# ENERGY SAVINGS SCHEME NOTICE 04/2020

PIAM&V Method Requirements

21/02/2020

## WHAT

This ESS Notice provides guidance on the requirements of the Project Impact Assessment with Measurement and Verification (**PIAM&V**) method of the *Energy Savings Scheme Rule of 2009* (**ESS Rule**).

## WHY

We have developed the PIAM&V Method Requirements in response to changes to the ESS Rule (ESS (Amendment No.1) Rule 2020) and feedback from Accredited Certificate Providers (**ACPs**) requesting additional guidance on the application of the PIAM&V method.

ACPs **must comply** with the PIAM&V Method Requirements when using the PIAM&V method.

The PIAM&V Method Requirements:

- Increase clarity and certainty for our ACPs, auditors and Measurement and Verification (**M&V**) Professionals, and
- Reduce potential regulatory risk related to the application of the PIAM&V method.

## WHO

This is for professionals and organisations that are involved in the delivery of energy saving activities using the PIAM&V method of the NSW Energy Savings Scheme (**ESS**).

## WHEN

Amendments to the ESS Rule were gazetted on 10 January 2020 and commence on 30 March 2020.

## WHAT NEXT

To ensure that the requirements of the ESS Rule are met, we encourage ACPs and M&V Professionals to assess the M&V Plan and Report as well as the M&V Professional Reports using the guidance in this document.

ACPs must ensure that they develop energy models and calculate the energy savings in accordance with the requirements of the ESS Rule.

ACPs are ultimately responsible for the quality of the records they obtain to support the claimed energy savings, including the M&V Plan, M&V Report and the M&V Professional Reports.

The PIAM&V Method Guide is currently in the process of being amended to ensure it is consistent with and reflects the obligations under the PIAM&V Method Requirements. Further updates will be provided when the review of the PIAM&V Method Guide is complete.

For more information email the ESS Compliance Team at:

ess_compliance@ipart.nsw.gov.au

# PIAM&V Method Requirements

## Background

The PIAM&V Method Requirements are published by the Scheme Administrator under the *Energy Savings Scheme Rule of 2009* (**ESS Rule**). They have been developed in response to requests for further guidance for Accredited Certificate Providers (**ACPs**), auditors and Measurement and Verification Professionals (**M&V Professionals**) and to address changes in the ESS Rule (clauses 7A.5A and 7A.16) that commence on 30 March 2020.

Under the ESS Rule, ACPs **must comply** with the PIAM&V Method Requirements when using the PIAM&V method (see clause 7A.16 of the ESS Rule).

### Transitional arrangements

Clause 11.12 of the ESS Rule provides that clause 7A.5A does not apply to Energy Savings Certificates (**ESCs**) for an Implementation with an Implementation Date on or before 14 August 2020. Clause 7A.5A concerns the review of Measurement Procedures in relation to the Baseline Energy Model by an M&V Professional, that is, the preparation of a Preliminary M&V Professional report.

### How to use this Document

The PIAM&V Method Requirements is structured so that each section has two parts:

1. **The requirements:** The requirements sections contain the PIAM&V Method Requirements that ACPs must comply with under clause 7A.16 of the ESS Rule.
2. **Explanatory text:** The explanatory text provides further guidance, including examples and additional information, to assist ACPs, M&V Professionals and auditors to better understand the scope and operation of the requirements. To the extent an ACP deviates from the approach outlined in the explanatory text, the Scheme Administrator expects that an ACP will provide further explanation in order to demonstrate how the approach it has taken complies with the Act, the ESS Rule and the PIAM&V Method Requirements.

## How this document relates to the PIAM&V Method Guide

The PIAM&V Method Requirements should be read in conjunction with other guidance materials, including the PIAM&V Method Guide. However, for the avoidance of doubt, while the PIAM&V Method Guide offers guidance regarding the PIAM&V method, clause 7A.16(c) of the ESS Rule provides that ACPs *must* comply with the PIAM&V Method Requirements. A contravention of a PIAM&V Method Requirement by an ACP is a contravention of the Rule.

## Terms defined under the ESS Rule

Where this document uses a term which is defined under the ESS Rule, that term is to be given its defined meaning under the ESS Rule.

# 1 Required records

## Method Requirements

1.1 In relation to the PIAM&V Method, an ACP must prepare or commission the following documents for each Implementation:

(a) Measurement and Verification Plan (**M&V Plan**) with a sampling plan (if using the Sampling Method)

(b) Preliminary Measurement and Verification Professional Report (**Preliminary M&V Professional Report**)

(c) Spreadsheets or tools that develop energy models and calculate Energy Savings

(d) Measurement and Verification Report (**M&V Report**), and

(e) Measurement and Verification Professional Report (**M&V Professional Report**).

