- supporting documents for the measurement periods T_b to justify use of the proposed baseline period,
- the rationale for why these measurement periods T_b have been selected, and
- how many '*n*' measurement periods T_b have been or will be used as the basis for the baseline period calculations.

The baseline energy consumption is calculated using data from periods immediately preceding the implementation date, up to a maximum of five years. Where this is not possible, due to data unavailability or other reason, the baseline energy consumption may be set using other periods acceptable to the Scheme Administrator.[44]

[44] *ESS Rule*, cl 8.7.1(b)

It may be appropriate to use an alternative baseline period if it can:

- be demonstrated to the Scheme Administrator that periods immediately preceding the implementation date are not suitable, and
- appropriate evidence for this can be collected.

Requests will be considered on a case by case basis.

C.2.1.2 Measurement periods T_b

The **measurement period** T_b is a defined period **before** the implementation that is representative of energy use at the site. It becomes the base unit from which baseline calculations are made.

One or more measurement periods T_b will constitute the baseline period. The measurement periods T_b must be:

- a minimum of one (1) day and a maximum of one (1) year, or
- a regular cycle of energy consumption that can be multiplied (by an integer number) to represent energy consumption before implementation of the RESA.

Measurement periods T_b from before the implementation, which are representative of energy use, must be defined.

C.2.1.3 Implementation and commissioning period

The **implementation and commissioning period** is the time period in which the new processes or end user equipment is installed and tested to verify if it functions according to its design specifications. When the performance of the new end user equipment or processes is deemed satisfactory, normal operations are considered to have commenced.

C.2.1.4 Determining the after measurement period

The **after measurement period** is the period over which energy savings calculations can be made. This period is the duration of the expected lifetime of the RESA (eg, new equipment expected lifetime) and it comprises as many measurement periods T_a as the expected RESA lifetime will allow. Refer to section 3.3 for information about the allowable lifespan of the baseline.

C.2.1.5 Measurement period T_a

The measurement period T_a is a defined period **after** the implementation that must be of the same duration as the measurement period T_b.

C.2.1.6 Measurement periods and ESC creation

When determining T_b and T_a measurement periods, the frequency of ESC creation should be considered, as actual measurements for an entire measurement period T_a must be undertaken before ESC creation.

For example, if measurement periods T_b of one year are used, then data will need to be collected for one year for the measurement period T_a before ESC creation.

However, the length of the measurement periods T_b and T_a is likely to impact on the **confidence factor** approved as part of the application for accreditation. Shorter measurement periods T_b and T_a are likely to decrease the confidence factor and result in a decrease in the total number of ESCs that can be created.

C.2.2 Step 2 – Determining the energy savings

Once the measurement periods have been determined, Method 3 now requires the completion of steps 2A to 2F. Method 3 also requires you to complete steps 2D to 3 for each measurement period T_a for which ESCs will be created.

These steps are explained in more detail in the sections below.

C.2.2.1 Step 2A – Calculate the normalised consumption (in MWh)

For calculating the **normalised consumption T_b** the **total consumption T_b** (in MWh) of the site will need to be determined.

The total consumption T_b of the site corresponds to the total metered amount of energy consumed at the site before the implementation, for each of the defined measurement periods T_b.

The total metered amount of energy consumed at the site before the implementation will need to be determined, for each of the nominated measurement periods T_b.

Box C.4 Supporting evidence of how total consumption is calculated or measured

Evidence to support the total energy consumption is calculated should include:

- any sub-metering equipment on site, or
- data provided by the energy retailer (using the utility's revenue grade meters).

Once the total consumption T_b for each of the measurement periods T_b has been determined, Step 2A of method 3 should be used to calculate the normalised consumption T_b (in MWh) for *n* time periods T_b. This is done by normalising the total consumption T_b to determine the consumption that would have occurred for the measurement period T_b had the conditions at the time of measurement period T_a existed, using:

(a) a set of normalisation coefficients, which are one or more coefficients calculated to account for the variation in total consumption T_b per unit of change for each corresponding normalisation variable used in (b) below, and

(b) a set of values, which are the difference between the values of the normalisation variables for each time period T_b, and the values of the normalisation variables for one time period T_a, determined by measurements or other data sources.

