# *Review of activity submissions for the Energy Saver Incentive 2012*

*Prepared for*

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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

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# *Executive Summary*

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. Retailers must contribute to meeting this target by acquiring and surrendering Victorian Energy Efficiency Certificates (VEECs). Each certificate represents 1 tonne of lifetime greenhouse gas emissions abatement beyond what would have occurred under business as usual (BAU).

VEECs are created through undertaking approved energy efficiency activities, which are deemed to produce specific amounts of greenhouse gas emissions abatement over their lifetime. In September 2011, the Department of Primary Industry (DPI) invited interested parties to provide submissions for new activity categories that could be considered for inclusion in the VEET scheme in 2012. VEET Submission Guidelines were provided to set out the submission assessment criteria. The criteria were based on the objectives of the Act and Regulations, and practical administrative considerations.

DPI has commissioned EnergyConsult to conduct a review of new activity submissions to determine their suitability for inclusion in the VEET as "deeming" measures. VEECs for deeming measures are calculated by determining the lifetime abatement of a measure, so that VEECs may be created upfront at the time the measure is installed. The outcome of the review is the present report.

The review progressed through several stages, as follows:

- Preliminary review of submissions and proposed activities to obtain an initial indication of which activities may be suited for inclusion in the VEET scheme, having regard to the submission guidelines, and identify where further information is required concerning the activities and submissions.
- Develop draft findings, after undertaking research and calculations, to determine which activities may be suited for inclusion in the VEET scheme, having regard to relevant energy performance and/or quality standards and other appropriate conditions that may be prescribed in regulatory settings. The draft findings identified which activities may be suitable for deeming based methods of calculating abatement.
- Revision of draft findings and preparation of a final report that includes activities recommend for inclusion in the VEET as deemed activities, preliminary specifications of these activities, and the proposed algorithms which can be used to determine their greenhouse gas abatement.

The following table summarises the findings concerning potential VEET activities.

**Table: Summary of review of proposed activities regarding deemed savings**

| Activity | Recommended Deemed Activity |
|---|---|
| Internet Portal with Energy Consumption and Savings Data | No |
| Behavioural Change through Social Marketing | No |
| Energy Benchmarking | No |
| Installation of Air-Conditioner Control Device | No |
| Hybrid Ventilation System | No |
| Heating and Cooling Ventilation System | No |
| Hybrid Air Conditioner | No |
| Biomass Space Heating | No |
| Installation of high-efficiency ducted gas heating in existing homes and businesses | Yes |
| Voltage Optimisation | No |
| Power Saving Device | No |
| Appliance Switching Devices | No |
| Recessed Downlight Covers | No |
| Thermal Roof Coating | No |
| Draught Testing and Prevention | further review |
| Retrofitting Windows with Thermal Films | No |
| Water Flow Controllers for Showers | No |
| Water Efficient Pre Rinse Spray Valves | Yes |
| Water Efficient Wash Down Guns | Yes |
| Temperature Mimicking Sensor | No |
| Water Dispensers | further review |
| Glass Door Merchandisers (GDM) | further review |
| Refrigerated Beverage Vending Machines | further review |

# Introduction

## Victorian Energy Saver Incentive Scheme

The Energy Saver Incentive sets an annual target for achieving lifetime greenhouse gas emissions abatement from implementing energy efficiency activities prescribed by regulations (for which certificates may be created) in a given year. Energy retailers are required to meet a proportion of the annual target by acquiring certificates. Certificates may only be created for undertaking prescribed activities. Each certificate represents 1 tonne of lifetime greenhouse gas emissions abatement beyond what would have occurred under business as usual (BAU) (e.g. in the absence of the scheme). To date, all certificates have been "deemed", meaning that the lifetime abatement for a particular measure is credited at the time the measure is installed.

The objectives of the Act are to:

- reduce greenhouse gas emissions;
- encourage the efficient use of electricity and gas; and
- encourage investment, employment and technology development in industries that supply goods and services which reduce the use of electricity and gas by consumers.

Section 15 of the Act describes the kinds of activities which may be prescribed to generate certificates under the ESI. Activities must result in a reduction in greenhouse gas emissions that would not have otherwise occurred.

The VEET scheme commenced on 1 January 2009 and is administered by Victoria's Essential Services Commission (ESC). The first phase of the scheme (2009 to2011), will save 8.1 million tonnes of greenhouse gas emissions from being emitted over the lifetime of the activities undertaken. The first phase incentivised only residential energy efficiency activities.

The second phase of the scheme will run from 2012 to 2014 and will save 16.2 million lifetime tonnes of greenhouse gas from being emitted and will be expanded to allow businesses to also receive benefits from undertaking energy efficiency activities under the scheme.

## New Activity Submissions and Review

In September 2011, DPI invited interested parties to provide submissions for new activity categories that could be considered for inclusion in the VEET scheme in 2012. VEET Submission Guidelines were provided to set out the submission assessment criteria. The criteria were based on the objectives of the Act and Regulations, and practical administrative considerations.

DPI required that a review of new activity submissions be undertaken to determine their suitability for inclusion in the VEET as a deeming measure. In future the VEET may also incorporate project based methodologies. EnergyConsult were commissioned to undertake that review, the outcome of which is the present report.

The review and present report had a number of aims which included:

- Determine which activities are suited for inclusion in the VEET scheme, having regard to relevant energy performance and/or quality standards and other appropriate conditions that may be prescribed in regulatory settings
- Identify which activities may be suitable for "deeming" based methods of calculating abatement
- Make recommendations regarding greenhouse gas abatement for the proposed "deemed" activities, or develop algorithms which can be used to determine the greenhouse gas abatement – that may be attributed to each activity if included in the ESI

Calculations of the abatement were to include any and all variations of each activity, due to variables such as climate zone, product performance characteristics (for example, lifetime, size/capacity, efficiency rating) and the specific applications (for example, in variations of business and/or residential settings).

There were 24 submissions that are relevant to a "deeming" methodology for assigning certificates which have been reviewed and assessed.

# *Methodology*

## *Preliminary Submissions Review*

The VEET Submission Guidelines were designed to elicit detailed information regarding proposed activities in order for DPI to make a judgement on whether proposals were suited to further investigation and ultimate inclusion in the scheme. Consequently, these Guidelines were used to develop criteria to assess which activity categories are suitable for inclusion in the ESI.

EnergyConsult developed an evaluation matrix which enabled the different submission to be evaluated according to their merits for inclusion in the ESI. The 24 submissions were then reviewed and an initial evaluation of the submissions was developed. EnergyConsult met with the Technical Steering Committee[1] to discuss the preliminary evaluations. Submissions where additional information was required were identified and revisions to the evaluations were made where the feedback from the Technical Steering Committee suggested modifications in the analysis was required.

[1] The Technical Steering Committee established by DPI was comprised of officials from across Victorian Government departments and agencies.

## *Reporting*

The second phase of the review involved collecting additional information on the submissions where required, further analysis of the submissions, development of preliminary specifications for the activities proposed for inclusion in the scheme and development of algorithms for the activities where a deeming methodology could be applied.

A draft report was prepared which for each submission/proposed activity presented:

- Description of the proposed activity and how it might create energy savings
- Preliminary specification, so potential energy savings could be calculated and the potential implications and implementation of the activity assessed
- Review of the proposed activity regarding its potential in the areas of:
    - energy savings and additionality
    - implementation and quality
    - innovation and industry development
    - compliance and verification
- Recommendations regarding whether the activity should be included in the VEET as a deemed activity.

This report was reviewed and further information sought regarding a number of activities. Activity analyses were reviewed when needed and a revised draft report prepared. This also was reviewed and then the current, final, report was prepared.

The following sections in this report present the findings for the different activities. The findings for activities of a similar nature are presented together in relevant sections of the report. The sections are:

- Behavioural change activities
- Heating and cooling appliance activities
- Appliance Power Controllers
- Power Controllers
- Improving the thermal properties of buildings
- Water efficiency activities.

# Behavioural Change Activities

## Proposed Activity: Internet Portal with Energy Consumption and Savings Data

### Activity Description

This activity aims to encourage energy savings behaviour through the provision of information feedback on energy consumption via a web portal linked to a household's interval meter data. Information is provided to the household concerning their recent energy consumption, together with information on energy saving tips and methods. The energy consumption data is collected from the household's interval meter and supplied to the householder by web portals, mobile phone applications, or SMS messages. The exact nature of the activity has not been described by the proponents but the principle component appears to be supplying relatively recent updates, e.g. daily, of their energy consumption via a web portal. It is also possible that the portal service could be developed to allow the benchmarking of a household's consumption against historical data and could flag when consumption is above average for the household.