## Explanatory Text

Required records and reasoning are addressed in various subclauses in clause 7A of the ESS Rule.[1] The PIAM&V Method Guide sets out that the M&V Plan and M&V Report are required documents and form part of the minimum required records. An example M&V Plan is provided in Appendix D of the PIAM&V Method Guide which sets out the typical information requirements is available on the ESS Website.

A template M&V Professional Report is available on the ESS Website and should be used by M&V Professionals to complete the M&V Professional Report. A template for the Preliminary M&V Professional Report will also be made available on the ESS Website for M&V Professionals to use.

[1] See, for example, clauses 7A.3 (Baseline Energy Model), 7A.4 (Operating Energy Model), 7A.5 (Measurement Procedures), 7A.6 (Energy consumption, Independent Variables and Site Constants), 7A.7 (Normal Year), 7A.8 (Effective Range), 7A.9 (Interactive Energy Savings), 7A.10 (Accuracy Factor) and 7A.13 (Persistence Model).

# 2 Measurement Period where energy consumption is subject to seasonal variation

## Method Requirements

2.1 An ACP must include evidence in the M&V Report that both the:

(a) Baseline Energy Model, and

(b) Operating Energy Model

include one or more complete operating cycles of the End-User Equipment (**EUE**).

2.2 Evidence that is provided by an ACP in support of Requirement 2.1 must demonstrate energy usage patterns over one or more complete operating cycles of the EUE and how the relevant variables are captured in the Measurement Period.

2.3 When developing the Measurement Periods for the Baseline Energy Model and the Operating Energy Model, ACPs must take all reasonable steps to reduce statistical bias.

## Explanatory Text

Clause 7A.5(f1) of the ESS Rule requires an ACP to ensure that the Measurement Period includes any time periods during which Independent Variables may reasonably be expected to lead to the Implementation increasing electricity or Gas consumption (or both). In practice, this requires an ACP to ensure that Measurement Periods cover a complete operating cycle. An operating cycle means the time period required for EUE within the measurement boundary to witness one complete cycle of energy usage patterns due to the effects of key Independent Variables; this covers all values of energy consumption throughout the operating cycle, from minimum to maximum.

The Office of Environment and Heritage's (**OEH**) *Measurement and Verification Operational Guide – Best practice M&V processes* (**OEH M&V Guide**)[2] indicates that industry practice is to include a complete 12 month operating cycle in measurement periods for implementations involving temperature-affected energy use. That is, for implementations with Independent Variables related to weather conditions and/or ambient temperature, a typical operating cycle is 12 months.[3]

2 Office of Environment and Heritage, December 2012.
3 Section 4.1.5 of the OEH M&V Guide provides relevant guidance in relation to the operating cycle.

The OEH M&V Guide is supported by guidance provided in the *International Performance Measurement and Verification Protocol Core Concepts* (**IPMVP Core Concepts**),[4] which notes the need for caution in Measurement Period selection. While not directly applicable to the ESS Rule in all respects, the IPMVP Core Concepts provides relevant guidance on Measurement Period selection.[5]

Where an ACP elects to use less than 12 months of data for the Measurement Period of either the Baseline Energy Model or the Operating Energy Model, the ACP must demonstrate that the shorter Measurement Period represents the complete operating cycle for the EUE.

Changes to EUE within the measurement boundary following the Implementation of the Recognised Energy Saving Activity (**RESA**) do not justify the use of a shorter Measurement Period. If changes within the measurement boundary have occurred (for example the addition of new EUE), then this may be a Non-Routine Event for the purposes of the ESS Rule. Clause 7A.5(g) of the ESS Rule requires ACPs to record and exclude any Non-Routine Events that occurred during the Measurement Period, ensuring that the percentage of time excluded is less than 20% of the Measurement Period.

To reduce statistical bias, when using utility meter data to measure energy consumption without sub metering (a whole of site approach), ACPs should use complete years (eg, twelve, twenty four or thirty six months) of continuous data during the baseline period and the operating period. This is consistent with the IPMVP which notes that models that use other numbers of months (eg, nine, ten, thirteen or eighteen months) can create statistical bias by under or over representing some periods of operation.

