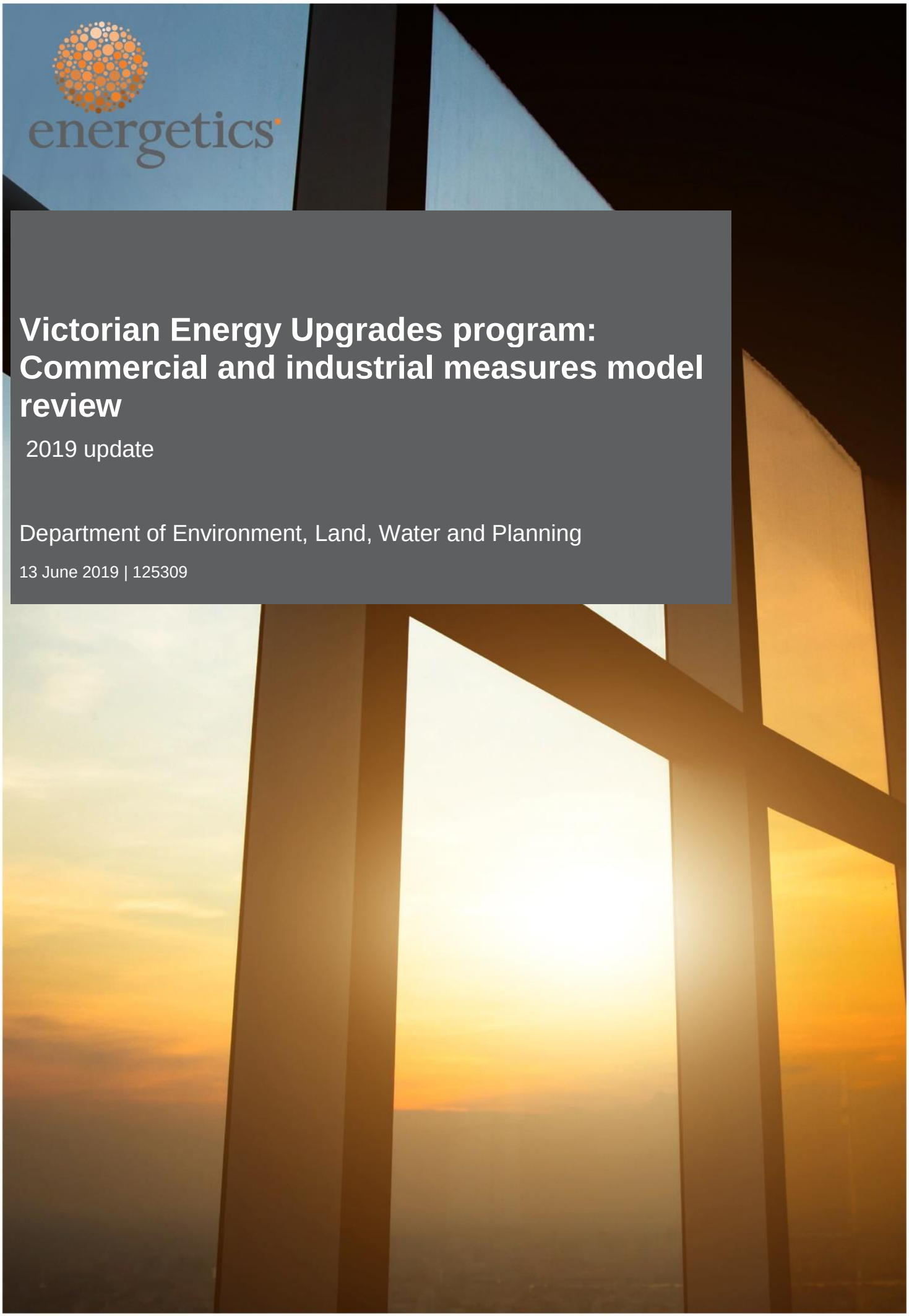

Victorian Energy Upgrades program: Commercial and industrial measures model review

2019 update

Department of Environment, Land, Water and Planning

13 June 2019 | 125309

About Energetics

Energetics is a specialist energy and carbon management consultancy. Our experts help clients to

