Measurement and Verification in Victorian Energy Upgrades

Specifications

Version 3 – TBC

VICTORIA State Government

Environment, Land, Water and Planning

Accessibility

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Contents

Introduction

The Measurement and Verification method provides methods and variables for project-based activities in the Victorian Energy Upgrades program. These are contained within this document, the Measurement and Verification Specifications (the specifications).

Purpose

This document sets out the specifications for calculating the carbon dioxide equivalent (in tonnes) of greenhouse gases using the Measurement and Verification method to be reduced by carrying out a prescribed activity.

Legislation and responsibilities

The Victorian Energy Upgrades program is enabled by the Victorian Energy Efficiency Target (VEET) Act 2007, the Victorian Energy Efficiency Target Regulations 2018 (the VEET Regulations 2018), the Victorian Energy Efficiency Target (Project-Based Activities) Regulations 2017 (the VEET PBA Regulations 2017) and the Victorian Energy Efficiency Target Guidelines (the Guidelines).

The Department of Environment, Land, Water and Planning (the department) supports the Minister in overseeing the Victorian Energy Upgrades legistlation.

This document sets out the rules for defining the methods and variables to be used when carrying out a prescribed activity using the Measurement and Verification method for the purpose set out in the PBA Regulations.

The Essential Services Commission (ESC) is the administrator of the Victorian Energy Upgrades program and is responsible for the Guidelines. Participants must also comply with the ESC's requirements, which are published on their website at http://veet.vic.gov.au.

This document should be read in conjunction with the Act, Regulations and material published by the ESC.

Using this document

This document is divided into three sections: **Information to be provided**, **Methods** and **Variables**.

Information to be provided lists the three methods that can be followed and defines the outputs that must be provided in a project impact report.

Methods sets out the calculations that must be undertaken in determining the abatement.

Variables sets out the terms by which projects are defined within energy models, the values for certain variables and the limits to the validity of energy models.

Information to be provided

Definitions

Project means the project which is described in the applications for the scoping approval and project plan approval under the VEET PBA Regulations 2017

Premises has the same meaning as in the VEET Act

Upgrade means the change to equipment or controls, or the set of changes to equipment and/or set of changes to controls as part of the project;

Information to be provided in an application for scoping approval

(1) In a project with more than one premises, the application for approval of a scoping plan must describe the similarity of premises and upgrade, including:

    (a) that energy sources affected by the upgrade are consistent for each premises

    (b) that the proposed measurement boundaries are consistent for each premises.

Note: Approval of a scoping plan for a single project with multiple premises may be refused by the ESC if the upgrades are not essentially identical across all premises.

Information to be provided in an application for approval of a project plan

(2) The application for approval of a project plan must identify one of the following methods for each measurement boundary intended to be used for all upgrades in to calculate the reduction in greenhouse gases:

    (a) a forward projection of savings using a baseline energy model and operating energy model;

    (b) annual reporting of savings using a baseline energy model and measured energy consumption; or

    (c) a combination of **Error! Reference source not found.**(a) and **Error! Reference source not found.**(b) comprising a forward projection followed by annual reporting of savings ('top-up').

(1)(3) Projects with multiple essentially identical upgrades occurring at multiple premises shall choose a single method listed in (2) for calculating reduction in greenhouse gases at all premises.

Information to be provided in an application for approval of a project impact report

(2)(4) The application for approval of a project impact report must include the following:

    (a) details of the measurement boundary(ies);

    (b) site constants and their standard valuess;

    (c) a calculation of the carbon dioxide equivalent to be reduced using Equation 1; ;

    (d) emissions factors used in abatement calculations;

    (e) details of any counted savings;

    (f) the baseline energy model(s) in equation form;
    Note: Projects with multiple measurement boundaries will require multiple baseline energy models, the dates these baseline periods cover may differ.