### Potential Specification

In order to determine the potential energy savings and additionality of an activity, it is necessary to be able to clearly define the nature of the activity. The present activity as defined by its proponents would probably involve a web portal for providing energy consumption feedback, energy cost information and advice on how to reduce energy usage. This information might also be supplemented by the use of mobile phone applications, SMS and e-mail alerts to encourage energy conservation.

However, as there are many websites currently available which offer information and advice on energy efficiency and energy conservation, this aspect of the proposed activity could not be used to specify the activity. The distinguishing feature of the proposed Web portal appears to be its provision of feedback on the actual energy consumption of the individual household at regular intervals. As information from electricity interval meters in Victoria is updated every 24 hours, it can be assumed that the energy consumption feedback on the web portals could also be updated every 24 hours. This suggests that a specification for the potential activity would be a web portal that supplies actual energy consumption feedback to the household which is updated every 24 hours, energy cost information and advice on how to reduce energy usage.

### Energy Savings and Additionality

The proponents compare this activity to the VEET In Home Display (IHD) activity, and argue that supplying periodic information concerning energy consumption will deliver lasting energy savings in a similar manner. There are three key differences between the proposed activity and the IHD activity, these being:

- feedback from the IHD is almost instantaneous, while the web portal will supply data delayed by 24 hours
- additionality of the activity compared to the IHD activity, and
- estimating the energy savings.

For a change in energy consumption to be considered as energy savings in the VEET scheme, the savings must be additional to that which would have occurred under the BAU scenario. For this to occur, the activity itself must be additional to the BAU scenario, i.e. the activity would not occur unless implemented as part of the VEET scheme. In this case, it is not clear that the provision of Internet portals with energy savings information would not occur under the BAU scenario, as some electricity distributors and retailers have started to provide such Internet portals.

The recent announcement by Jemena[2], an electricity distributor, of a web portal that supplies information from the smart (interval) meter on a household's electricity consumption confirms that electricity supply businesses may provide this type of service. The Jemena service is being made available to Jemena's 300,000 customers and will enable customers to track their electricity consumption, compare their consumption against targets they can set themselves, and obtain advice on energy savings. Similarly, Origin Energy have recently launched their free "Origin Smart" internet portal. The portal allows customers to view their historic energy consumption in half hour intervals. It appears highly likely that (most) energy retailers and distributors will soon offer the ability to monitor energy usage, and tips on energy savings, via an online portals.

Admittedly there are at present many households without smart meters who will not be offered energy web portal services that monitor their energy consumption, but as the smart meter roll out continues, it is reasonable to assume most households will be offered access to web portals which provide consumers with a range of information on their historical electricity consumption and energy saving tips within a 1-3 years.

The proposed VEET activity, energy-saving web portals that are linked to smart meters, are expected to provide similar information to the household about their energy consumption to the energy portals that are already being rolled out. Though the VEET activity sites might be developed to provide better diagnostics for identifying energy savings opportunities, it is likely that this will only lead to limited differences in the energy-savings of households using these sites versus the BAU retailer/distributor web portals. Consequently, as energy-savings portals are becoming available under a BAU scenario there will be limited additionality in energy savings created by this proposed VEET activity.

This is a key difference between this proposed activity and the installation of IHDs, which the proponents regard as a comparable activity. The IHDs are sufficiently

[2] http://jemena.com.au/customer/electricity/smart-meters/portal/

expensive that they would be rarely installed in homes unless supported by the VEET or some other program, consequently any savings created by the IHD can be regarded as additional to the BAU scenario. This is not the situation with the Internet portal activity. Estimating the energy savings from a Web portal is also more difficult than for the IHD. The research supplied concerning the Internet portal activity lists the findings from many international studies and then chooses six which they regard as the most relevant. From these six studies, an average saving was calculated of 2.67%. However, there is wide variation in the quality, size and relevant of the studies. One study in particular seems inappropriate, as it is based on research done 14 years ago and did not involve the use of internet portals, and for another study the wrong energy-saving result has been used in calculating the cross-study mean savings. Removing the first result and adjusting the second result means the average savings drops to 1.3%.

This initial review of the research evidence indicates the variability in research quality and findings and the difficulty of attempting to estimate the likely savings from an internet web portal. There also seems to be no research supporting the assumed lifetime of the activity, and if the web portals were offered by energy retailers, then consumer churn could further reduce the operating life of the web portals. In contrast, the use of IHDs to reduce energy consumption has been studied for many years and the estimation of the energy savings from the IHD activity for the VEET is based on the results of 34 studies, a number of which were conducted in Australia, and informed by a further 40 related studies of the impact of consumption feedback on energy usage. (Accenture, 2011) The impact of the IHD is therefore much more predictable and better researched and understood than that of an Internet portal.

## *Implementation and Quality*

There are no OHS issues involved in this proposed activity. There are no issues involved in providing relevant skilled and trained staff to support the proposed activity.

Ensuring the quality of any proposed Internet portals could be an issue but as insufficient information on the proposed portals was available, this issue was not explored further.

## *Innovation and Industry Development*

There could be considerable innovation involved in developing the proposed Internet portals, if they were refined and developed to maximise the energy savings from Victorian households using the portals. There would be a small number of employment positions created in the development of the portal and its support.

## *Compliance and Verification Issues*

Ensuring that the Internet portals complied with the provision of household energy consumption data and that this was updated on a 24 hour basis would involve some ongoing monitoring of the proposed activities. It is unclear how it would be verified that households were supplied Internet portals and accessed this information, but presumably

it would be possible to confirm that households are using the proposed portals via emails or similar confirmation from the householder. However, it will be harder to confirm the on-going use of the web portals, especially if the portals are offered by energy retailers due to customer churn, or who the energy savings should be attributed if householders change the web portals they use.

## *Recommendation*

It is not recommended that Internet portals providing energy consumption feedback be added to the list of VEET approved activities. The additionality of this activity is considered to be too minimal to justify its inclusion as an activity, as it is likely that these services will be rolled out by electricity utilities under BAU.

# Proposed Activity: Behavioural Change through Social Marketing

## Activity Description

This activity aims to encourage energy savings behaviour through the use of community-based social marketing techniques. The principal component of the program appears to be the provision over a twelve month period of a series of eco-coaching telephone calls to registered participants preceded by a meter read and a feedback letter that compares their consumption with their neighbours using specially designed graphics.

## Potential Specification

The proposed activity is at present not clearly defined and its proponent suggests further research is required to develop the proposed social marketing program.

For the purpose of this review the proposed activity will be defined as the provision of marketing and information material designed to encourage a reduction in energy consumption through a change in household behaviour.

## Energy Savings and Additionality

The proponent is suggesting a 5% energy savings can be achieved through a social marketing program. However, minimal information is provided to support this claim. Though research does exist which shows behavioural change can reduce energy consumption, the extent of such reductions are very dependent on the nature of the participants, the program and the situation. Predicting the persistence of such changes is also extremely difficult, and insufficient information has been supplied to support the claimed savings. Also, the proposed program is to operate for 6-12 months, but the proponent claims energy savings are expected to last for five years, but there is no justification for this claim.

Without there being considerably greater detail concerning the nature of the proposed social marketing program, and relevant research to enable the energy savings to be reliably predicted, it is not possible to estimate the potential energy savings from this proposed activity.

## Implementation and Quality

There are no OHS issues involved in this proposed activity. There are no issues involved in providing relevant skilled and trained staff to support the proposed activity. However, there are issues with the business model which appears to underpin the proposed activity. The proponent is predicting the activity will create 1.14 tonnes of greenhouse savings per household engaged, which could be assumed to create around $30 revenue in VEEC. However social marketing programs are labour intensive and relatively expensive to

implement, e.g. the proposed activity involves undertaking a series of at least four telephone calls and obtaining meter readings for each household, the development of education materials, undertaking marketing campaigns, etc. It is difficult to see how these activities can be undertaken at a cost of less than $30 per household, so the cost of implementing the activity are almost certainly going to exceed the revenue created by the VEECs obtained, and the activity is highly unlikely to be implemented.

It is not possible to review the quality of the proposed social marketing program as insufficient information is provided, nor is it clear how the quality of such a program could be measured or guaranteed if it was to become an VEET activity.

## *Innovation and Industry Development*

There could be some innovation involved in developing the proposed social marketing program as, though such programs have already been developed locally and internationally, there will still be scope to improve the effectiveness of such a program. There would be a small number of employment positions created in the development of the program and its support, assuming the activity rested on a viable business model.