- Be leaders. Develop and implement strategy
- Be informed. Make data-driven decisions
- Be efficient. Drive business improvement and realise savings
- Buy better. Leverage energy supply and carbon markets

Copyright

Disclaimer

The information contained in this document is of a general nature only and does not constitute personal financial product advice. In preparing the advice no account was taken of the objectives, financial situation or needs of any particular person. Energetics Pty Ltd is authorised to provide financial product advice on derivatives, carbon units, Australian carbon credit units and eligible international emissions units to wholesale clients under the Corporations Act 2001 AFSL (Australian Financial Services License) No: 329935. In providing information and advice to you, we rely on the accuracy of information provided by you and your company. Therefore, before making any decision, readers should seek professional advice from a professional adviser to help you consider the appropriateness of the advice with regard to your particular objectives, financial situation and needs.

Document Control

Description	Prepared by	Reviewed by	Approved by	Approval Date
Initial Draft	Miheka Patel	Gordon Weiss	Gordon Weiss	14 March 2019
Final Version	Miheka Patel	Gordon Weiss	Gordon Weiss	13 June 2019

Table of contents

1. Background

The Victorian Government is looking to set new targets for the Victorian Energy Upgrade (**VEU**) program from 2021 to 2025. As part of the target setting exercise the Department of Environment, Land, Water and Planning (**Department**) is required to produce a Regulatory Impact Statement (RIS) to undertake a cost benefit analysis of several target options. The cost benefit analysis requires modelling of the uptake of energy efficiency activities currently included, or shortly to be included, in the program under several target options.

In 2013, 2015 and 2017 Energetics delivered modelling and output scenarios of business sector energy efficiency activities. To ensure the robustness of the modelling of the extension of the VEU program to 2025, the Department requires a review of the energy saving measures applicable to the business sector.

This report details a critical review of current measures and underlying assumptions of the business sector energy efficiency activities and updates made to these. Specifically, this report reviews assumptions around:

- the pool of opportunity for different activities
- the cost of activities
- the energy saving potential of these activities
- sectors or activities that may be missing or are not properly represented in the pool of opportunities modelling.

It builds on both Energetics' earlier 2015[1] study into opportunities in the business sector and 2017 study into the measures that could be feasibly delivered under the PBA method.[2]

How the VEU program is modelled

The modelling of the program is summarised in Appendix A. The appendix outlines how the availability of an incentive (i.e. Victorian Energy Efficiency Certificates (VEECs)) can drive the uptake of measures, and that two approaches are used to model the uptake of measures. For some measures, the rate of uptake is a function of the fraction of the installation cost which is funded by the incentive without consideration of the energy cost savings. The approach generally works for the less costly measures. For other measures, the incentive reduces the installation cost and improves the financial return of the net investment in the measure. We assess financial return using the payback period.

It should be noted that the assessments of payback periods within the model were undertaken on a purely financial basis. There are a range of non-financial barriers that may also limit the interest in energy efficiency projects. We account for the impact of the non-financial barriers associated with a measure by adjusting the payback period required for a business owner to invest in the measure and/or by adjusting the implementation cost of the measure such that the model does not predict the uptake of a measure unless an incentive is provided.

The data that defines the take-up of a measure comes from several independent sources – observed take-up of measures, reported costs to implement energy efficiency measures, savings based on a basket of specific activities within a broad measure and forecasts of energy prices.

[1] "VEET Energy Saver Incentive Scheme: Business Sector Energy Efficiency Modelling", Energetics, 25 March 2015

[2] "VEU scheme business sector modelling: 2017 update", Energetics, 28 March 2018

Care must be taken in establishing the total volume of instances of each measure that can be taken up so that savings are not double counted. For instance, there is an overlap between savings due to an upgrade to HVAC controls and savings due to a general HVAC upgrade as the latter will generally include an upgrade to the controls. This is best done by modelling a small number of measures across a range of difference sectors.

2. Updating the energy saving measures

Most of the commercial sector measures used in the earlier modelling of the VEU program came from the modelling of the National Energy Savings Initiative (**NESI dataset**), The revised set of measures for this 2019 modelling was largely derived from the earlier modelling, with the addition of measures and data from material published by Sustainability Victoria (**SV**) and the Equipment Energy Efficiency (E3) Committee.