    (g) the accuracy factor(s);

(h) for projects using the forward creation method:

    (i) the operating energy model(s) in equation form;

    (ii) a normal year for each independent variable, if relevant;

    (iii) interactive energy savings for eachthe normal year;

    (iv) the decay factor(s) for each year of the forward creation period;

    (v) a calculations of energy savings using Equation 2;

    (vi) a calculations of normal year savings using Equation 4;

(i) for projects using the annual creation or top up method:

    (i) measured energy consumption data for the reporting period(s);

    (ii) measured values for the reporting period (s) for each independent variable, if relevant;

    (iii) interactive energy savings for the reporting period(s);

    (iv) previous energy savings calculated using Equation 3 for any previous reporting periods, including any negative energy savings;

    (v) a calculations of energy savings using Equation 3;

    (vi) a calculations of measured annual savings using Equation 5;

(j) evidence that energy models comply with the statistical requirements;

(k) evidence that time intervals used to calculate energy savings are eligible time intervals;

(l) written justification of the steps and decisions taken in completing the calculations for each type of model.

    Note: Projects introducing multiple essentially identical upgrades may use the same type of model with the same reasoning and decisions in model development.

Methods

Calculation of carbon dioxide equivalents of greenhouse gases

(3)(5) The carbon dioxide equivalent (in tonnes) of greenhouse gases to be reduced by undertaking a project is calculated using Equation 1, where variables are determined in accordance with sections (9)(7) to (21)(19).

Equation 1 – Carbon dioxide equivalent to be reduced

$$carbon\ dioxide\ equivalent =$$
$$\sum_j (\ electricity\ savings_j \times electricity\ emissions\ factor_j$$
$$\times RF_j)\ \ \text{electricity savings x electricity emissions factor x RF}$$
$$+ \sum_j (\ gas\ savings_j \times gas\ emissions\ factor_j\ )\ \text{gas savings x gas emissions factor}$$
$$+ \sum_j (\ renewable\ energy\ savings_j$$
$$\times renewable\ emissions\ factor_j\ )\ \text{renewable energy savings x renewable emissions factor}$$
$$- \sum_j (\ counted\ savings_j)\ \text{counted savings}$$

where:

(a) j is the measurement boundary number in the case that there are multiple measurement boundaries under one project.

(a)(b)   *electricity savings* is calculated in MWh using Equation 2 or 3, taking references to "energy" in Equations 2 to 5 of this Division to mean "electricity".

(b)(c)   *RF* is the regional factor, which is 0.98 if the ~~project~~ premises is ~~undertaken~~ in metropolitan Victoria or 1.04 if the ~~project~~ premises is ~~undertaken~~ in regional Victoria, as defined in the Locations Variable List in the Victorian Energy Upgrades Specifications 2018.

(c)(d)   *gas savings* is calculated in GJ using Equation 2 or 3, taking references to "energy" in Equations 2 to 5 of this Division to mean "gas".

(d)(e)   *renewable energy savings* is calculated using Equation 2 or 3, taking references to "energy" in Equations 2 to 5 of this Division to mean "renewable energy".

(e)(f)   *counted savings* is a variable determined in accordance with section (13)(11).

(g) *emissions factors* are provided in section (11)(9).

Equation 2 – Energy savings using forward creation method

$$energy\ savings = \sum_i (normal\ year\ savings \times AF \times DF_i)$$

where:

(a) i is a year of the maximum time period for forward creation for the project.

(b) *normal year savings* is calculated using Equation 4.

(c) AF is the accuracy factor for the measurement boundary.

(d) DF_i is the decay factor for that measurement boundary in year i.

Equation 3 – Energy savings using annual creation or top up method

$$energy\ savings = measured\ annual\ energy\ savings \times AF \pm$$
$$previous\ energy\ savings$$

where:

(a) *measured annual energy savings* is calculated per measurement boundary using Equation 5.

(b) *AF* is the accuracy factor for the measurement boundary determined using Table 1, where the "relative precision" means the relative precision of the measured savings at 90% confidence level.

(c) *previous energy savings* is the total amount of energy savings calculated using this equation for the previous reporting period of that measurement boundary (if any), including negative energy savings (if any).

Equation 4 – Normal year energy savings

$$normal\ year\ savings = \sum_t (E_{BM,t} - E_{OM,t}) + E_{int}$$

where:

(a) t is an eligible time interval in the normal year for that measurement boundary.

(b) $E_{BM,t}$ is the energy consumption for t from the baseline model for that measurement boundary.

(c) $E_{OM,t}$ is the energy consumption for t from the operating model for that measurement boundary.