## *Compliance and Verification Issues*

It is unclear exactly what the compliance issues might be with this proposed activity as its nature is not defined. Presumably it could be verified that households were engaged in the social marketing program through the use of signed enrolment forms, but it may be harder to confirm that the households continued to participate throughout the program.

## *Recommendation*

It is not recommended that social marketing programs be added to the list of VEET approved activities. Any potential energy savings cannot be adequately predicted and it is uncertain that a viable business model could be developed which would enable this activity to be implemented.

# Proposed Activity: Energy Benchmarking

## Activity Description

This activity aims to encourage energy savings behaviour through the provision of comparison energy consumption, or benchmarking, information and advice. Householders are supplied with advice which compares their energy consumption to a sample of similar households, based on demographics, house size and locality. The advice could also contain information concerning high bill alerts, peak time rebates, rate analysis tools and a range of energy-saving tips relevant to the particular season. Relevant information could be supplied through a mailed report, web portal, via mobile phone etc.

The principle component of the proposed activity appears to be supplying information so householders can compare their energy consumption to that of similar households. However, electricity bill benchmarking may be introduced under a national or Victoria scheme (discussed below) which would reduce the additionality of this proposed activity.

## Potential Specification

A potential specification for the activity could be the provision of information which would enable the householder to compare their energy consumption to that of similar households in order to motivate them to reduce their energy consumption.

The provision of other information, behavioural change programs and different methods of delivering the comparisons could not be part of the activity specification, as such actions are too broad to be regarded as a specific activity.

## Energy Savings and Additionality

The proponent is suggesting an energy savings of between 2% and 4% over a five year period can be achieved through this use of comparative or benchmark information. However, minimal information is provided to support this claim. Research shows comparative information can reduce energy consumption, but the extent of such reductions are very dependent on the nature of the participants, the program and the situation. Predicting the persistence of such changes is also extremely difficult.

There is also expected to be limited additionality for the proposed activity with regard to electricity consumption of households. The National Energy Retail Rules (Retail Rules) states that energy retailers will be required to include information on the electricity bills of residential customers to enable them to compare their household electricity usage with that of households of a similar size in their local zone. This was to become effective in October 2012 but Victoria has announced it will defer joining the Retail Rules framework, and so will not be implementing the national bill benchmarking.

In Victoria, state-based arrangements may be put in place to give effect to the bill benchmarking component separately from the national scheme. However, in the interim, addtionality concerns are still justified as Victoria has its own state-based energy bill benchmarking arrangements in place for electricity. These are enabled through provisions in the *Energy Legislation Amendment (Retail Competition and Other Matters) Act 2008* and have resulted in the majority of retailers providing energy benchmarking data to customers.

The provision of energy bill benchmarking by energy retails means the BAU scenario has almost all small Victorian electricity customers receiving benchmarking, or comparative energy consumption, information on their electric bills, and/or via a website. A well designed comparative energy consumption and advice service might be able to further engage customers and might produce some additional electricity savings beyond that created by the national or Victorian benchmarking, but this is likely to be fairly limited. This will mean that supplying comparative electricity consumption data to households must be regarded as having limited additionality as far as the VEET scheme is concerned.

There is no current, or proposed requirement for providing benchmarking data on gas bills. The additionality of the proposed activity for the provision of gas comparative consumption is also uncertain for a number of reasons:

- One proponent appears to be advocating an opt-out approach to the supply of comparative energy consumption information, so if an energy retailer adopted this activity, they would provide the comparative information to all their customers. This approach would not work under the VEET Act and Regulations, as these require that households agree to participate in a measure and assign their right in certificates to a particular activity provider, which is inconsistent with the opt-out approach. (This would apply equally to electricity consumption information provision. )

- Even if receiving the comparative information became an opt-in activity, and the activity only focused on gas consumption, there still are many programs currently operating in the community which are designed to encourage energy saving and greenhouse abatement behaviours. The activity proponent would have to prove that their program was producing energy savings beyond that achieved by these BAU programs, and at present no information exists to support such a claim.

This analysis indicates that the provision of comparative energy information in the electricity sector may at best produce limited additional energy savings to those occurring under a BAU scenario, due to the likely introductions of energy bill benchmarking. Even if the provision of comparative energy information was restricted to information concerning gas consumption, it would have to be an opt-in program for it to be considered a VEET activity. Also, given the wide variety of freely available information concerning energy consumption, estimating a household's energy consumption and reducing energy consumption, it will be very difficult to define an information program of this sort as a VEET activity and to forecast the energy savings in a way distinguishable from BAU energy savings. Consequently this activity may be better suited for a project-

based measurement approach, possibly with participating houses' energy consumption being compared to that of a control population's.

## *Implementation and Quality*

There are no OHS issues involved in this proposed activity. There are no issues involved in providing relevant skilled and trained staff to support the proposed activity.

Ensuring the quality of any proposed comparative energy consumption information service could be an issue but as insufficient information on the activity was available, this issue was not explored further.

## *Innovation and Industry Development*

There would be some innovation involved in developing the proposed comparative energy consumption information service so as to maximise the impact of the service in promoting energy savings in Victoria. There would be a small number of employment positions created in the development and supply of this information.

## *Compliance and Verification Issues*

Defining a specification for this proposed activity would be challenging given the range of existing information services, which would make assessing that a specific program complies with the specification also a challenge. Ensuring that the comparative energy consumption information service was accurate and supplied to households would involve some ongoing monitoring of the proposed activities. If the activity was supplied by energy retailers this would also create verification issues, as customer churn would mean many customers only received or used the comparative energy consumption information service for a restricted period.

## *Recommendation*

It is not recommended that comparative energy consumption information services be added to the list of VEET approved activities. The additionality of this proposed activity is considered to be limited, as there are significant challenges in adequately specifying the proposed activity given the range of existing energy saving advice programs in the market. Furthermore, it will be very difficult to forecast/deem the energy savings in a way that is distinguishable from BAU energy savings. This proposed activity will be better suited to a project-based measurement approach.

# Heating and Cooling Appliance Activities

## Proposed Activity: Installation of Air-Conditioner Control Device

### Activity Description

This activity involves installing an independent device that works in conjunction with an air-conditioner's temperature control thermostat.

The proponents claim the device saves energy by reducing the compressor run time by measuring the indoor unit (i.e. evaporator) cold air supply temperature and fine tunes the air-conditioner's performance each and every compressor cycle.

Therefore, while the thermostat is controlling the room temperature, the device ensures that the cold air supply is always just sufficient to deliver the right amount of cooling. The proponents claim this is achieved by matching the time that the compressor runs to the actual cooling load each and every cycle. The proponents claim as a result the device ensures that the compressor will run longer with a crowded room or at the middle of the day, when the temperature is hotter, whereas running time will be reduced with an empty room or in the cool of the night. However, as this is what a standard thermostat does in controlling an air-conditioner, it is unclear what the independent control device actually does.

### Potential Specification

It is unclear what the potential specification of this activity could be, as the technology and the mechanism for generating energy savings is not clear and has not been defined. Without greater information on how this device achieves savings or what the technology actually does it will be impossible to define a VEET activity. It is also important to note that VEET is based on generic activity measures and not measures based on specific proprietary technologies.

### Energy Savings and Additionality

The proponent's calculations of the energy consumption and running costs of a residential air conditioner contained some errors which lead to an overestimation of residential energy consumption and costs by a factor of up to ten times actual Victorian requirements. Consequently the energy savings and VEECs created by this activity, assuming the device worked as the proponents claim, would only be a fraction of those estimated by the proponent and this may affect the financial viability of this proposed activity. Savings in the non-residential sector could be larger but are also very unlikely to approach those described by the proponent, and could not be deemed due to the wide variability in non-residential cooling demands.

It is also not clear how the energy savings of 30% or more claimed by the device proponents can be achieved. There is no independent test data to support the claims or a plausible explanation of how measuring the cold air supply temperature relates to the actual cooling heat load or number of occupants in the room or an energy saving. There is a "how it works" graphical illustration that shows the room temperature cycling from 18°C to 26°C without the device and more precise control of ± 0.5% when using the device. However, a modern air conditioning system would not operate in this manner and would normally cycle through a few degrees at most.

The situation described in the "how it works" illustration could occur when a system is excessively oversized relative to the heat load where the air-conditioning system overshoots or constantly hunts the set point. However this is an application issue and oversizing to this extent is very rare and in many instances contractors under size systems to meet a client's budget.

