Review of Abatement Factors for New Activities Proposed for the Energy Saver Incentive

Prepared for

Department of Primary Industries

March 2010

EnergyConsult PTY LTD

655 Jacksons Track
Jindivick, Victoria 3818
Australia
ABN: 18 090 579 365
Tel: +613 5628 5449
Fax: +613 9923 6175
Email: info@energyconsult.com.au

Contents

Introduction

The Department of Primary Industries (DPI) provides policy and legislative advice to the Minister or Energy & Resources on the establishment and ongoing effectiveness of the Victorian Energy Saver Incentive scheme. The Energy Saver Incentive is the public name for one of the first mandatory energy efficiency target schemes in Australia. The target itself is called the Victorian Energy Efficiency Target (VEET) and is a legislative requirement placed on energy retailers through the Victorian Energy Efficiency Target Act 2007.

The scheme is designed to help households reduce greenhouse gas emissions and cut their power bills. The Energy Saver Incentive sets a target for energy savings in the residential sector, and requires energy retailers to meet their related targets through energy efficiency activities, such as providing households with energy saving products and services at little or no cost.

The first phase of the energy saver incentive aims to save 8.1 million tonnes of greenhouse gas over the lifetime of the measures implemented – the equivalent of making around 675,000 households carbon neutral for a year. It will play an important role in achieving the Government's targets of reducing Victoria's overall emissions to 60 per cent below the level it was in 2000 by 2050. The scheme commenced on 1 January 2009 and is administered by the Essential Services Commission.

In August 2009, DPI announced that it would examine opportunities to add to the list of eligible activities in the Energy Saver Incentive. DPI issued submission guidelines that contained instructions on the supporting information required, including the average energy and greenhouse gas savings asserted, and relevant standards that may apply to the proposed activity. DPI has since received a number of formal submissions for new activity categories.

A review panel convened by DPI has examined submissions and developed abatement values for those activities it has deemed to be suitable for inclusion. A draft set of Regulations that include the new activities are to be issued for consultation in February 2010.

Objective

DPI requires a review to be undertaken of the draft abatement factors it has developed for a range of new activities to be included in the Victorian Energy Saver Incentive scheme. DPI has commissioned EnergyConsult to undertake this review.

The abatement factors reviewed relate to the following activities:

1. Installation of low energy General Service Lamps- Amendment addressing use small GLS lamps and rewarding high power factor lamps

2. Installation of low energy down lights- Amendment so establish two sub-categories which covers the installation of a 240-volt low energy downlight fitting, and the replacement of an existing 12-volt halogen downlight with low energy downlights
3. Installation of a high efficiency gas ducted heater in a new home
4. Upgrade of existing gas heating ductwork
5. Replacement of existing refrigerative air conditioner with ducted evaporative cooler
6. Top up of existing ceiling insulation
7. Purchase of high efficiency televisions
8. Purchase of low greenhouse clothes dryer
9. Purchase of high efficiency pool pump
10. Installation of smart power board
11. Installation of an In-Home Display energy consumption device

This reports documents the approach used and the findings of the review.

Project Scope

The Victorian Energy Saver Incentive scheme depends on the implementation of measures that are robust and deliver realistic energy savings. The regulations specify the abatement factor for the prescribed activities under the Act and hence are critical to the establishment of energy savings. We understand that DPI and the review panel have calculated the proposed abatement factors for the new activities and as part of the risk management require an independent review of the methodology.

The calculation of abatement factors will depend on a number of factors, including:

- the functionality of the energy saving measure/activity;
- the proportion of energy end-use that the measure/activity is targeting;
- the efficiency improvement for the measure/activity;
- the effective life of the measure/activity;
- the climate zone where the activity is undertaken (for climate variable activities), and;
- the energy end-use trends and government policies (MEPS, rebates, etc) affecting the energy use of the activities.

The calculation of the abatement factors for the proposed activities will be depend on several factors and assumptions which can be estimated from literature, research and engineering calculations. In several cases, the VEET uses technical standards to assist with the calculation of abatement factors and these standards are typically used in the energy labelling, MEPS or building codes. The use of these standards ensures that common approaches are used for calculations and measures of energy performance. It is desirable to use these standards as guides as they can also be referenced in the regulations.