(d) E_{int} is the total interactive energy savings for the ~~project~~ measurement boundary in the normal year.

Equation 5 – Measured annual energy savings

$$measured\ annual\ energy\ savings = \sum_t \left(E_{BM,t} - E_{meas,t}\right) + E_{int}$$

where:

(a) t is an eligible time interval in the reporting period for that measurement boundary.

(b) $E_{BM,t}$ is the energy consumption for t from the baseline model for that measurement boundary.

(c) $E_{meas,t}$ is the measured energy consumption for t at that measurement boundary.

(d) E_{int} is the total interactive energy savings for the ~~project~~ measurement boundary in the reporting period.

Conditions and circumstances under which a certificate cannot be created

~~(4)~~(6) A certificate cannot be created using Equation 2 for a prescribed activity if:

(a) creating the certificate would result in more than 50,000 certificates being created up front for the prescribed activity in a single project; or

(b) certificates have previously been created for the ~~prescribed activity~~upgrade using Equation 3; or

(c) certificates have previously been created for the prescribed activity for the same premises using Equation 2 three times.

Time at which prescribed activity is undertaken and reduction in greenhouse gas emissions occurs

~~(5)~~(7) The project is taken to have been undertaken at the end of:

a. for the purposes of creating certificates using a reduction in greenhouse gases calculated using Equation 2—the operating period of the final measurement boundary to complete works; or

b. for the purposes of creating certificates using a reduction in greenhouse gases calculated using Equation 3—the reporting period of the final measurement boundary to complete works.

~~(6)~~(8) The reduction in greenhouse gas emissions that results from a project is taken to have occurred 6 months after the end of:

a. for the purposes of creating certificates using a reduction in greenhouse gases calculated using Equation 2—the operating period of the final measurement boundary to complete works; or

b. for the purposes of creating certificates using a reduction in greenhouse gases calculated using Equation 3—the reporting period of the final measurement boundary to complete works.

Variables

Terms

(7)(9) Measurement boundary

    (a) The measurement boundary of ~~a project~~an upgrade must include:

        (i) all energy consuming products installed or removed in implementing the ~~project~~upgrade; and

        (ii) all energy consuming products for which energy consumption is affected by the upgrade~~project~~, unless (b) applies; and

        (iii) all energy generating products installed or removed in implementing the upgrade~~project~~; and

        (iv) every product that is co-metered with energy consuming products referred to in (i), (ii) or (iii).

Note: energy generating products may not export energy outside of the measurement boundary.

    (b) An energy consuming product or a component of an energy consuming product may be excluded from the measurement boundary if:

        (i) it is impractical or disproportionately costly to measure changes in the energy consumed by the product that result from implementation of the upgrade and the change in the energy consumed is minor or trivial; or

        (ii) changes in the energy consumed by the product is accounted for in the interactive energy savings.

    (c) Measurement boundaries of similar upgrades in a project should be determined in a consistent manner across all upgrades within a premises and across all premises within the project

(8)(10)   Site constants

    (a) Each measurement boundary ~~project~~ must have one or more site constants.

    (b) A site constant is a parameter of the ~~premises where the~~ measurement boundary ~~project is undertaken~~ that affects the energy consumed within the measurement boundary but does not vary under normal operating conditions.

    (c) For each site constant a standard value must be defined, which is the value the site constant is expected to have under normal operating conditions. ~~.~~

(9)(11)   Emissions factors

    (a) For the purposes of Equation 1, the emissions factor:

        (i) for electricity is 1.095;

        (ii) for natural gas is 0.05523;

        (iii) for liquefied petroleum gas is 0.0642;

        (iv) for solar, wind, hydroelectric, geothermal and ocean energy is zero;

        (v) for any other renewable energy is the relevant emissions factor for the renewable energy listed in Section 2.1 of the National Greenhouse Accounts Factors published by the Commonwealth Department of the Environment in ~~August 2016~~July 2018.