All energy models should be checked for statistical bias. Statistical bias may be reduced by selecting Measurements Periods which:

a) Are the same length (eg, 12 months), where appropriate, and

b) Are integer multiples of the operating cycle, not fractions of the operating cycle.

4 Efficiency Valuation Organisation, October 2016

5 Section 5.2 and Section 6.5 of the IPMVP Core Concepts, for example, state that 'Option C: Whole Facility' should use complete years of data during the baseline period, and that the reporting period should encompass at least one normal operating cycle.

# 3 Normal operating conditions

## Method Requirements

3.1 Measurements of the Independent Variables and Site Constants must:

(a) Take into account the context of the EUE within the Site

(b) Be made under normal operating conditions, and

(c) Exclude any Non-Routine Events.

3.2 Non-Routine Events:

(a) Must be recorded in the M&V Report, and

(b) Cannot represent more than 20% of the duration of the Measurement Period.

3.3 An ACP must define and document the normal operating conditions of the EUE for the measurements taken.

## Explanatory Text

The requirement that ACPs take into account the context of the EUE within the Site is intended to assist ACPs in identifying projects in which the context of the Site may affect the measurement of Independent Variables and Site Constants. For example, refrigeration within an air-conditioned building is less likely to be affected by ambient conditions than refrigeration in an unconditioned space. The Independent Variable for this project may therefore be inside temperature rather than ambient temperature.

Clauses 7A.3(a) and 7A.4(a) of the ESS Rule require that baseline and operating energy models respectively are based on measurements taken under normal operating conditions.

Requirement 3.3 provides that ACPs must define and document the normal operating conditions of the EUE for the measurements taken. It is not sufficient to simply state that the EUE was operating under normal conditions. The ACP must describe the normal operating conditions both before and after the Implementation. These conditions will be different for each site and may include but are not limited to:

a) The original EUE's load factor, duty cycle or other parameters describing its use and the frequency and consistency of care and maintenance.

b) That the EUE modified, replaced or installed as part of the Implementation is properly installed, maintained and used in accordance with the equipment manufacturer's instructions

c) The normal hours of operation of the EUE across one or more complete operating cycle

d) Weather conditions (if applicable) (eg, if the average temperature, cooling degree days or heating degree days during the Normal Year are significantly different from the Measurement Period, then it is unlikely to represent normal operating conditions), and

e) Normal production levels (if large variations in production represents normal operation then this should be documented in the M&V Plan and the M&V Report and supported by evidence).

# 4 Engaging an M&V Professional

## Method Requirements

4.1 The written explanatory reasoning required under clause 7A.5A of the ESS Rule must be provided in the form of a Preliminary M&V Professional Report which is consistent with any current template Preliminary M&V Professional Report published by the Scheme Administrator. The Preliminary M&V Professional Report must be prepared by an M&V Professional.

4.2 The Preliminary M&V Professional Report must:

(a) Be signed and dated by an M&V Professional and the Energy Saver prior to the Implementation Date

(b) Be based on a review of the M&V Plan and include written explanatory reasoning of the appropriateness of the items listed in clause 7A.5(a)–(g) of the ESS Rule and, regarding the Baseline Energy Model only, the Measurement Procedures for:

(i) The Independent Variables and Site Constants

(ii) The baseline Measurement Period, ensuring that the selected Measurement Period represents a complete operating cycle and includes periods for which Independent Variables may reasonably be expected to lead to the Implementation increasing electricity consumption or Gas consumption or both.

4.3 The M&V Professional Report must be signed by an M&V Professional and refer to and consider both the Preliminary M&V Professional Report and the M&V Report.

4.4 If the Measurement Procedures change, these changes must be assessed by an M&V Professional who must deem the amended Measurement Procedures appropriate and provide their written explanatory reasoning in the M&V Professional Report.

## Explanatory Text

Preparation of a Preliminary M&V Professional Report is intended to ensure compliance with clauses 7A.5(h) and 7A.5A of the ESS Rule. A template Preliminary M&V Professional Report which covers the obligations in Requirement 4.2(b) will be made available to M&V Professionals on the ESS Website.

The ESS Rule does not require that the Preliminary M&V Professional Report be submitted to the Scheme Administrator for review prior to the Implementation Date. However, the Preliminary M&V

Professional Report will form part of the evidence which is reviewed and tested at audit to ensure that the calculated Energy Savings from the Implementation meet the requirements of the ESS Rule.

The Preliminary M&V Professional Report and M&V Professional Report do not need to be completed by the same M&V Professional.