Measures for the large industrial sector also came from the NESI dataset.

How the measures have been changed

Key changes in the model include alterations to improve user functionality and the update of measures within the model. These changes are further detailed in Appendix B and are summarised below. Refer to Appendix A for a description of the model.

- The addition of new measures such as upgrades to boilers to address gas consumption in the commercial and industrial sector
- Update of the implementation costs and payback periods of measures to account for non-market barriers that may limit their uptake
- Update of the pool of opportunity and energy savings for measures allocated to commercial and industrial sites
- Removal of measures which have minimal impact on the program or are covered in other VEU sub models
- The allocation of sectors (large commercial, small and medium-sized enterprises (SME), and large industrial) to Australian and New Zealand Standard Industrial Classification (ANZSIC) subdivisions and the ability to specify the proportion of each subdivision covered by the program.
- Update of the base year of the model to 2019

The assumptions and parameters that define the business sector measures

Table 1 outlines some of the key assumptions that were required to define the measures.

Table 1: Key assumptions used to develop the measures

Item	Details
Business-as-usual	Where activities involve the upgrade of equipment at the point of replacement (e.g. installing a high efficiency motor at the time the motor needs replacing), the BAU case assumes that a unit compliant with the Minimum Energy Performance Standards (MEPS) is installed. In other cases, the savings associated with the measure represent a weighted average of savings for measures reported in the Commonwealth Energy Efficiency Opportunities (EEO) program and other energy audits. Commercial-in-confidence data has also been used to derive installation costs and savings potentials for some measures.
Averaging different items	Energy savings were calculated based on the average of energy savings achieved across several applications of the measure reported in EEO and other energy assessments. The aggregation of different instances of the measure will include the use of different pieces of equipment. The extensive, publicly available EEO dataset, which was used to derive the

	average savings for an energy efficiency measure, was assumed to be representative of the total pool of opportunities in the wider economy.
Average annual energy savings	**Commercial buildings and SMEs**: An average was calculated for annual energy savings for commercial buildings and SMEs, based on the fraction of the total energy used by the building or facility resulting from the implementation of the energy efficiency measure, and the average amount of energy used by each type of building. The product of these two values gives the average annual energy savings. **Industrial facilities**: We used the "Percentage of total energy used by a facility that is saved by the measure" reported in the industrial component of the NESI dataset.[3]
Measure life	This is the estimated length in years that the measure is expected to deliver energy savings once installed. Sources included the Carbon Trust persistence factor data base, the Low Carbon Australia persistence factor data base, EES residential baseline study, RIS: NAEEEC Report 2003/10 Minimum Energy Performance Standards and Alternative Strategies for Linear Fluorescent Lamps, the BIS Shrapnel Household Appliances 2006 and Energetics commercial in-confidence figures.

Pool of opportunities	In most instances, we used the following approach to estimate the number of opportunities for large commercial and SME buildings:
	• The total energy consumption for each type of building or SME facility was estimated using the energy reported by ANZSIC sector, measures of building size and activity as reported to the Australian Bureau of Statistics (e.g. employee numbers, sales volume, patient numbers, student numbers) and measures of energy intensity within various types of buildings.
	• The average energy used by each type of building or facility was assessed by either:
	  ○ aggregating a set of representative assessments of a specific building type to directly estimate the average, or
	  ○ estimating the total number of buildings in a specific category and then dividing the total energy used by those buildings by the total number of buildings.
	• Using our estimate for the total energy used by each type of building in Victoria, and our estimate of the average energy used by a building, we estimated the number of buildings of each type in Victoria.
	• Using our estimate for the fraction of all buildings or facilities where a measure was applicable (e.g., an upgrade to a boiler is only applicable to a building with a boiler) and our estimate of the fraction of buildings where a measure has already been adopted, we adjusted the estimate of each type of building or facility in Victoria to give the number of buildings or facilities where a particular measure is still able to be implemented. This is the pool of opportunities.
	