Reasons for the variation in total consumption T_b before the implementation should be explained, for example:

- variations in ambient conditions,
- variations in input characteristics, or
- change in goods manufactured at certain times of the year.

For each of the reasons, and to account for the variation in total consumption T_b before the implementation , an appropriate **normalisation coefficient**[45] should be calculated to account for the variation of total consumption T_b. A set of values to correlate the normalisation variables between the periods before (measurement periods T_b) and after (measurement periods T_a) the implementation should be determined.

Regression analysis and other forms of mathematical modelling can determine the number of normalisation coefficients (independent variables) that contribute to the variation of total consumption T_b.

For further guidance on the development of appropriate normalisation coefficients, refer to the IPMVP, Volume 1.[46] Also, an example of how method 3 may be applied in practice is available on the ESS website at: www.ess.nsw.gov.au/Methods_for_calculating_energy_savings/Metered_Baseline_Methods.

45 Normalisation coefficients refer to regularly changing parameters affecting the site energy use, and are also called independent variables.

46 Efficiency Valuation Organisation, 2012 "International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings - Volume I", available at http://www.evo-world.org/

C.2.2.2 Step 2B – Calculate the normalised baseline (in MWh)

Use Step 2B of method 3 to calculate the **normalised baseline** for each of the ***n*** measurement periods T_b.

$$\textit{Normalised Baseline} = \{\sum_{T=1}^{n} \textit{Normalised Consumption}_{Tb}\} \;/\; n$$

C.2.2.3 Step 2C - Calculate baseline variability (in MWh)

The **baseline variability** is calculated based on the highest and lowest normalised values of energy used in the baseline period. It is the unexplained variance in the baseline for each measurement period T_b.

The baseline variability will differ based on the number of measurement periods T_b used to calculate the reduced energy consumption as a result of the implementation.

Step 2C of Method 3 of the ESS Rule prescribes how to calculate baseline variability, depending on the number of measurement periods T_b that have been nominated.

- If two or more measurement periods T_b are used in the calculations, the difference between the maximum normalised consumption T_b and minimum normalised consumption T_b, recorded across all your measurement periods T_b should be halved as follows:

$$\textit{Baseline Variability} = (\textit{maximum Normalised Consumption}_{Tb} - \textit{minimum Normalised Consumption}_{Tb}) / 2$$

- If only one measurement period T_b is used in the calculations, the baseline variability is 10% of the normalised baseline.

C.2.2.4 Step 2D - Calculate the reduced consumption (in MWh)

Step 2D of Method 3 of the ESS Rule should be used to calculate the **reduced consumption** for each measurement period T_a.

$$\textit{Reduced Consumption} = \textit{Normalised Baseline} - \textit{Total Consumption}_{Ta}$$

Where:

- T_a denotes a time period, after the implementation date, the duration of which is equal to the measurement period T_b, and
- **Total Consumption T_a** (in MWh) is the consumption of energy for the site measured by metering that consumption over a measurement period T_a.

This step must be repeated for each measurement period T_a.

C.2.2.5 Step 2E - Calculate confidence factor

Step 2E of Method 3 of the ESS Rule should be used to calculate the **confidence factor** which reflects the degree of uncertainty in the calculations, information and assumptions that are used.

Confidence Factor = *1 - (Baseline Variability / Normalised Baseline)*

C.2.2.6 Step 2F – Calculate energy savings (in MWh)

Step 2F of Method 3 of the ESS Rule should be used to calculate the energy savings (in MWh) resulting from the implementation.