A key aspect to consider in the calculation of the abatement factors is the objective of the VEET regulations:

The objectives of these Regulations are to prescribe:

> *activities carried out in residential premises that result in reduction of greenhouse gas emissions that would not otherwise have occurred if the activities were not undertaken;*

This requirement means that activities are additional to the "business as usual (BAU)" case and should therefore take into account the current and future trends in technology energy use, either influenced by natural efficiency improvements or government policy.

The anticipated greenhouse savings of the abatement actions to be reviewed have previously been calculated and EnergyConsult's task was to review the calculations and the assumptions underlying the analyses.

Project Methodology

EnergyConsult's methodology involved completing the following tasks which are directly related to the deliverables outlined in the RFQ:

1. Review of Objectives and Obtain Documentation
2. Review Methodology and Assumptions
3. Report on General Accuracy of Calculations

These stages of the project involved the following activities, as described below.

1. Review of Objectives and Obtain Documentation

The purpose of the first stage is to review the objectives and approach with the DPI representatives and obtain all the necessary spreadsheets and documentation. This will enable the review to be closely aligned with the objectives of DPI and ensure a thorough understanding of the scope of the review.

Telephone conversations and emails with the department representative were undertaken to obtain further background. The following documentation was provided:

- 100203_SV VEET Calculations.xls
- Outline of VEEC Methodology for new measures_final.doc

2. Review Methodology and Assumptions

The core of the review was to examine the methodology, data and assumptions used to calculate the abatement factors for the each of the new activities. This involved the following:

- Examining the approach to develop BAU energy consumption for each activity and what data, assumptions and factors were applied. Determining if the overall approach was appropriate and consistent with the VEET regulations, especially the consideration of the additionality of any emissions reductions.
- Reviewing in detail the analysis and assumptions used to calculate the energy and greenhouse gas reduction for each of the new activities. The factors considered in the detailed review include:
  - How the activity reduces energy consumption for the end-use
  - What assumptions are used that underpin the energy efficiency/energy savings of the activity and their sensitivity to the impact of the activity
  - Data sources and research used to support the assumptions

- Testing and measurement standards used to support the calculation of the abatement
- Lifetime of the proposed activity
- Trends in technology and energy end-use that affect the long term savings of the activity.
- Variation in Victorian climate zones affect the calculation of abatement
- Physical size variations within the activity and how these will affect the calculation of the abatement factor.

In undertaking the review, EnergyConsult drew upon the following sources of information as required:

- ABS data,
- measurements of energy efficiency/performance for products (Energy Rating, AGA, etc)
- measurement of standby power by EnergyConsult of over 8000 products over the last 10 years.
- Published and un-published sales, stock and penetration data for energy using products developed to support the national E3 programme
- Reports and studies, including RIS, product profiles and surveys.

EnergyConsult also met with the VEET nominated committee member who developed many of the calculations to methodologies and data sources.

3. Report on General Accuracy of Calculations

EnergyConsult prepared the present report analysing the findings of the review of the methodology and assumptions.

Review Findings

Overall Approach to Abatement Calculations

The approach taken to the determination of the abatement factors for the twelve new initiatives was reviewed by EnergyConsult and found to be in keeping with the intention of the VEET/ Energy Saving Initiative scheme. All the initiatives, to varying degrees, if implemented would result in additional reductions on greenhouse emissions, compared to BAU. They therefore met the key criteria of the scheme.

Calculations of abatement were all based on stated assumptions and quantified values. The reasoning used to derive the abatement factors was reasonably well described in the majority of cases. The analysis and calculations were presented in the spreadsheets and generally could be checked for verification purposes.

For a number of the initiatives the calculations are based on the cooling and/or heating load requirements of different sized homes in Victoria. These load values could not be reviewed or assessed by the authors and so could only be assumed to be correct. If there are any inaccuracies in these load values, these will affect the abatement factors.