(10)(12)   Reporting period

    (a) The reporting period, in relation to a measurement boundaryproject, is a 12 month period commencing:

        (i) Immediately after the implementation start time for athe project with a single measurement boundary; or

        (i) Immediately after the date that normal operations are capable of commencing within a measurement boundary after all changes to be implemented by the project within that measurement boundary are completed (this includes any testing and commissioning) for a project with multiple measurement boundaries; or

        (ii) immediately after another reporting period but not later than 9 years after the implementation start time.

            Note:

            Tthis means there can be a maximum of 10 reporting periods, therefore if a project covers multiple measurement boundaries or multiple sites with upgrades implemented at different times, the number of eligible reporting periods for some measurement boundaries or some sites may be reduced.

(11)(13)   Counted savings

    (a) Counted savings are the reduction of carbon dioxide equivalent (in tonnes) of greenhouse gases represented by certificates created in respect of activities upgrades undertaken within the measurement boundary after the end of the baseline period.

    (b) An adjustment may be made to counted savings in respect of activities upgrades prescribed by the Victorian Energy Efficiency Target Regulations 2018 if:

        (i) for projects using the forward creation method, where the adjustment corrects for the proportion of eligible time intervals in the normal year; or

        (ii) the adjustment corrects for the number of years that the savings coincide with the remaining eligible annual reporting periods; or

        (iii) the adjustment is required for compliance with Regulation 14(b) of the Victorian Energy Efficiency Target (Project-Based Activities) Regulations 2017.

(12)(14)   Baseline energy model and operating energy model

    (a) A baseline energy model or operating energy model is a model established by:

        (i) regression analysis that:

          – is based on the values of the measured energy consumption within the measurement boundary and independent variables during the baseline period (for a baseline energy model) or operating period (for an operating energy model) where site constants are at their normal values; and

          – is based on at least 80% of the total number of time intervals in the baseline period (for a baseline energy model) or the operating period (for an operating energy model); and

          – has at least six times as many independent observations of the independent variables as the number of independent variables in the energy model; or

        (ii) An estimate of the mean that:

          – is based on the values of the measured energy consumption within the measurement boundary during the baseline period (for a baseline energy model) or operating period (for an operating energy model), where site constants are at their normal values and where the coefficient of variation of the measured energy consumption over the period is less than 15%; and

- is based on at least 80% of the total number of time intervals in the baseline period (for a baseline energy model) or the operating period (for an operating energy model).

(b) The baseline period referred to in (a):

    (i) must not end more than 24 months before the day work for the purposes of the upgrade~~project~~ has commenced at the premises; and

    (ii) must end before the day and time that work for the purposes of the upgrade~~project~~ has commenced at the premises, unless (c) applies.

(c) The baseline period may end after the day that work for the purposes of the upgrade~~project~~ has commenced at the premises if the effects of the ~~project~~ upgrade can be temporarily suspended so that conditions prior to the ~~project~~ upgrade being undertaken can be measured.

(d) The operating period referred to in (a):~~.~~

    (i) must not start before the implementation start time in a project with a single measurement boundary; and

    (ii) must not start before all normal operations are capable of commencing within that measurement boundary after all changes to be implemented by the project within that measurement boundary are completed (including testing and commissioning) in a project with multiple measurement boundaries; and

    (iii) must end no later than two years after the implementation start time.

~~(13)~~(15) Accuracy factor

(a) The accuracy factor is determined using Table 1, where the "relative precision" means the relative precision of the normal year savings at 90% confidence level.

~~(a)~~(b) Accuracy factors are determined for each measurement boundary in a project with multiple measurement boundaries.

~~(14)~~(16) Maximum time period for forward creation

(a) The maximum time period for forward creation in relation to a project is 10 years, commencing immediately after the implementation start time of the project.

~~(15)~~(17) Normal year

(a) A normal year is a set of values for a 12 month period for each independent variable used in the baseline energy model and the operating energy model.

(b) A value in a normal year must be provided for each time interval.

(c) A normal year must reasonably represent the expected mean, range and variation of the independent variables used in the baseline energy model and operating energy model in an average year of the maximum time period for forward creation.

~~(16)~~(18) Interactive energy savings

(a) Interactive energy savings are energy savings attributable to the upgrade~~project~~ that are outside the measurement boundary.

(b) The total interactive energy savings for any model are limited to a maximum of:

(i) in a normal year, 10% of the difference between the energy consumption calculated using the baseline energy model and the energy consumption calculated using the operating energy model for eligible time intervals in the normal year, for all energy sources.