	The modelling of measures applicable to the large industrial sector used a different approach. The large industrial sector covered mining and industry excluding non-ferrous metals. The latter were excluded as non-ferrous metal production is dominated by metal (aluminium) smelting which takes its electricity directly from the wholesale market. The pool of opportunity for the industrial measures covers the energy used by the large industrial sector as determined during the modelling of the national energy savings initiative. This basically covered the entities that were obligated under the National Greenhouse and Energy Reporting (NGER) program.
	
	More detail on calculating the pool of opportunity can be found in the report on the Commercial and SME Energy Efficiency Data on the NESI Consultants Reports webpage[4].

[3] Inputs to Energy Savings Initiative modelling from Industrial Energy Efficiency Data Analysis Project: ***http://www.industry.gov.au/Energy/Documents/energy-efficiency/energy-savings/consultant/Industrial_data_subsector_grouping_level_dataset.xls*** (Accessed March 2015)

[4] ***http://www.industry.gov.au/Energy/Documents/energy-efficiency/energy-savings/consultant/Commercial_and_SME_EnergyEfficiencyDataReport.pdf*** (Accessed March 2015)

Implementation cost	The cost to implement a measure was based on values from the NESI dataset and updated to reflect paybacks for the same of similar measures reported by SV or other sources, then further adjusted upwards if the model predicted significant take-up of the measure in the absence of any incentive payment to account for non-market barriers.
Maximum uptake rate/year	Where a measure is only applicable at the point of replacement of the equipment, the maximum uptake rate is the total pool of opportunity divided by the life of the equipment i.e. the turnover of stock. In other cases, it was based on our estimate of what is achievable and reasonable. This is the part of the model where there is the greatest uncertainty. Note that where measures were assessed using a project-based method, the maximum take-up in the first year was set to zero to account for the time needed to undertake the assessment and the internal processes to approve and then implement the measure.

Table 2 outlines some of the more important element of the model.

Table 2: Important elements in the model

Item	Details
Average number of certificates	Where a commercial measure uses a default abatement factor[5] to determine the number of certificates, the number of certificates is equal to the energy savings times the emissions factors times the measure lifetime. For measures where the magnitude of the incentive is determined by a project-based methodology, the number of certificates is equal to the energy savings times the emissions factors times a discount factor (90%). This reflects the normal approach that is applied to project based methods in existing schemes where discount factors (determined by persistence factor models) are used to calculate the number of certificates from the savings determined by the correct application of measurement and verification (M&V).
Additionality	The energy savings for the measures have accounted for the impact of regulatory additionally. For instance, the savings due to the installation of an appliance subject to minimum energy performance standards (MEPS) are taken to be the savings above the MEPS level.
Rebound and decay	Rebound in this instance refers to the scenario where the implementation of a more energy efficient technology drives a slight increase in the use of a more efficient equipment compared to the previous, less efficient technology (generally related to the energy cost saving differential). With deemed abatement, this may result in slightly less greenhouse gas (GHG) abatement than anticipated. Decay is the slow loss of performance as equipment ages. The model accounts for rebound by reducing the savings due to an implemented measure from year to year.[6] Our default factor, based on Energetics' experience is to reduce the energy savings by 3% each year and this value was used in the model of the VEU program.
Payback installation hurdle	Our default payback thresholds are to include any measure that offers a payback within 3 years for measures in large businesses and 1.75 years for the SME sector. Where the take-up is assessed using the payback threshold, 50% of the available instances of the measure will be taken up when the average payback is equal to the threshold.

[5] Default abatement factors are used to calculate the number of abatement certificates that may be created from the installation of common equipment such as compact fluorescent lamps, refrigerated display cabinets and certain electric motors. Calculation of certificates using default abatement factors is simple as the number of certificates is linked to the size of the appliance and not the characteristic of the particular installation.

[6] Note that the year by year reduction in energy savings is independent of the discounting of calculated emissions savings when determining the number of certificates for project-based measures.