Detailed Review Individual Initiative Abatement Calculations

Each of the abatement initiatives were reviewed in turn and the findings are presented below.

Retrofit of low energy lighting – high power factor lamps

The rationale for this abatement is that low energy lighting, especially compact fluorescent lamps, often has low power factors. This can lead to greater transmission losses and harmonic distortions, resulting in 'real' power losses. The installation of high power factor lamps, instead of the low power factor ones, leads to less power losses, and have creates small greenhouse emission savings. This has been expressed as a Power Factor "factor" of 104.8%, which would be applied to the savings of low energy lighting initiatives under the Energy Saver Incentive scheme.

The analysis assumes that low power factor lamps will not be installed under a business as usual (BAU) scenario, and this is accepted as probably correct as householders are unlikely to be aware of the power factor issue and the high power factor lamps are more expensive.

The calculation of the impact of power factor on system losses appears to be correct from the fundamental perspective of electrical energy laws and theory. The impact of harmonic losses is considered marginal at the system level; however it does impact on local distribution systems and wiring. Although very little evidence is available to validate the estimated impact of a reduction in harmonics, the calculation produces only a marginal benefit and is considered appropriate.

Installation of low energy General Service Lamps (Aggregation)

The rationale for this abatement is that low energy lighting, compact fluorescent lamps, if installed instead of incandescent lamps will create energy savings above those that would occur under a BAU scenario. The savings have been calculated for a basket of different sized lamps, to avoid estimating savings for small and large lamps which was previously undertaken.

The calculations were reviewed and provide a realistic estimate of the impact that a change from a set of incandescent to low energy lamps would create, assuming the underlying assumptions are correct. However, a critical assumption is that for the BAU scenario it is assumed that the majority of householders would install General Service Lamps (GSL) when replacing failed incandescent lamps. The analysis recognises that such lamps will be a mixture of pre-MEPS lamps and post MEPS lamps, which is acceptable, but only assumes 20% of replacement lamps will be low energy lamps under the BAU scenario.

The Victorian Utility Consumption Household Survey, 2007, indicated that the ratio of CFL to incandescent GSL in the main rooms of the 2000 households surveyed was approximately 40%, but that this dropped to around 25% in the bedrooms. An ABS survey[1] also suggests that the proportion of energy saving lamps, self reported, has grown by about 10% annually, so the penetration of CFLs is probably now considerably higher than the Victorian Utility Consumption Household Survey found in 2007.

These research surveys do not directly address the question of what proportion of replacements of GSL lamps are energy savings lamps on a BAU basis. However, the research does suggest the BAU replacement rate may be higher than the 20% assumed and more importantly that this replacement rate is changing rapidly due to the implementation of the MEPS for lamps.

It is recommended that research be conducted into the present and projected penetration rate of CFLs versus MEPS-compliant GSL be conducted, as well as the ratio of CFL sales versus MEPS-compliant GSL. The discount rate for the installation of CFLs should then be reviewed based on this research.

Installation of low energy downlights

The rationale for this abatement is that replacing a halogen lamp (pre-MEPS or post-MEPS) with a low energy lamp, with the equivalent light output, will produce energy savings. For replacement of 12V lamps and fittings by 240V lamps, the savings are due to the lower energy lamps and the elimination of the transformer.

[1] ABS Environment Issues: Energy Use and Conservation- 4602, March 2008

Savings have been calculated for low energy lamps which meet the minimum efficacy requirements, as well as for two high efficiency bands. Each high efficiency band has a luminous efficacy 20% higher than the previous band.

The calculations were reviewed and provide a realistic estimate of the impact that a change from a set of halogen lamps to low energy lamps would create.

Some issues that remain unresolved are it is very difficult to obtain data on the lumen output and the luminous efficacy of the reflector lamps used in downlight fittings, and many low energy lamps appear to have much lower light levels than the lamps they are replacing. However, these issues are recognised and are being addressed.

Installation of high efficiency gas ducted heater in new home

The rationale for this abatement is that the typical ducted heater installed in a new home is of mid-rage efficiency and that upgrading these heaters to more efficient heaters will result in significant energy savings over the life of the heaters.