(ii) in a reporting period, 10% of the difference between the energy consumption calculated using the baseline energy model and the measured energy consumption for eligible time intervals in the reporting period, for all energy sources.

(c) Interactive energy savings must be estimated in accordance with a repeatable method that:

(i) uses data recorded for the premises where the upgradeproject is undertaken; or

(ii) is consistent with generally accepted estimation approaches in the science and engineering field applicable to the kind of effects being estimated.

(d) The sameA consistent method must be used to estimate interactive energy savings in all calculations for the project.

(17)(19)   Decay factor

   (a) The decay factor for a year iss assigned on a per measurement boundary basis and is determined using Table 2 or by applying a persistence model.

   (b) A persistence model must meet the following requirements:

      (i) it provides a reasonable estimate of the expected lifetime of an energy consuming product in whole years; and

      (ii) it provides a decay factor representing the decline in performance of the product each year by taking into account:

      – the type of the energy consuming product; and

      – how the energy consuming product is used; and

      – the environmental characteristics of the premises where the energy consuming product is used; and

      (iii) the model provides the most conservative set of yearly decay factors when applied to more than one energy consuming product.

(18)(20)   Measured energy consumption

   (a) The measured energy consumption is the energy consumed by all products that is measured within the measurement boundary.

   (b) If the project includes undertaking multiple essentially identical upgrades at different premises, the measured energy consumption must be determined for each premises.

   (b)(c)   If the project includes undertaking multiple essentially identicalsimilar activities upgrades at the same premises, the measured energy consumption can be determined from measurements taken for a sample of the activities upgrades if:

      (i) the measured energy consumption of each activity upgrade can be reasonably described by the same energy model; and

      (ii) the sampling methods used produce a random sample; and

      (iii) the calculation of the relative precision used to determine the accuracy factor includes quantification of the impact of the sampling.

(19)(21)   Time intervals

   (a) The accredited person must nominate a measurement frequency for each measurement boundary.

   (b) The length of a time interval is determined by the measurement frequency.

   (c) The first time interval in a period must start at the start of the period, and each subsequent time interval in the period must start immediately after the previous time interval ends.

   (d) The length of a time interval used to calculate electricity, gas or renewable energy savings may differ; however:,

      (i) time intervals used to calculate savings of the same energy source must be of the same length; and

      (ii) time intervals for the baseline and reporting periods of a measurement boundary must be of the same length; time intervals used to calculate savings of the same energy source must be of the same length.

      - unless measurement frequency and hence time interval length is determined by utility data intervals.

(c)(e)   A time interval in a period is an eligible time interval if, with respect to that time interval:

(i)   if the period is a reporting period, values for the measured energy consumption have been obtained; and

(ii)   values for all independent variables have been obtained; and

(iii)   if the period is a reporting period, all measurement boundarysite constants are at their standard values; and

(iv)   the value of each independent variable is an amount that is:

–   no less than the minimum value of the effective range minus 5% of the difference between the maximum and minimum values of the effective range; and

–   no more than the maximum value of the effective range plus 5% of the difference between the maximum and minimum values of the effective range.

(d)(f)   The effective range referred to in (e) is:

(i)   if the time interval is in the reporting period—the range of values of the variable used to develop the baseline energy model; or

(ii)   if the time interval is in the normal year—the range of values that are in both:

–   the range of values of the variable used to develop the baseline energy model; and

–   the range of values of the variable used to develop the operating energy model.

Table 1 – Accuracy factor

Relative precision	Accuracy factor if an energy model for the project is developed using an estimate of the mean	Accuracy factor if all energy models for the project are developed using regression analysis
< 25%	0.9	1
25% to < 50%	0.8	0.9
50% to < 75%	0.7	0.8
75% to < 100%	0.5	0.6
100% to < 150%	0.3	0.4
150% to < 200%	0.1	0.2
>=200%	0	0

Table 2 – Decay factor

Year (i)	Decay factor
1	1.00
2	0.80
3	0.64
4	0.51
5	0.41
6	0.33
7	0.26
8	0.21
9	0.17
10	0.13