If measuring electricity consumption:

Electricity Savings = *Reduced Consumption* x *Confidence Factor* x *Regional Network Factor*

Where the *Regional Network Factor* is the value from Table A24 of the ESS Rule corresponding to the postcode of the address of the site or sites where the implementation took place.

If measuring gas consumption:

Gas Savings = *Reduced Consumption* x *Confidence Factor*

C.2.3 Step 3 – Calculate net energy savings

The final step is to calculate the net energy savings.

It is possible that an implementation designed to achieve electricity savings may increase gas consumption or vice versa. The energy savings of one energy source may be outweighed by the increased consumption of the other and result in negative net energy savings. The following formula is used to determine this.

If *Electricity Savings* x *Electricity Certificate Conversion Factor* + *Gas Savings* x *Gas Certificate Conversion Factor* < 0, then *Electricity Savings* = 0 and *Gas Savings* = 0

For implementations that increase either electricity consumption or gas consumption, both electricity savings and gas savings must be calculated.

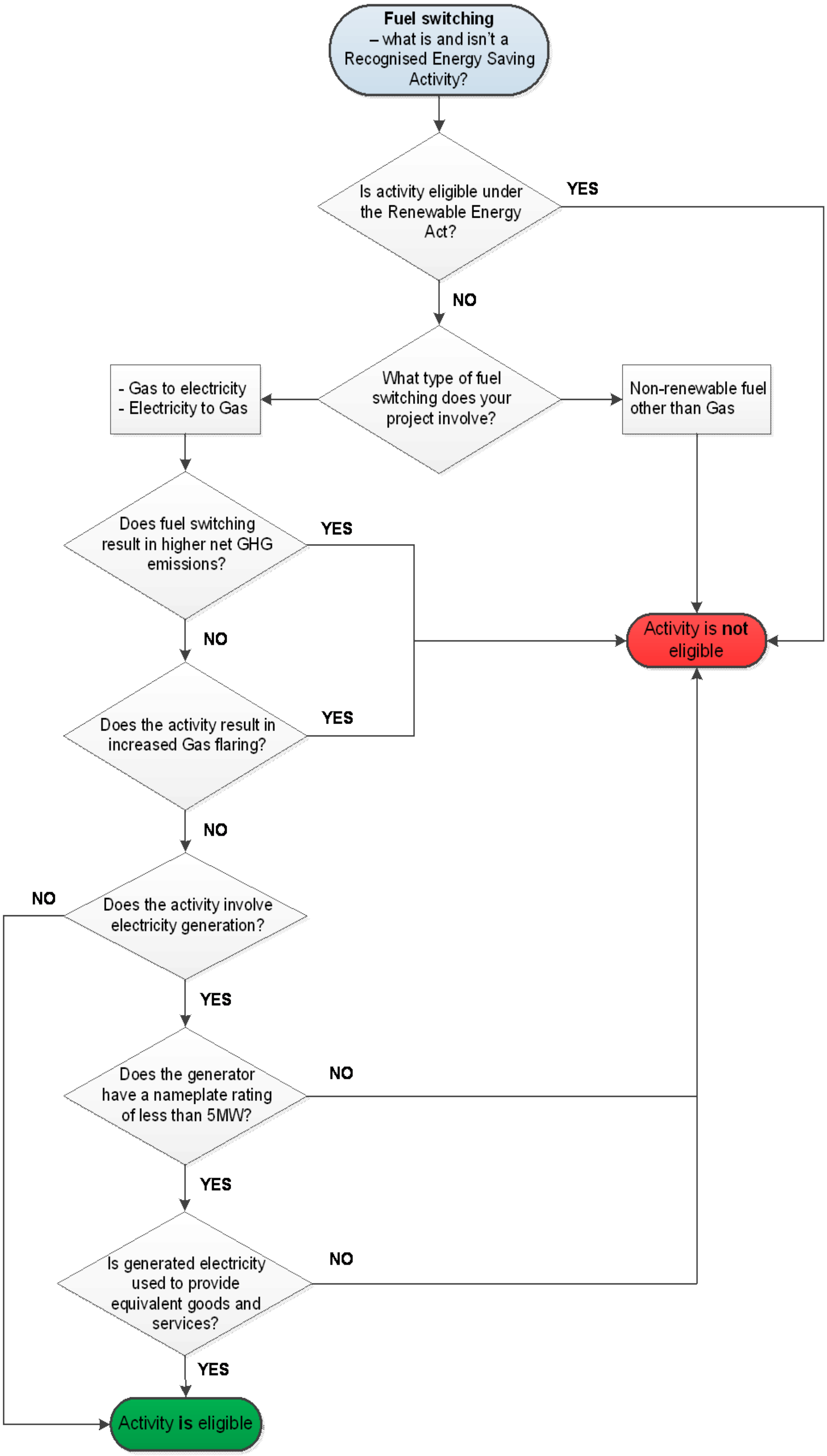
D Fuel switching activities

Under clause 5.3 of the ESS Rule, fuel switching (from electricity to gas or from gas to electricity) that increases the efficiency of energy consumption may constitute a RESA, provided the activity meets certain criteria.

Figure D.1 may assist potential applicants for accreditation to determine if a proposed fuel switching project is eligible to be treated as a RESA under the ESS.

Some project examples are included in Boxes D.1 and D.2 for further reference.

Figure D.1 Flowchart of eligible fuel-switching activities



D.1 Examples of fuel switching activities eligible under the ESS

Eligible Activity	Example
Gas to Electricity	▼ Installing a gas engine, cogeneration or trigeneration unit with a power generation capacity of less than 5MW, where all generated electricity is used onsite for the production of goods and/or services (ie, no power exports). ▼ Replacing gas-fired heating equipment with electric heating equipment[47]
Electricity to Gas	▼ Replacing electric heating equipment with gas-fired equipment.[48] ▼ Replacing an electrical drive or electrically driven equipment[49] with gas-powered equipment.