A significant portion of new air conditioners installed use inverter technology and many of these already measure up to 3 sensing points to optimise the approach to set point. An external device could interfere with the intended control algorithm or design of existing inverter technology. Independent test results would be required for a range of equipment types using non inverter and inverter technology to verify the total savings potential and additionality versus a BAU scenario. A generic specification of the control technology would also be required in order to specify this activity, and probably relevant testing and performance standards would also be need as part of the specification.

Given the unsatisfactory explanations as to what this air-conditioner control technology actually does, the flawed calculations of potential energy savings and the lack of evidence that the device is achieving any significant energy savings, it is concluded that insufficient evidence exists that the potential activity would create additional energy savings.

## *Implementation and Quality*

A registered electrician will need to install this device as it involves installing a contactor (electrical relay) in the mains voltage/high current circuit used to power the compressor. It is possible that installing such a break in the current would result in a fault with inverter technology as many air conditioning equipment suppliers have on board diagnostics that check for a current or electromagnetic field and non-detection would cause a fault condition. The use of a suitably qualified electrician would minimize the OHS risk, however it is highly unlikely that equipment manufacturers would support modifications of this nature and void equipment warranty. If this activity were undertaken equipment manufacturers would need to be consulted to confirm this activity complies with the manufacturers installation guidelines.

This activity involves modifying the equipment and it is possible the air conditioner will no longer be MEPS[3] compliant and interfere with demand response interfaces found in new air conditioners that allow customers or electricity utilities to manage the energy demanded by those appliances. The need for the air conditioner to be MEPS compliant after the installation of the device would need to be required in the specifications of the proposed activity.

## *Innovation and Industry Development*

There is no innovation potential associated with installing these devices. The proponents claim the technology performs well on most kinds of air-conditioning units, from window type installations through to split units with conventional and variable speed (inverter) technology and package based solutions. As ducted systems are not mentioned and the evaporator (indoor unit) is typically located in the roof space we assume these devices are not suitable for use with ducted systems. There are more than 2 million air conditioners installed in Victoria and fitting these control devices could involve a substantial amount of activity, but this will not occur without market acceptance.

## *Compliance and Verification Issues*

As previously mentioned, a generic specification of the control technology would be required in order to specify this activity, and probably relevant testing and performance standards would also be need as part of the specification. Assessing whether particular controlling devices meet these specifications would be the first step in ensuring compliance in the implementation of this proposed activity.

Electricians installing these devices would be required to complete relevant electrical compliance certificates and verify the device had been installed. If this activity were undertaken equipment manufacturers should be consulted to confirm this activity complies with the manufacturers installation guidelines. Verification surveys could also be undertaken.

## *Recommendation*

It is not recommended to add the activity of installing an independent control device, to work in conjunction with an air-conditioner's temperature thermostat, as an VEET approved activity. There is insufficient evidence that the activity would create any energy savings, or to quantify such savings.

There would need to be a generic test method/framework that could be used to test the impact of the control device and to enable a reliable prediction of potential energy savings before the proposed activity could become an approved VEET activity with deemed savings. It is incumbent on industry to prove that real savings will result from the

[3] MEPS information available from www.energyrating.gov.au

proposed activity and to develop a relevant and reliable measurement system for the device.

# Proposed Activity: Hybrid Ventilation System

## Activity Description

The proposed activity is to install a ventilation system that is designed to remove heat from the thermal mass of a home, accumulated from excess solar gains or heat from occupants and appliances. The ventilation system works by:

- Reducing a house's heating load by removing heated air from the roof space on sunny days, as a roof space can become very hot and transfer heat into the living space. This can be done either through providing natural ventilation or by pumping air from the roof cavity when required.

- When appropriate conditions prevail, such as when the outside temperature drops below the internal temperature after a hot day, the ventilator can draw in cool outdoor air into the living space by operating as a ceiling exhaust fan, which allows cooler air to be drawn into the living space through vents, windows etc.

## Potential Specification

The ventilation concepts proposed by this technology have been used for several decades in building ventilation and HVAC designs. In natural mode this technology is simply a roof ventilator which exhausts hot air from the roof-space through a vent via a venturi effect when wind is blowing or natural ventilation when there is no wind. In 'power mode' the technology operates in a similar way to 'economiser technology' by operating a ceiling exhaust fan when the outside air temperature is lower than the indoor air temperature in summer, expelling the warmer inside air and drawing in the cooler outside air through windows, vents or gaps in the building shell. The main difference between the proposed activity and 'economiser technology' is it pumps out warm air via a ceiling vent while the 'economiser' pumps in the cool air via the air conditioner ductwork (which has multiple locations throughout the dwelling).

There are no widely used energy performance specifications for these ventilation activities, however they are proven practices known to have some energy saving potential. However, the extent to which roof ventilation can reduce heat flow through the ceiling in summer and achieve energy savings will depend on the extent to which the ceiling is insulated. If the ceiling is adequately insulated (and around 80% of houses in Victoria have some insulation on the ceiling), the energy saving potential will be significantly diminished. Roof ventilation in summer could save some additional energy where air conditioning was ducted through the roof space (especially ducting for refrigerative air conditioning), but there is no information provided in the submission on this. Similarly, drawing in cooler outside air for cooling has some potential to save energy depending on

the efficiency of the existing building shell for summer conditions, although a similar and perhaps larger effect could be achieved from householders simply opening windows and doors when outside temperatures drop.

## Energy Savings and Additionality

The proponents used thermal simulation software to model the energy consumption of a fully ducted air conditioning system and a hybrid ventilation system. The cooling and ventilation loads were simulated for 10 Victorian climatic zones and predicted energy savings based on an "average" ducted refrigerative air conditioning system with a coefficient of performance (or EER) of 3.0. However, it is uncommon to have a fully ducted refrigerative air conditioning system in a Victorian home and the house modelled was over 25% larger than the size of an average Victorian home.

Part of the modelling task involved verifying the accuracy of thermal simulation software by comparing actual measurements to simulated estimates for a 'typical' residential dwelling. However the verification dwelling was located in Sydney, not in Victoria, which undermines the value of the verification of the model given the difference in cooling requirements between homes in Sydney and Victoria. Also the verification testing was conducted in May, when the test house required heating, rather than in summer when the house required air conditioning and the hybrid ventilation system was to be used. This means the model has not been adequately verified, given it is being used to model air conditioning requirements, and so the modelling results cannot be treated as a reliable predictor of the energy savings from the hybrid ventilation system.

In addition, thermal modelling results are highly sensitive to input assumptions and it is unclear if the assumptions used reflect the way the hybrid systems and the air conditioners of the houses would operate in reality. For example, the ventilation system was set to ventilate the living space when the outside air dropped below 26C, but commonly air conditioning is set to keep houses several degrees cooler than this. This would make the modelling indicate the hybrid ventilation system was operating, hence saving energy, for a longer period than would occur in reality. Also, the modelling seems to rely on the occupancy and usage patterns in the AccuRate thermal modelling tools. This would result in an assumed usage of the air conditioning system which is substantially larger than for the average Victorian household.

Behavioural factors were also not considered in the assessment such as occupants opening windows when the right conditions arise to provide natural ventilation, therefore reducing the saving potential. As this is a highly common behaviour, the energy savings from the hybrid ventilation system would have to be significantly discounted to allow for this effect. There was also no mention of a damper in the ductwork to prevent hot air escaping from the conditioned space during winter; and if this were the case the householder would incur a significant energy penalty.

The proponents estimate savings on cooling energy can be up to 61% for one hybrid ventilation unit mounted on a typical 190m$^2$ home (145m$^2$ conditioned area) equating to

emission savings as much as 0.7 tonnes of $CO_2$-e per annum. However, it is very uncommon for Victorian homes to have a fully ducted air conditioning system, so the modelled use of the air conditioning system is likely to have been above the Victorian average. The greenhouse factor which the proponents used in the calculations is too high, so the estimated greenhouse savings in an average home would be much lower. Also, an energy saving of up to 60% seems excessively high and is inconsistent with HVAC energy saving theory and testimony.

Removing heat from the roof space has the effect of lowering the cooling 'heat load' or size of the air conditioner required to service the cooling load. Removing heat from the roof is expected to reduce the 'heat load' by possibly 5% for a typical insulated home. In addition, a properly operating economizer typically saves around 10% in a commercial building including heating and cooling energy savings (possibly 20% depending on the geographical location and application). The hybrid ventilation system might therefore also save up to 10% of the cooling energy consumption by ventilating heat from the living space. This information suggests hybrid ventilation systems, which aim to obtain both these types of cooling efficiencies, would have some energy savings potential, but the savings amount is likely to be significantly less than that modelled and is more likely in the 5% to 10% range.