	Where the model predicted significant take-up of a measure in the absence of any incentive, we adjusted the payback hurdle downwards to better capture potential non-market barriers. Measures that received this treatment included upgrades to motors, installation of variable speed drives (VSDs), upgrades to pumping systems and installation of boilers in some industrial premises. Some measures may use different payback thresholds and the Excel model should be inspected to identify the actual payback thresholds employed.
Lifetime energy saved	The lifetime savings for an instance of a measure is equal to the sum of annual savings over the lifetime of the measure. The total energy saved is the aggregate of energy saved for each instance of each measure.
Certificate administrative fee	A further adjustable percentage (currently 5%) of the certificate price is deducted to account for the cost incurred by the Accredited Person or third party involved in installing a measure.
Average cost of implementation	The average cost is equal to the cost of applying the measure to the entire building or facility (equipment + installation + feasibility studies). The average costs for large commercial and SME measures were derived from the NESI dataset. Large industrial measures were derived from the industrial component of the NESI dataset.[3] In addition, the Excel model allows for the inclusion of an adjustment to the installation cost that may be used to capture non-market barriers and other factors. The Excel model should be inspected to identify any adjustments.

Table 3: Data items to be considered

Item	Details
GHG coefficients	These are provided by the Victorian Government and used consistently across all VEU modelling. The values used in the model can be adjusted by the Victorian Government.
Energy prices	The electricity and natural gas prices used in the VEU program business sector model were derived from sources in the public domain (e.g. Modelling of the Australian Electricity Generation Sector, ACIL ALLEN Consulting, 2013) and Energetics propriety sources. The values used in the model can be adjusted by the Victorian Government.

3. Outputs from the VEU C&I model

The 2019 VEU commercial and industrial sector model was updated and modified so it could be integrated with the residential and commercial lighting models. The combined models then allowed for the impact of a wider range of variables within the sub-models to be tested.

The commercial and industrial sector sub-model was developed so that an annual VEEC price, energy price and GHG coefficients could be input from a master model. Then, based on the pre-defined parameters within the sub-model, the estimated annual certificates created are calculated and returned to the master model.

Appendix A Details of the model

This report focuses on commercial energy efficiency measures and the assumptions used to model their impact. The following section provides an overview of the functionality of the model.

Figure 1 to Figure 4 outline the process used to determine the number of certificates created for different certificate prices. Each energy efficiency measure was defined according to adjustable parameters such as the total pool of efficiency opportunities, the costs of implementation and the average electricity and gas savings that will result. The model also includes adjustable parameters. Examples include a certificate price ($/certificate[7]), a greenhouse gas (GHG) emissions factor, any administrative fees associated with the creation of certificates and persistence factors that discount the number of VEECs created relative to the emissions savings to better model the application of the project-based assessments.

The total number of certificates created depends on the annual GHG emissions savings, the duration of the energy efficiency measure and the GHG emissions factor applied.

The incentive for participants is a function of the number of certificates created, multiplied by the value of each certificate. The latter is net of any fees associated with the administration of the program.

The model calculates the uptake of measures based on the incentive to participate. Two approaches are used. For the less costly measures most suited to SME markets, the uptake is calculated based on a simple relationship between the size of the incentive and the cost of the energy efficiency measure. Figure 2 shows the uptake of simpler measures such as replacing an old appliance. There is a default take-up curve plus one for low cost appliances and one for new technologies (where there can be resistance to early adoption).

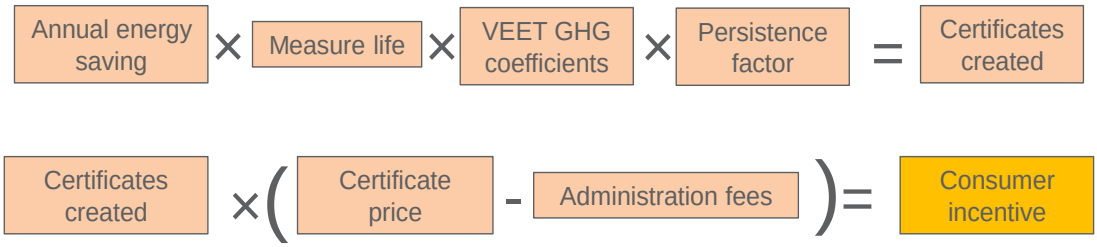

Figure 1: Calculation of incentive level

In determining the deemed savings for a project, the calculated emissions savings can be discounted by fixed but selectable persistence factors. The persistence factors address the need to discount certificates created due to uncertainty in the delivery of emissions abatement.