The calculations were reviewed and provide a realistic estimate of the impact that a change from installing a standard heater compared to installing a high efficiency heater. However, one assumption should probably be reviewed and that is The BAU efficiency of heaters was assumed to be 75%. Industry feedback and recent research by EnergyConsult into gas ducted heating would suggest the efficiency might be slightly lower, 72%, for heaters installed in new homes.

The following observations were also made about some of the assumptions and values used in the calculations:

- New ducted heaters do not have pilot lights, so the savings assumed in not having these pilots are not valid. The calculation can be corrected by changing the cell B31, 'Pilot energy', to 0 (zero). However, making this change produced no significant difference to the estimated abatement factor

- Conversion efficiency of heaters is assumed to relate directly to the star rating of heaters, but in fact relates to the seasonal operating efficiency and also includes a component for heat load factor. However, this can be ignored in the calculations as the heat load factor impact on star ratings can be assumed to be similar across different ranges for heater efficiency.

- The multiplication factor for 5.5 stars versus 5 star heaters, presently 1.25 could be revised if the BAU is altered to 72%, though it results in only a small change. The ratio of savings for the 5.5 versus the 5 star will be equal to 1.211.

Upgrade of existing gas heating ductwork

The rationale for this abatement is that by replacing the duct work of a gas heater the efficiency of the total heating system will be improved, reducing energy use and hence greenhouse emissions.

An invasive study of the ductwork of heaters has previously shown that existing duct work can be very inefficient and that considerable energy savings can be made by replacing the ductwork. The analysis assumes that the ductwork is replaced when a heater is replaced.

The calculations were reviewed and provide a realistic estimate of the impact of installing new ductwork would create on the overall energy efficiency of an average heating system.

The following observation was made concerning the assumed life of the savings, which is set at 14 years. Give the deterioration that normally occurs in ductwork over time, this initially appeared to be too long. However, the authors were informed that VEET measure would require a much higher R-value than is normal and better installation standards, including the applications special collars in addition to duct tape. This should mean the ductwork will undergo considerably less degradation in performance than the existing ductwork, hence the longer operating life.

Replacement of existing refrigerative air conditioner with ducted evaporative cooler

The rationale for this abatement is that by replacing a refrigerative air conditioner (AC), either ducted or room, with a ducted evaporative cooler will result in considerable energy savings. This will result in emission abatements.

The efficiency of refrigerative AC and evaporative is well established and the cooling loads of Victorian homes were used to determine how this improvement in efficiency would translate into energy savings. The reasoning behind these analyses appeared sound.

The calculations were reviewed and provide a realistic estimate of the impact that replacing the refrigerative AC will produce.

Top Up of existing ceiling insulation

The reasoning behind this abatement is that many houses have been insulated in the past but that the insulation effectiveness is too low, due to the insulation packing down over time or lower R value insulation being initially installed. The initiative assumes that the performance of the existing insulation is only equivalent to R1.5 and that a top up of the insulation will raise the insulation efficiency to R4.0. The result will be a decrease in the heating and cooling load of the houses concerned, which means less energy will be required for heating and cooling the home.

The calculations were reviewed and provide a realistic estimate of the impact that topping up the insulation will produce.

It is recommended that health and safety issues be given serious consideration before this action is to be included as VEET abatement. Given the serious issues that have developed with the national residential insulation installation scheme, it is recommended that full consideration be given to developing training and certification requirements for installers who might be accredited to do VEET abatement top up insulation.

Purchase of high efficiency television

The rationale for this abatement is that when a consumer purchases a television, if they purchase a high efficiency television rather than a low efficiency one then there will be a saving in the energy used by the television. This will result in emission abatement savings over the life of the television.