As the savings estimates are not consistent with expected savings from accepted HVAC technology and practices, the proponents would need to provide independent modelling and test results to substantiate their claims. They would need to provide modelling for a more typical Victorian houses, allow for Victorian housing stock, and model for a typical (room) air conditioner installation and a more typical usage profile. Consideration would also need to be given to the fact that many people ventilate their homes when the outside temperature drops, which would mean any savings from the ventilating of the living space would need to be adequately discounted. Some results from actual product trials conducted in Victoria would also be needed to substantiate the modelling of the estimated savings. Alternatively, any VEECs created by the installation of the technology would need to measured using a project measurement approach.

## *Implementation and Quality*

The Plumbing Industry Commission requires technicians installing RAC equipment (including duct fixing) to be licenced, and issue a compliance certificate when installing equipment where the total value of work, including materials and any equipment, labour and GST, is more than $750.[4] It is unclear if the amount would exceed $750 and if a licenced plumber would undertake the activity. In addition, in some instances there may be a need for an electrician.

[4] *The Victorian Plumbing Act, 2008.*

This activity may involve accessing roofs of single and two storey residences, which will require adherence to appropriate Worksafe practices. In addition care will need to be taken to ensure roof penetrations do not result in leaks and water damage. The OHS and associated risks of this activity would be greatly reduced if skilled trades personnel undertook these activities and were accountable for certifying the quality of the installation.

## *Innovation and Industry Development*

The current installed base of hybrid ventilation systems or similar technologies is very low in residential dwellings in Victoria and there is potential for existing contractors to use ventilation technology to lower energy consumption. The extent of industry activity would depend on the penetration and market acceptance of this technology.

The potential for innovation is minimal as this activity already exists and a significant portion of the activity involves low skills level (installing ducts and roof penetrations). However, there may be scope for the development of other ventilation systems that are similar or integrated with air conditioner ductwork, as with existing economiser technology used on commercial systems.

## *Compliance and Verification Issues*

If a compliance certificate were required for installation, this would provide certification the device had been installed in accordance with required standards and further testimony (photographs and forms) could provide further verification that the system is in use.

## *Recommendation*

This activity is not recommended to be added to the list of VEET approved activities at this stage. The expected saving from installing a hybrid ventilation system is likely to be small relative to the cost of the activity and there is insufficient information to adequately quantify the energy savings from the proposed activity. In addition there is currently no generic energy performance specification or test standard which could be used to assess the products against any minimum eligibility criteria which would be required for the activity to be approved.

# Proposed Activity: Heating and Cooling Ventilation System

## Activity Description

The proposed activity of solar thermal air heating and cooling is a similar concept to the hybrid ventilation system with some additional features. The proponents describe the technology as using the sun's power for space heating during the heating season, and night sky radiation for space cooling during the summer months. There are a variety of technologies which can supply these heating and cooling ventilation functions and the ventilation systems may include:

- Powered or unpowered ventilation of the roof cavity to reduce the cooling loads
- Ventilation of the living space to remove warm air when the external temperature drops
- Pumping warm, filtered air from the roof space, from warm air collectors installed under metal roofs or from solar panels on the roof into the living space to reduce heating loads
- A control system monitors indoor, outdoor and roof space or panel temperatures to determine when to switch between roof ventilation or living space conditioning modes.

In some systems and circumstances a solar panel may provide the electricity to power the ventilation fans, thereby saving a small amount of energy (approximately 40W motor) when there is sufficient solar power.

## Potential Specification

A potential specification of this technology could be a heating/cooling ventilation system that ventilates the roof space and living areas for cooling, and pumps warm air into the living space from the roof space, warm air panels or solar panels under appropriate conditions. However, it is unlikely that an adequate specification of this activity could be developed without technical standards and energy efficiency measurement standards for this technology. At present such standards do not currently exist.

## Energy Savings and Additionality

As has been previously discussed regarding the proposed hybrid ventilation system activity, venting hot air from the roof cavity and venting warm air from the living space, when the external air temperature is sufficiently low, could potentially slightly lower the cooling energy requirements of a home or building. Pumping warm air into the living

space from roof cavities, panels or solar collectors will also probably result in some reduction in heating energy requirements in a home or building.

However, there is insufficient evidence and research available to quantify the magnitude of energy savings from heating/cooling ventilation systems. Without technical standards and energy efficiency measurement standards, it will not be possible to determine what the energy savings from different versions of this technology might be. To estimate the potential energy savings from such systems in Victoria will require appropriate modelling based on a typical Victorian household, and ideally this would be backed up by trials in Victoria which could verify the savings. These trials need to be conducted in Victoria as those conducted in very different climates will provide little relevant information to calculate savings for the Victorian ESI.

Assuming the cooling and heating ventilation system produced quantifiable energy saving, it is probable that these savings would be additional to the BAU scenario as this technology is not normally installed.

## *Implementation and Quality*

Currently there are no Australian and/or industry product standards for products covered within this activity but an efficiency verification standard and/or methodology would be required if this was to become an approved VEET activity producing deemed VEEC. Proponents of this activity have cited *ANSI/ASAES423 MAR98 Thermal Performance Testing of Solar Ambient Air Heaters* as a related international standard but this standard would need to be evaluated to establish its applicability to equipment described in this activity and in climates that were consistent with Victoria.

There was no mention of filtration standards or maintenance programs to guarantee the quality of air entering the conditioned space. The systems which pump warm air from the roof spaces or warm air collectors under the roof could end up pumping all sorts of contaminations including dust, insulation fibres, asbestos, mould, pests (i.e. dead birds and rodents), bacteria, humid air from bathroom exhausts, etc. into the living space. Some suppliers offering similar technology use specialised High-Efficiency Particulate Arresting (HEPA) or electrostatic filters and offer customers maintenance contracts to ensure filtration quality is maintained. However, the risk of contamination of the conditioned space with this technology over the lifespan of the equipment is still a significant concern.

Similar to hybrid ventilation systems, installing these heating and cooling ventilation systems may involve accessing roofs of single and two storey residences, which will require adherence to appropriate Worksafe practices. In addition care will need to be taken to ensure roof penetrations do not result in leaks and water damage. The OHS and associated risks of this activity would be greatly reduced if skilled trades personnel undertook these activities and were accountable for certifying the quality of the installation.

## Innovation and Industry Development

The proponents suggest that financial incentives for this activity can have the effect of reducing prices and could stimulate the activity as seen with both solar panels and solar hot water. Inclusion in the VEET would lead to a requirement for a minimum specification and test standard, which could also stimulate improvements and innovation for this type of technology, as currently no such standards exist.

Future industry development will depend on equipment suppliers' ability to quantify or guarantee actual energy savings for homeowners and closer alignment with HVAC industry practices. The suppliers of systems which pump warm air from the roof cavity, or warm air collectors under the roof, will also need to overcome existing barriers including consumer concerns of contaminants entering the conditioned space.

The potential for innovation is reasonably large as, though these systems already exist, some of them are manufactured in Victoria and are a fairly early stage technology with scope for future improvement.

## Compliance and Verification Issues

If a compliance certificate were required for installation, this would provide certification the device had been installed in accordance with required standards and further testimony (photographs and forms) could provide further verification that the system is in use.

## Recommendation

This activity is not recommended to be added to the list of VEET approved deemed activities at this time. There is currently insufficient information to quantify the energy savings from the proposed activity. Also, there is currently no technical or energy efficiency standards which could be used as the basis of setting minimum eligibility criteria for the ESI. Such standards would need to be developed, and modelling undertaken for a typical Victoria house – backed up by Victorian trials – to build confidence in the level of savings which can be achieved.

However, it is likely that heating and cooling ventilation systems will produce some energy savings and this proposed activity could at present be suitable for a project-based measurement approach for installations in SME buildings.

# Proposed Activity: Hybrid Air Conditioner

## Activity Description

This technology incorporates a specially designed solar collector with conventional air conditioning split system technology.

The concept of this technology is that the solar collector provides an additional heat source to superheat the working fluid (i.e. refrigerant) which enables the refrigerant to begin changing state in the condensing coil earlier. This is claimed to reduce the superheat of compression required when cooling as well as utilising more of the condenser cooling face of the coil.

## Potential Specification

This technology combines established vapour compression air conditioning technology with a solar collector to improve the efficiency of this process. There are some solar assisted models currently listed on the www.energyrating.gov.au website (e.g. solakool, solair world with solar tubes), although these must be tested using the current conventional air conditioner test and with the solar component of the air conditioner disabled. There are no energy performance specifications or tests in common use covering this technology and although the major international air conditioner manufacturers are constantly striving to improve the efficiency of their products, none have adopted this technology. This suggests the technical merit of this technology remains unproven.