If a business sector GHG emissions abatement measure is more costly and generally applicable to larger businesses, then it is more appropriate to use an approach based on the payback. Figure 3 shows the calculation. The payback threshold, which establishes when the energy efficiency measure will be taken up, is a distribution function that reflects the range of thresholds for different participants.

[7] One certificate is intended to be equivalent to 1 tonne of lifetime greenhouse gas abatement.

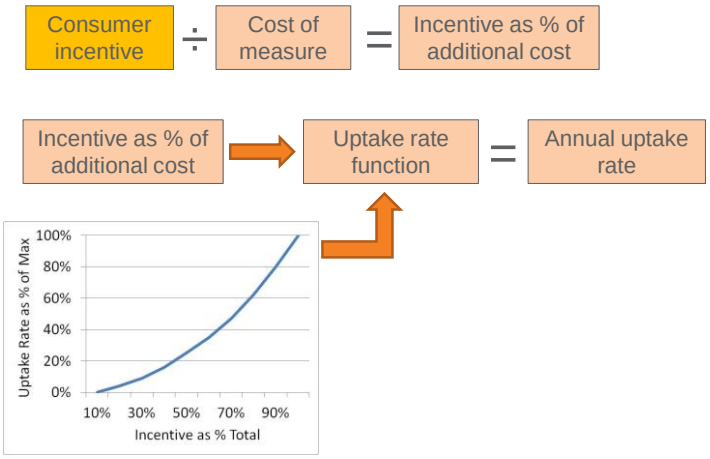

Figure 2: Measure uptake for smaller measures – take up curves as a function of incentive percentage

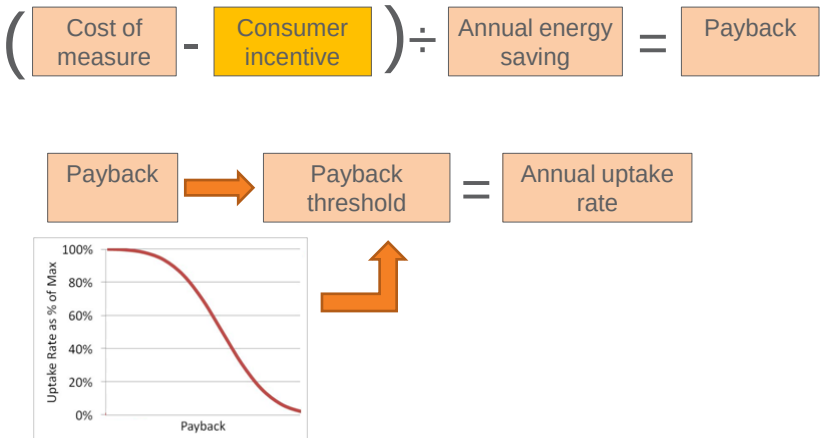

Figure 3: Measure uptake for larger measures – take up curves as function of payback

Finally, the actual number of instances that the energy efficiency measure is adopted is expressed as the uptake rate times the total pool of opportunity. Total uptake figures are managed by a constraint that limits the maximum annual uptake to reflect the fact that the market has limited capacity to deliver any one measure within a fixed period. See Figure 4 for an overview on how this functionality works.

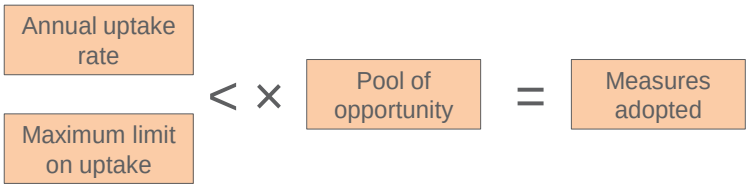

Figure 4: Measures adopted

Appendix B Updates to the 2019 VEU commercial and industrial model

New measures for the large commercial and SME sectors

Several new measures applicable to the large commercial and SME sectors were added to the existing model. Many of these new measures are focused on improving the performance of gas using equipment, and address a concern that earlier modelling of the VEU program did not properly account for opportunities to reduce the consumption of gas. Table 4 lists the new measures. Full details of the new measures are in the model.