# 5 Measurement boundary

## Method Requirements

5.1 In defining the measurement boundary for an Implementation, an ACP must document all items of EUE which are modified, replaced, installed or removed.

5.2 An ACP must ensure that Energy Savings calculated using measurements from a utility meter have occurred as a result of the Implementation.

## Explanatory Text

Clause 7A.5(d) requires an ACP to define which items of EUE will have their electricity or Gas consumption measured. These requirements are intended to provide clarity to ACPs where utility meter data, rather than sub metering, is used to estimate Energy Savings such that only the EUE that is included in the Implementation needs to be defined, not all energy consuming equipment on the Site.

Common examples of Implementations to which Requirement 5 relates, include:

- Where there are multiple items of equipment measured by the utility meter that are not subject to the Implementation
- Where the measurement boundary encompasses equipment that is not eligible for **ESC** creation (eg, solar PV, solar water heater, or exports of onsite electricity generation to the network), and
- Where an Implementation occurs across multiple levels of a building or areas of a production facility and a portion of the energy load is shifted outside of the measurement boundary (or to another utility meter).

Where these situations arise in the context of an Implementation, ACPs should carefully consider setting the measurement boundary to ensure that the measured energy consumption is representative of the energy consumption of the EUE that is the subject of the Implementation.

For example, it may be appropriate to use utility meter data (that is, a whole of site approach) where the ACP can demonstrate that the energy savings are greater than 10% of the baseline energy use. If the energy savings are less than 10% of the baseline energy use, then the ACP should adjust the measurement boundary and install sub-metering to directly measure the energy consumption of the EUE for the Baseline and Operating Measurement Periods.

Where the utility meter data includes equipment that is not eligible for ESC creation, the ACP should consider segregating the energy consumption or supply of energy from this equipment so that the energy consumption data from the utility meter can be adjusted accordingly.

# 6 Independent Variables and Site Constants

## Method Requirements

6.1 An ACP must have regard to and document all relevant Independent Variables and Site Constants in the M&V Plan and M&V Report.

6.2 An ACP must ensure that the selected Independent Variables and Site Constants affect the energy consumption of the EUE.

6.3 When preparing energy models using Regression Analysis:

(a) ACPs should ensure that the thresholds of statistical good fit in Table 1 are met.

(b) In circumstances where the statistical thresholds in Table 1 are not met, an M&V Professional must provide written explanatory reasoning to justify that the selected Independent Variables are appropriate for the Implementation.

Table 1 Statistical thresholds that should be met when using Regression Analysis

| **Modelling criteria** | **Threshold** |
|---|---|
| t-statistic of Independent Variable | Absolute value > 2 |
| Adjusted $R^2$ (Adjusted coefficient of determination) | > 0.75 |
| Coefficient of Variation (Root Mean Square Error) CV(RMSE) | < 25% |

## Explanatory Text

It is expected that ACPs will:

- Measure energy consumption over a complete operating cycle and use Independent Variables and Site Constants to model energy consumption using Regression Analysis.
- Evaluate how well a particular Regression Analysis explains the relationship between energy use (dependent variable) and Independent Variables.

To assist with this process, we have set out three tests (Table 1) based on the Efficiency Valuation Organisation IPMVP Core Concepts Statistics and Uncertainty for IPMVP[6].

ACPs and M&V Professionals should use these tests when evaluating whether the Independent Variables are appropriate for the Implementation. If the Regression Analysis does not meet the thresholds in Table 1, it may be an indication that some relevant Independent Variables are not included, or that the functional form of the energy model (eg, linear) is not appropriate.

In these instances, ACPs should consider using additional Independent Variables or a different functional form for the energy model (eg, non-linear or multiple linear models based on season) to improve the fit. ACPs should also consider consulting with the M&V Professional to determine whether additional Independent Variables are appropriate for the Implementation. In some cases the use of additional Independent Variables or a different functional form for the energy model may not meet the thresholds of statistical good fit. In that scenario, Requirement 6.3(b) provides that the M&V Professional must provide their explanatory reasoning to justify that the selected Independent Variables are appropriate for the Implementation, despite them not meeting the statistical thresholds in Table 1.

The M&V Professional should assess the selection and evaluation process for Independent Variables and Site Constants in the M&V Professional Report.

The terms Independent Variable and Site Constant are defined in clause 10.1 of the ESS Rule. Unlike the IPMVP, the ESS Rule specifically relates the energy consumption of the EUE to the Independent Variable and Site Constants, rather than the energy consumption of the system or the facility. In order to comply with the definitions in the ESS Rule, an Independent Variable or Site Constant must affect the energy consumption of the EUE. As such, temperature would not be an appropriate Independent Variable for a lighting upgrade, as the electricity consumption of lighting is not temperature dependent.