A potential specification for this activity cannot be developed, nor the activity become an approved activity in the ESI, without technical energy performance specifications and tests for this technology and an acceptable standardised efficiency measuring system and test standard.

## Energy Savings and Additionality

The proponents claim an efficiency improvement of around 50% to 52% versus regular variable speed (inverter) air conditioners.

At this stage the proponents do not appear to have sufficient technical information or test data to establish the extent of the efficiency improvement or to verify the range of savings under relevant circumstances/applications (i.e. climate zone, orientation, daylight hours, etc.).

The proponents only provided test results from an overseas test laboratory, but many of the test results were based on 60Hz equipment and it is not clear under what test conditions, climate zones or if the laboratory is NATA certified (or meets similar

independent accreditation). Further independent evidence and research would be required to validate the 50% savings claims and to quantify these savings with confidence. There would also need to be an accepted test for use in Australia to assess the energy performance of these types of products.

Given the current information on the energy savings of the hybrid technology, any VEECs created by the installation of the technology would need to measured using a project-based measurement approach applied to SME installations of the technology.

Assuming the hybrid air conditioner produced quantifiable energy saving, it is probable these savings would be additional to the BAU scenario as this technology is not normally installed.

## Implementation and Quality

There are no efficiency standards or energy performance tests that specifically cover this technology and an efficiency verification methodology would be required to ensure suppliers meet efficiency claims. Any test standard would need to be able to assess performance against a standard air conditioner, and also provide performance information for Victorian climates. Until such standards are developed it is unlikely that this activity could be specified as a VEET activity.

In addition the equipment must comply with all other relevant technical, safety and efficiency standards including *AS/NZS 3823, Performance of electrical appliances-Air conditioners and heat pumps*.

It is also plausible that if the installation of this technology became part of the VEET scheme, then conditions and guidelines would be required to be developed where different credit values would apply for different regions (i.e. similar to some existing VEET activities). Installation guidelines would also be required to ensure the solar collectors were located correctly (i.e. orientation) rather than in a shaded location such as on a wall beside the condensing unit, under an eave or on a roof shaded by trees.

## Innovation and Industry Development

This technology is imported from Asia and there is limited potential for innovation. The number of suppliers offering this technology and market penetration is extremely limited at present (i.e. around five suppliers that supplied < 0.05% of the market in 2011). The technical skills required to install this technology is similar to the existing skills required to install air conditioning equipment and is unlikely to be a barrier. As this activity and the skills required to install the technology already exist, it is unlikely that it will result in industry development. If the savings potential justify the additional cost, purchasers of equipment may elect to select a hybrid air conditioners rather than existing options.

## Compliance and Verification Issues

The installation of hybrid air conditioners will require the use of licenced trades people and a plumbing and electrical compliance certificate. The compliance certificates would confirm the equipment had been installed in accordance with required practices and further testimony (photographs and forms) could provide further verification that the system is in use and the solar panel is installed correctly.

## Recommendation

It is not recommended that the installation of this technology be made an approved VEET activity at this time. This proposal may have potential to become a new activity, but cannot do so until adequate energy savings in Victoria has been proven and the relevant technical and energy efficiency measurement standards have been developed and accepted by energy efficiency authorities as adequate for Australian climates. The proposed activity could at present be suitable for a project-based measurement approach for installations in SME buildings.

# Proposed Activity: Biomass Space Heating

## Activity Description

The activity involves the installation of a biomass home space heater. The heater resembles an enclosed wood heater and can run on different biomass fuels including wheat, crushed olive pits and peach stones, coal chips etc. There is no information to suggest that these heaters run more efficiently than other enclosed, fuel burning heaters such as enclosed wood burners.

## Potential Specification

It is unclear how this could be defined as an VEET activity. Presumably it would involve the replacement of some other heater (electric or gas) by the biomass heater instead, or the installation of these heaters in new homes instead of the default heater. However, as the biomass heater is likely to have the same or inferior energy efficiency to any heater it may replace, e.g. gas, electric or wood space heaters, there will be no energy savings and there can be no guarantee there will be any greenhouse emission savings either.

In addition, the scope of VEET is confined to electricity and gas retailers, and most activities included to date are based on saving electricity/gas or converting from electricity to gas. It is therefore not clear that there is a mandate for including equipment fuelled by bio fuel. Also, while some biofuels may result in reduced greenhouse gas emissions they could increase smoke and other particulate emissions, which would not be desirable. Consequently, these issues mean it is not possible to specify this activity as a VEET activity.

## Energy Savings and Additionality

As the energy efficiency of the biomass heater will be similar to an enclosed wood-burning heater, and inferior to efficient gas space heaters or electric space heaters, there can be no energy savings from the installation of biomass heaters.

There can be no guarantee there will be any greenhouse emission savings from the installation of the biomass heaters, as the greenhouse impacts will be entirely dependent on the fuel used in the heaters and the type of heating being replaced. Consequently it is impossible to predict the amount of greenhouse emissions savings or even if any greenhouse emissions savings will occur.

## Implementation and Quality

It is understood the biomass heater needs to meet the relevant solid fuel home heater standards and emission limits, and relevant installation standards, so the quality of the heater and its installation is unlikely to be an issue.

## Innovation and Industry Development

As these biomass heaters already exist in the market there will be no product innovation from them becoming part of the VEET scheme. It is unlikely that such heaters would become highly popular, so there would be minimal additional employment created if installation of these heaters became part of the VEET scheme.

## Compliance and Verification Issues

As it is not possible to specify this activity, compliance and verification issues have not been examined.

## Recommendation

It is not recommended that the installation biomass space heaters be included as an VEET activity. The installation of such heaters may not lead to energy savings and will not lead to predictable greenhouse emissions savings.

# Proposed Activity: Installation of high-efficiency ducted gas heating in existing homes and businesses

## Activity Description

The installation of high-efficiency ducted gas heaters in new homes is already an approved VEET activity, and it is proposed that this activity be extended to include the installation of high-efficiency ducted gas heaters in existing homes and businesses where no gas ducted heating, ducted refrigerative air conditioning or central heating is currently installed.

## Potential Specification

The potential specification would be a variation to that of the existing Schedule 20, the installation of a High-Efficiency Ducted Gas Heater, but the specification would be amended so there was no reference to newly constructed premises. The resulting specification could be:

> *Installing a high efficiency ducted gas heater, that is certified by an accredited body to achieve a minimum 5 star rating when tested and rated in accordance with AS 4556–2000 with a minimum rated output heating capacity of 10 kW as determined in accordance with AS 4556–2000 and listed in the ESC register, in a dwelling where no gas ducted heating, ducted refrigerative air conditioning or central heating is currently installed.*

## Energy Savings and Additionality

It is understood the reason that the installation of high-efficiency ducted gas heaters, where no central or ducted heating currently existed, was restricted as a VEET activity to new homes was that there was concern that by extending the activity to existing homes, the VEET might be encouraging the installation of ducted systems which consumed more energy. As gas ducted heating systems are installed in the majority of new homes in Victoria, it was considered unlikely that the VEET activity would encourage greater energy consumption in new homes.

However, market data suggests that already approximately 25% of gas ducted heaters sold are new installations in existing housing. Often these heaters are installed as part of home renovations. As the price of installing such heaters will be approximately $3,000-$6,000, while the VEECs obtained by installing a high efficiency in a new home are approximately $150, it is highly unlikely that any financial incentive obtained under the VEET scheme would motivate householders to install gas ducted heating if they did not already intend to. Consequently, this argument for excluding the installation in existing homes of high-efficiency ducted gas heaters, where no central or ducted heating currently exist, does not appear to be valid.

As the average ducted gas heaters installed in either new or existing homes will be a low to medium energy efficiency heater, installing a high efficiency ducted gas heater will produce energy savings when compared to the BAU scenario. The savings produced by installing a high-efficiency ducted gas heater therefore meet the additionality requirement of the VEET scheme.

The energy savings from this potential activity will therefore be equal to the difference in the energy consumption of the market average ducted gas heater compared to those of a high-efficiency ducted gas heater, and will be similar in an existing house as in a new home, provided it is assumed that the existing home has similar thermal properties to that of a new home. This would generally not be the case, but as the installation of ducted gas heaters is often associated with the renovation of existing homes and upgrades of the building shell, it is likely that the renovated homes will have greater similarity to new homes. The resulting greenhouse emission savings are therefore assumed to be equal in new and existing homes.