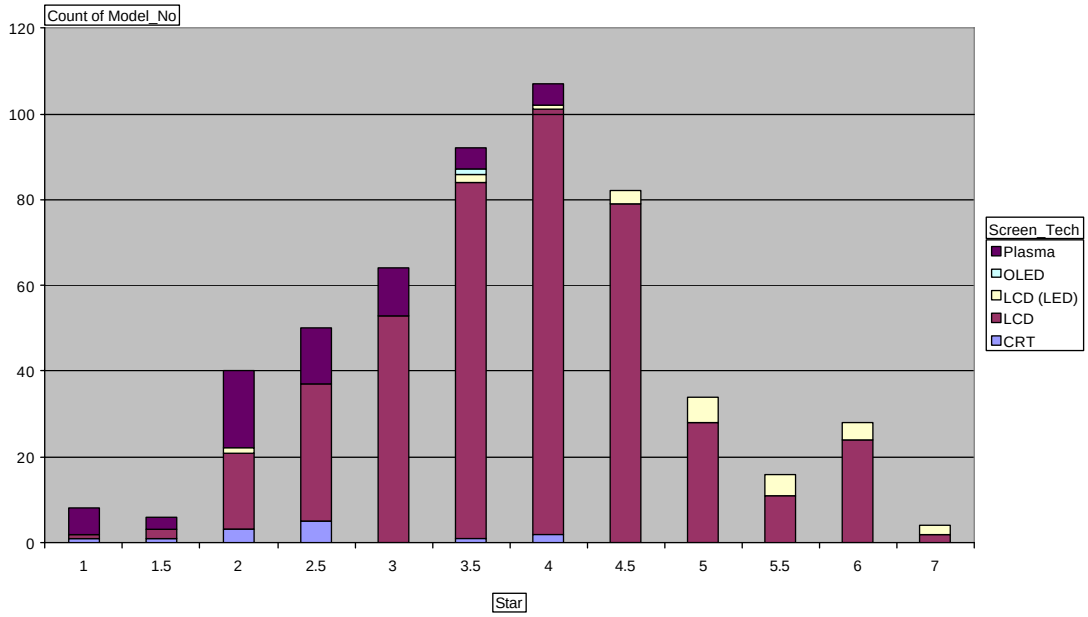
The reasoning and calculations for determining the energy savings appear appropriate. However, one of the major assumptions of the analysis is incorrect. The analysis assumes the sales weighted efficiency of televisions is 3 stars, but research recently conducted by EnergyConsult[2] shows 3.75 stars is the average of model weighted stars for registered televisions at the present time. (See chart below derived from study data). This suggests that the BAU sales weighted efficiency of televisions should probably be assumed to be 4 stars for the abatement calculations, especially considering the rapid increase in higher star rating models in the last 6 months. The calculations will need to be revised to incorporate the higher sales weighted SRI, in cell B47, and the calculation below row 58 will need to be revised accordingly. These changes will decrease the VEEC abatement factors.

Another issue is the definition of what is a high efficiency television. The write up of the 'Purchase of high efficiency television' states that the minimum is a 5 star television, but allowing for the steady improvement in the efficiency of televisions that is expected to occur over the next few years, consideration should be given to raising this base level to 5.5 stars. As televisions are already achieving 7 star ratings, this would still allow for many televisions to obtain VEEC abatements.

Given the steady improvement in the efficiency of televisions, it is also recommended that the assumed BAU sales weighted efficiency of televisions should be revised at the end of the VEET Phase 1 period.

[2] Using updated data (Feb 2010) to our report 'Baseline Power Consumption of Televisions', 2009 by EnergyConsult

Figure 1: Star Rating of Televisions Registered February 2010



Source: EnergyRating.gov.au 25 February 2010.

Purchase of low greenhouse clothes dryer

The rationale for this abatement is that when a consumer purchases a clothes dryer, if they purchase a high efficiency dryer rather than a low efficiency one, there will be a saving in the energy used by the dryer. This will result in emission abatement savings over the life of the dryer.

The reasoning and calculations for determining the energy savings appear appropriate. The assumptions underlying the calculations also appeared appropriate so the resulting abatements would appear to be appropriate.

Purchase of high efficiency pool pump

The rationale for this abatement is that when a consumer purchases a pool pump, then if they purchase a high efficiency pump there will be a saving in the energy used by the pump. This will result in emission abatement savings over the life of the pump.