Examples of common Independent Variables for different EUE and applications are provided in the OEH M&V Guide.

6 Efficiency Valuation Organisation, IPMVP Core Concepts Statistics and Uncertainty for IPMVP, June 2014, pp. 8-10, Section 2.2 Evaluating Regression Models

# 7 Accuracy Factor

## Method Requirements

7.1 In applying clause 7A.10 of the ESS Rule, an ACP must take into account all material sources of error associated with the development of the model when calculating the relative precision of the Electricity Savings or Gas Savings estimate. This should include, but not be limited to, the following sources of error:

(a) Data uncertainty, being the uncertainty generated from insufficient data either in terms of quantity or time period

(b) Measurement uncertainty, and

(c) Modelling uncertainty, including uncertainty generated through the use of estimates and assumptions.

## Explanatory Text

ACPs must ensure that all material sources of error are accounted for when determining the Accuracy Factor to be used. Potential sources of error that should be considered by an ACP when performing an uncertainty analysis include:

- Using utility meter data to estimate the energy consumption of specific items of EUE rather than directly measuring the energy consumption of the EUE
- If an energy model established using Regression Analysis does not meet the statistical thresholds in Table 1 set out in relation to Requirement 6
- Using out of range data that may represent a Non-Routine Event
- Omission of relevant Independent Variables (examples of common Independent Variables for different EUE and applications are provided in the OEH M&V Guide)
- Inclusion of Independent Variables that are not relevant or do not affect the energy consumption of the EUE, for example an Independent Variable that fails the statistical thresholds in Table 1
- Functional form of the energy model (eg, linear or non-linear relationship)
- Insufficient data, either in terms of quantity (ie, sample frequency or gaps in data points) or duration of the measurement period.

Additional guidance is available in the IPMVP Core Concepts *Uncertainty Assessment for IPMVP*.[7]

7 Efficiency Valuation Organisation, July 2019

# 8 Estimate of the Mean model

## Method Requirements

8.1 An ACP must assign a value for each time period in each Measurement Period for relevant:

(a) Independent Variable(s) and Site Constant(s) for Regression Analysis, and

(b) Site Constant(s) for an Estimate of the Mean.

8.2 An ACP must demonstrate that the use of an Estimate of the Mean model is appropriate. This includes:

(a) Assessing if there are Independent Variables that significantly affect energy consumption, and

(b) Measuring likely Independent Variables to ensure that they do not have a significant effect on the energy consumption as described in the OEH M&V Guide.

8.3 The ACP must document:

(a) The process used to determine that an Estimate of the Mean energy model is appropriate

(b) All potential Independent Variables that were tested and why the variables were excluded from the model, and

(c) That the selected Measurement Periods include one or more complete operating cycles.

## Explanatory Text

An energy model established using an Estimate of the Mean must meet the statistical requirement that the Coefficient of Variation is less than 15% (clause 7A.2 of the ESS Rule). Where an Estimate of the Mean is used, it is important to ensure that energy consumption data for a complete operating cycle has been analysed to determine if there are any relevant Independent Variables.

In accordance with Requirement 2.1, ACPs must use a complete operating cycle to determine the type of energy model to use. Where relevant Independent Variables are identified and the Coefficient of Variation is less than 15%, ACPs may choose to use an Estimate of the Mean rather than Regression Analysis. In all instances, the ACP should document the process used to identify if relevant Independent Variables are present. It is not sufficient to state that an Estimate of the Mean was used and therefore there are no relevant Independent Variables.

Under clause 7A.6 of the ESS Rule, among other things, a value for the Site Constant(s) must be provided for each time period in each Measurement Period. If there is any change to the Site Constant(s) during the Measurement Period, then this must be recorded and accounted for in the Normal Year. It is therefore not sufficient to provide one value for the Site Constant, even if the Site Constant does not change. For example, if hourly data is used to estimate energy consumption at a Site for a year, the ACP must provide a value for the Site Constant(s) for every hourly value used. That is, 8,760 occurrences of the Site Constant(s) must be recorded even if the Site Constant(s) does not change. Further, if the Site shuts down for maintenance for one day a year, this results in a change to the Site Constant(s). To comply with Requirement 8, the ACP should provide 8,736 values (8,760 hours minus 24) for the Site Constant taken during normal operating conditions, and 24 values corresponding to the maintenance period.