Furthermore, consistent with the approach taken for all other VEET heating activities, the proposed measure may also be available to businesses. Under the current practice, the heating activity would generate the same amount of VEECs in business as in residential. This is based on a previous assessment made by DPI that found that greenhouse gas abatement in a small business environment would at least match those savings found in a similar residential environment.

### *Implementation and Quality*

The quality and efficiency of ducted gas heaters are already covered by the relevant standards. There is a well-established and reputable industry already installing gas ducted heaters, so the implementation and quality of this activity should not be an issue.

### *Innovation and Industry Development*

Given high-efficiency ducted gas heaters already exist, as does the industry selling and installing such heaters, there is no innovation or industry development that will result from this activity. The measure would simply extend the number of houses which could obtain a VEET incentive for installing a high efficiency gas ducted heater.

### *Compliance and Verification Issues*

The compliance and verification issues of this activity would be the same as those for the installation of high-efficiency gas ducted heaters in new homes and businesses where no central or ducted heating currently exist, so no additional compliance and verification issues will result from this activity. As the energy savings from installations in new and existing homes or business are assumed to be the same, it is also not necessary need to verify what type of home or business the heater has been installed in.

## Recommendation

It is recommended that the existing VEET activity, the installation of high-efficiency ducted gas heaters in new homes where no central or ducted heating currently exist, be extended to also include the installation of high-efficiency ducted gas heaters in existing homes and businesses.

# Power Controllers

## Proposed Activity: Voltage Optimisation

### Activity Description

The voltage supply specification in Australia (and UK/EU) is 400/230V+10% -6%, and equipment is designed and certified to operate with these ranges. In practice voltage is supplied from the grid often exceed the minimum supply voltage and voltage optimization units correct the over-voltage by bringing it in line with the actual needs of the equipment on site. The energy savings from voltage optimisation devices is attributed to the reduction in power consumption in equipment that is voltage dependent (i.e. in general this will apply to resistive electrical loads which are not controlled by a thermostat where power consumption varies with the voltage squared, $P = V^2/R$, and to some extent with motors), due to the reduction in the supply voltage.

The level of saving is very dependent on the amount of voltage dependent equipment used, so it can vary significantly across sites. Examples of non-voltage dependent equipment include laptops (fixed output of 20V), thermostatically controlled devices (in most instances simply take a shorter time to deliver the energy such as air conditioners, electric jugs), LED and T5 fluorescent lighting, motor loads controlled by variable speed drives, etc. Examples where voltage optimization can result in energy savings include incandescent lamps, T8 fluorescent lighting and possibly metal halide lamps (depends on ballast) and uncontrolled motors.

### Potential Specification

Voltage optimisation equipment can be installed across a wide range of electrical loads ranging from 30kVA to 2,000kVA. A potential product specification would need to cover all relevant Australian Electrical Safety Standards encompassing these applications including AS/NZS 60076 for power transformers.

Most suppliers of voltage optimization equipment recommend that all installations should begin with a comprehensive analysis of a site's power conditions. As each site is different, with its unique infrastructure and specific load requirements, there is no one-size-fits-all 'voltage management' plan and each plan should be tailored to the site to ensure that savings are maximised. The energy savings value in residential applications may not be sufficient to justify this tailored approach, and larger SME sites offer better potential. One proponent suggested SME premises with an electricity spend in excess of $20,000 per annum are viable for voltage optimisation, suggesting an electricity consumption threshold of greater than 100,000 kWh per annum may be needed.

It is conceivable that residential voltage controllers could be installed in the switch boards of homes, and these might produce some energy savings. However, as only a small proportion of residential lighting and equipment (e.g. incandescent lights and pool

pumps) are voltage dependent, the average energy savings is expected to be small and the cost of installing the voltage optimisers may not be justified. Given the wide variation in the equipment and appliances used in homes, it is highly likely that installing a voltage optimiser might only be justified in a limited proportion of homes. There is also a risk that reducing the voltage supplied could cause problems for electric motors uses in domestic appliances and this might shorten appliance life. Without further information on what residential situations justify the installation of a residential voltage optimiser, when it is safe to install these, and what are the minimum required technical requirements of the optimisers, a potential specification for a residential activity cannot be developed.

The installation of a voltage optimiser may be relevant to some SME sites, where the potential energy savings are greater. However, it is not possible to define a potential specification that would enable this activity to be treated as an approved, deemed activity in the SME environment due to the wide variation in the energy demand and equipment used in SME sites. Consequently, this activity lends itself more to a project-based measurement methodology for SME sites.

## *Energy Savings and Additionality*

The proponents suggest voltage optimisation technology can reduce electricity consumption and carbon emissions by up to 20% with an average saving in the order of 12% to 15% across a wide sector of applications including commercial, industrial retail and public sector. Residential applications are estimated to deliver less saving, in the order of 10%, but this can be greater if the house has pool pumps. However, the level of energy savings is highly dependent on the existing site voltage, size of the voltage tapping applied and the proportion of voltage dependent equipment on site, and cannot be reliably predicted. It also varies significantly with the age of the equipment on the site.

As the energy savings from this activity is variable and unpredictable, this activity would be best suited to a project-based measurement methodology and should be aimed at SME sites, possibly with energy consumption exceeding 100,000 kWh annually.

The additionality of this activity will need to be considered even when using a project measurement approach to determining energy saving. A significant portion of voltage dependent equipment is of an older vintage and has a higher likelihood of being replaced by more efficient equipment or processes, which needs to be considered in the BAU scenario for the project measurement. The lifespan of the potential savings will be influenced by when the voltage dependent product will be replaced by more efficient technology that may not have the same energy saving benefits from voltage optimisation.

## *Implementation and Quality*

The existing compliance measures currently in place and the requirement to involve electrical engineers in the feasibility and design process for voltage regulation, and the need for such equipment to be installed by qualified electricians, provide reasonable

assurance the activity will be implemented in accordance with prescribed safety and technical requirements.

Product quality is not likely to be a significant issue as voltage optimisation equipment is typically guaranteed for ten years with an expected lifetime of around 30 years.

One proponent highlighted the potential risk of equipment reducing the voltage below Australian Standards in a low-voltage event from the network supplier. It was recommended that an 'under-voltage bypass' be included as a standard requirement on voltage optimisation installations. This is an important quality measure and if this activity were to proceed, further investigation would be required to understand what criteria would need to be met to satisfy the various Energy Authorities in Victoria.

Further investigation and consultation with Energy Authorities would be required to obtain a better understanding of their requirements associated with voltage optimisation for intended application types.

## *Innovation and Industry Development*

Given that voltage regulation equipment already exist, the introduction of this as an activity in the VEET will not create significant product innovation. However, if this activity became popular, then some additional industry development that will result from this activity and some local product innovation may result.

## *Compliance and Verification Issues*

The compliance and verification issues of this activity would be the same as those for any project measurement activity, as the activity is not suited to be an approved VEET activity.

## *Recommendation*

It is not recommended that the installation of voltage regulation equipment be included as a deemed VEET activity. The installation of such equipment will not lead to predictable energy savings in either the residential or SME environment and this activity is much better suited to a project based measurement approach.

# Proposed Activity: Power Saving Device

## Activity Description

This activity involves installing an energy saving device on the mains power of residential dwellings. The technology is described as the world's first chemical based energy reduction device.

The proponents claim that "A Reduction of Energy Loss caused by electrical resistance is achieved when rotating electromagnetic waves are introduced into an electrical system. This results in less energy being converted into heat (due to resistance) and therefore a loss of available electrical energy."

This technology is called "new science" and although there is supporting evidence from several reputable independent research facilities claiming energy savings in the order of 5% to 8% when used for fairly specific applications, it is unclear how the device achieves these savings or if the technology is plausible. In particular, it is unclear whether the device would achieve energy savings when connected to a residential switchboard or used with specific residential equipment and appliances.

The applicant claims that the technology is patented worldwide and has been proven in every continent in the world. However, there was no evidence found of other governments offering incentives for this technology.

## Potential Specification

It is unclear what the potential specification of this activity could be, as the technology or how it achieves the energy savings is not clear, and has not been defined with certainty. Without greater information on how this device achieves savings, the nature of the technology or what the technology actually does, it will be impossible to define an VEET activity. It should be noted that the deemed VEET activities are based on generic energy efficiency measures and not based on proprietary technologies. Unless it is possible to set out a generic specification for this type of technology and an energy performance test, it will not be possible to include it as a deemed measure.