The reasoning and calculations for determining the energy savings appear appropriate. The assumptions underlying the calculations also appeared appropriate so the resulting abatements would appear to be appropriate.

Installation of smart power board

Smart power boards operate by switching off appliances that otherwise would be using energy while operating in standby mode, or which are left switched on but are not in use.

As standby power and unnecessary operating power consumption can be significant, the reduction of this over a number of appliances can result in significant power savings in the longer term.

The allocation of VEET certificates for power boards can occur through two methods:

- A default allocation of certificates to any smart power boards which can demonstrate that they meet the minimum functionality specification[3]. This is to be based on an assessment of the level of standby power savings which could be achieved by such devices, based on measured standby data.

- Certificates based on specific properties of power boards, where companies submit data from a robust field trial of the device for assessment by a review panel established by DPI. The panel will then make a determination of the number of certificates to be assigned to the device on a case by case basis.

The calculations of the default allocation of certificates were reviewed for this report.

The reasoning and calculations for determining the energy savings from automated power boards appear appropriate. However, one assumption, that 90% savings in standby will be achieved by the boards has not been justified and appears to be too high; given this is the default calculation of the savings from the power board. This value may depend on the operation of the power board, so it is suggested that this be revisited when the minimum functional specification is developed.

It also appears that the abetment value will depend on the number of outlets for the power board. Although it may be reasonable to assume that at least 4 devices are controlled by the power board, it may not necessarily be the case. Also, a smart power board can have additional outlets made available by inserting a standard power board into one of the controlled outlets. It would be advisable to review this requirement/factor with the minimum functional specification.

It was also noted that 5 yr old penetration data has been used to weight the standby power values, which are also 5 years old, and a lot has changed in the Home entertainment and PC market. The authors are aware that more recent data is not available but it is suggested that the penetration assumptions be reviewed when further research in this area is published.

Abatement saving have also been calculated for manually operated power boards. It has been assumed that a manual power board will achieve 50% of the savings of an automated board, but this seems highly unrealistic. Any device that is reliant on

[3] EnergyConsult have not been provided the minimum functional specification and hence our review of this measure is limited to the information provided.

behavioural changes to achieve an outcome will have a highly variable impact across households, and an impact that is likely to rapidly decline over time.

It is recommended that abatement certificates for manually operated power board only be allocated on the basis of a data from a robust field trial of the device for assessment by a review panel established by DPI. Such a trial would need to provide evidence of the board's impact over a representative sample of households and over sufficiently long period to establish the long term usage behaviour of households with regard to the power board.

Installation of an In-Home Display energy consumption device

The in-home displays may reduce energy consumption by providing householders with information about their consumption and especially their consumption during peak demand periods.

The calculations were reviewed and are an appropriate way of calculating the potential energy savings and abatement from this initiative.

One key assumption, that the display will result in a 3.5% reduction in energy use, was not justified but appears to be reasonable. A Country Energy trial in 150 households, of an energy consumption display and time-of-use tariffs, resulted in an approximately 4% reduction in mean annualised energy use and several tails in the USA have resulted in savings of 5% to 7.4%.

Another important assumption is the length of operating life of the display, which was set at seven years. No justification was provided for this value but it appears reasonable.

Conclusions

In general the approach taken to determining the abatement factors for each initiative appeared reasonable and likely to produce a realistic estimate of the abatement that each initiative would produce. However, there were a number of assumptions and values used in different analyses which were questioned and will need to be revisited. The main one are:

- The assumed BAU rate of installation of low energy lamps is probably much higher than assumed, but research is not available to determine what this should be. Research should be conducted and the BAU assumption revisited when this is available.
- The BAU efficiency of gas ducted heaters for new homes may have been set as too high, and could be revised down to 72%, which would increase the abatement certificates from this measure.
- The BAU efficiency of the average television has been assumed to be too low and needs to be raised to 4 stars and the minimum eligibility for a high efficiency television should be set at 5.5 stars. The calculations of the purchasing of a high efficiency television will need be revised.
- The impact of manually operated smart power boards should be determined for each board submitted and justified on the basis of a robust field trial.

b