Table 4: New measures for the Large commercial and SME sectors

Measure Name	Building type where the measure applies	End use
Voltage optimisation	All large commercial buildings	Whole site
Domestic water heating: Solar and heat pump water heaters	Hospitals	Water heating
Air Compressors: Improved operation of compressed air systems	Hospitals and universities	Air Compressors
Boilers, furnaces and ovens: System upgrade	All large commercial buildings	Boiler, furnace and oven upgrades
IT equipment and cooling upgrades	All large commercial buildings	IT equipment and cooling systems
Water heating: Solar water heater and heat pump water heaters	All large commercial buildings	Space heating
Boilers, furnaces and ovens: Replace boiler	All SME premises excluding industrial premises	Boiler replacement
Building envelope: Upgrades	All SME premises	Building shell upgrade
Domestic water and space heating: Solar water heater and heat pump water heaters	All SME premises	Water heating
Boilers, furnaces and ovens: Replace boiler	SME Industrial	Boiler replacement
Process heating: Solar water heater and heat pump water heaters	SME Industrial	Water heating

Measures that were updated from the 2019 model C&I model

Most measures were updated in the latest version of the model. The major changes were:

Measures for large industry

In earlier versions of the C&I model, measures applicable to large industrial facilities (i.e. the SAP sites) were allocated to Mining, Industry or Metals. In the most recent version, measures for the SAP sites were allocated to the following industry types:

B06 - Coal Mining
B07 - Oil and Gas Extraction
B08 - Metal Ore Mining
B09 - Non-Metallic Mineral Mining and Quarrying
B10 - Exploration and Other Mining Support Services
C11 - Food Product Manufacturing
C12/13 - Beverage, Tobacco and Textile
C14/15/16 - Wood, pulp, paper and printing
C17 - Petroleum and coal product manufacturing
C18 - Basic chemical and chemical product manufacturing
C19 - Polymer product and rubber product manufacturing
C20/21 - Mineral Product, Primary Metal and Metal Product Manufacturing
C22 - Fabricated Metal Product Manufacturing
C23/24/25 - Other Manufacturing
D28/29 - Water and waste services

In addition, the pool of opportunity and savings rates for the measures was updated using more recent energy use data for Victoria.

Measures for the Large Commercial and SME sectors

Energetics used data provided by the Department as well as propriety sources to update the energy savings associated with some measures, particularly measures that offered potential savings in gas.

The target payback periods and capital costs of some measures were adjusted to better account for the non-market barriers that are currently preventing the implementation of measures that otherwise looked to be commercially attractive but are not currently being taken up by businesses.

The key measures, in terms of their likely adoption, that were updated are listed in the Table 5.

Table 5: Key updated measures for the Large Commercial and SME sectors

Measure Name	Building type where the measure applies	End use
Boilers, furnaces and ovens: Replace boiler	Large commercial	Boiler replacement
HVAC: Variable speed drives and control for fans	Large commercial	Ventilation and fans

Measures that were removed from the 2019 model C&I model

Measures linked to building management systems were removed as these measures are part of a separate VEU system sub-model. The upgrading of HVAC cooling towers as it has very little impact on the outcomes of the program.

Contact details

Energetics is a carbon neutral company

www.energetics.com.au

Sydney
Level 7, 132 Arthur St, North Sydney NSW 2060
PO Box 294 North Sydney NSW 2059
P: +61 2 9929 3911
F: +61 2 9929 3922

Perth
Level 3, 182 St Georges Tce, Perth WA 6000

P: +61 8 9429 6400
F: +61 2 9929 3922

Melbourne
Level 5, 190 Queen St, Melbourne VIC 3000
PO Box 652, CSW Melbourne VIC 8007
P: +61 3 9691 5500
F: +61 2 9929 3922

Brisbane
Level 12, 410 Queen St, Brisbane Qld 4000

P: +61 7 3230 8800
F: +61 2 9929 3922

Adelaide
Mitsubishi Administration Building
Level 1, 1 Tonsley Blvd, Adelaide SA 5042
P: +61 3 9691 5509
F: +61 2 9929 3922

abn 67 001 204 039
acn 001 204 039
afsl 329935