D.2 Examples of fuel switching activities that are not eligible under the ESS

Ineligible Activity	Examples
Gas or electricity to other fuels (renewable and non-renewable)	▼ Replacing a gas-fired boiler with a: – coal-fired boiler – biogas-fired boiler – biomass boiler ▼ Retrofitting a dual gas burner on an existing boiler to replace natural gas with biogas
Fuel switching that results in an increase in flaring	▼ Replacing a biogas-fired heater with an electric heater resulting in increased biogas flaring as less biogas is used (where biogas is generated onsite)
Fuel switching that results in an increase in net Greenhouse Gas (GHG) emissions	▼ Removing a gas cogeneration system to reduce gas consumption resulting in higher purchased electricity use and increased net GHG emissions. ▼ Retrofit a dual gas burner on an existing cogeneration system to co-fire coal seam gas and reduce natural gas consumption. The switch to coal seam gas will result in higher GHG emissions due to the higher emission factor of coal seam gas compared to natural gas.
Fuel switching activity that is eligible to create tradeable certificates under the *Renewable Energy (Electricity) Act 2000*	▼ A 1MW biogas electric generator, which is eligible to create Large-scale Generation Certificates (LGCs) under the Renewable Energy Target (RET) scheme. Biogas is an eligible renewable energy source under the RET scheme to create renewable energy certificates.
Electricity generation where any generated power is not used to provide equivalent goods or services	▼ A 4MW cogeneration system that supplies more than 100% of a site's electrical consumption with the excess power exported to the grid
Electricity generation from a generating system that has a nameplate rating greater than 5MW	▼ A 6MW cogeneration system running at 80% capacity. Though the power output is less than 5MW the nameplate rating is greater than 5MW.

[47] Such as a furnace, water heater or steam producer using eg, a resistance, induction or microwave heater.

[48] Heating equipment such as a furnace, kiln, dryer, water heater or steam generator.

[49] Such as air-conditioning systems, refrigeration compressors or pumps.