## Energy Savings and Additionality

The proponents cited the average Victorian household electricity consumption per is estimated at 5,533 KWh per annum, and therefore applying the device would achieve savings of 443 KWh per annum, based on 8% savings, but there is no evidence provided to justify this 8% savings from the appliances and equipment in a typical Victorian home. The proponents calculated that abatement based on a 10 year lifespan and the magnitude of the opportunity based on a market penetration of 5% or 110,000 dwellings.

There was supporting evidence from several independent research facilities claiming savings in the order of 5% to 6%. However, these tests were for selective equipment, e.g. an induction hob and a three phase motor, neither of which are highly common residential equipment in Victoria. There is no evidence provided of energy savings for a whole household if the device is connected to the switchboard. It appears that the device may minimise power consumption with inductive loads, possibly through the reduction of harmonic distortion. It is uncertain that placing the device on the mains power supplies of residential dwellings would generate comparable savings for the wide variety of appliances and equipment used in residential dwellings.

In order to determine the energy savings and additionality of an activity, it is necessary to be able to clearly define the nature of the technology and activity. As it is unknown how this device achieves energy savings, the nature of its technology and what the technology actually does, and no energy performance test for this type of product, it is impossible to define an VEET activity. Consequently it is impossible to determine the energy savings and additionality of this activity.

Further evidence is required to clarify how the device works, independent testimony of how the device would perform in real life applications and quantification of energy savings from independent field studies conducted in Victoria.

## *Implementation and Quality*

A registered electrician will need to install this device and the use of suitably qualified electricians would minimize the OHS risk.

The proponents claim the device has a certificate of compliance based on *AS/NZS 3100:2009 Approval and test specification – General requirements for electrical equipment.* This standard is one of a series of approval and test specifications issued by Standards Australia to protect users against hazards from the operation of electrical equipment.

The proponents claim the device does not reduce or affect the supply voltage and will not interfere in any way with the operation of any equipment, however no evidence was provided. Further investigation would be required to ensure installation of the device would comply with all relevant Australian Electrical Safety Standards.

## *Innovation and Industry Development*

There is limited potential for product or service innovation as the product is already designed and produced overseas. If the product was proven to work, then the VEET incentive might increase market uptake.

The proponents estimate it will take a registered electrician approximately 30 minutes to install the device. If this activity were implemented and penetrated 5% of NMIs as suggested, this would generate a substantial amount of installation activity (i.e. over 100 electricians one year to install 110, 000 devices).

## Compliance and Verification Issues

Electricians installing these devices would be required to complete relevant electrical compliance certificates and verify the device had been installed. Further testimony (photographs, forms and authorisation signatures) could provide further verification that the system is in use.

## Recommendation

This activity is not recommended to be added to the VEET approved activities as, based on the information provided, it is not possible to determine if this technology has real energy saving potential in the residential sector. In future there may be some potential for this activity to be used in business applications, and for any energy savings to be measured and recognised using a project-based methodology.

# Appliance Power Controllers

## Proposed Activity: Appliance Switching Devices

### Activity Description

Several devices are suggested which potentially could reduce electricity consumption of appliances by either making it easier for householders to switch off appliances, automatically switching off appliances after a set period, or enabling the householder to program the times at which an appliance can operate. These devices are proposed as an alternative to standby power controllers (SPC) used for home audio-visual or computing equipment, which are already an eligible measure under VEET.

A key difference between the proposed appliance switching devices and SPC devices approved under the VEET scheme is the SPC have predetermined, automatic functions for controlling attached appliances but the switching devices do not. All of the switching devices involve some intervention by the householders by manually switching off the appliance, choosing the period before the appliance switches off or programming the period the appliance operates. The impact of the switching devices can therefore vary enormously, which means it is not possible to accurately predict the resulting energy savings.

### Potential Specification

A difficulty with this activity as described by its proponent is that it could involve the installation of the switching devices on any appliance, and the resulting impact of the switching device will therefore depend on what appliance it is attached to. It would therefore be necessary for any potential activity specification to require that the installation of the switching device be for a specific set of appliances, as is the case for SPCs. These sets of appliances would probably be appliances in the audio-visual (AV) or information technology (IT) environments in the first instance, as these have previously been found to offer the most potential savings of standby power and information is available on the potential savings in these areas.

In the potential activity specification it would also be necessary to identify the type of switching device, as the savings will vary with the device types. The specification would need to be tightly defined, especially for devices that involved the manual switching of appliances. The manual switching devices would need to be defined so as to distinguish them from a basic power board with on-board switches – the device would have to have some functionality which encouraged and facilitated householders to use the switch. Likewise, the timer and programmable switching devices would need to be distinguished from commonly available timers, so the device would again have to have some functionality which encouraged and facilitated householders to use the device to save energy in a way that commonly available timers do not.

At present the proponent has not described the activity or devices in a manner that would enable a potential activity specification to be developed that would meet the above requirements, and it is unclear how such a specification could be constructed.

## *Energy Savings and Additionality*

Unfortunately, even once an activity is specified so that it is known which sets of appliances would be connected to the switching devices, it is not possible to determine what the resulting energy savings would be from the activity. This is because there is not sufficient information to determine what energy savings can occur through the use of the different switching devices. The obvious place to use the switching devices is in the residential AV and IT environments, but SPCs already exist that aim to address this wastage and are an established VEET activity. The switching devices are likely in most situations to be significantly less effective at energy savings than an SPC, as the savings from the switching devices is reliant on household behaviour, i.e. users switching off the devices or setting times for the use of the equipment. Highly motivated households might be able to obtain more savings than an SPC in the IT environment, but generally automating the switching off of equipment via a SPC will save more energy in both the IT and AV environments. Also, the timing or programmable switching devices are not suitable with home computing equipment, as computers need to be switched off via the operating system controls to avoid data loss and damage to programs.

As an existing VEET activity already exists that addresses the energy wastage from home audio-visual equipment and computing equipment, good arguments and information would need to be presented to justify introducing another activity which will address the same energy wastage but in a probably less effective manner. Some arguments have been presented by proponents of switching devices that SPC will be inconvenient for users, and the SPC therefore be quickly disconnected. However, research conducted on the installation of SPCs through the VEET scheme (ESC 2012) suggest only a minority of SPC are disconnected, 16%, which undermines this argument. Further research is required to justify that the switching devices can meet an energy savings need that the SPC cannot, or meet it more efficiently. Research which quantifies the energy savings from different type of switching devices is needed and such research would need to include Australian field studies. Consequently, without clearer specifications of the switching device activity and further information quantifying the energy wastage that would result from using the switching devices, it is not possible to determine what energy savings would be obtained from the switching devices with sufficient accuracy to develop deemed savings estimates. However, it may be appropriate to use these switching devices in SME settings and measure the energy savings using project-based measurement techniques.

## *Implementation and Quality*

All switching devices would need to be meet AS/NZS 3197:2005 safety standards.

If this were to become an activity, switching devices would need to be installed and connected to specific AV and IT appliances, in similar configurations to that required for the SPC activity.

Alternatively, in the SME environment, any equipment could be attached so long as appropriate energy metering and data collection facilities were also arranged in order to support project measurement. These installations would not need to be undertaken by people with particular qualifications, but it would be advisable to use people with sufficient technical understanding of how the devices need to be connected in order to save energy and how this can be measured.

## Innovation and Industry Development

There will be a small amount of product innovation involved in developing or refining the proposed switching devices, but as variations of these products already exist the innovation will be small. If the switching devices became popular, a small amount of employment could be created through their installation.

## Compliance and Verification Issues

If the switching devices were to be treated as a deemed saving activity, and were to be installed to the relevant specific sets of appliances, then the compliance arrangements and issues would be very similar to those of the SPC activity. Photos and signed installation forms would probably be required.

Verifying that the switching devices had been installed as stated would require periodic physical audits of relevant households or SME premises.

## Recommendation

It is not recommended that the appliance switching devices be an approved activity in the VEET scheme at this time, due to the lack of research supporting the quantification of the potential energy savings. As a potential VEET activity, there is also a need to develop activity specifications that ensure the switching devices deliver savings beyond the BAU provided by power boards and timers – that is, that the devices resulted in appliances being switched off to a greater extent.

The appliance switching devices may however be an appropriate device to be used in the SME environment, with their energy savings measured by appropriate project measurement techniques.

# Improving Thermal Properties of Buildings

## Proposed Activity: Recessed Downlight Covers

### Activity Description

When insulation is installed in ceilings it is required by the wiring rules (AS/NZS 3000-2007) to be cut back 200 mm from downlights that are recessed into ceiling, unless the luminaire has a suitable fire resistant enclosure. The resulting holes in the insulation allow heat to escape or enter the room below. This increases the heating or cooling load of the house, which in turn increases the energy used to heat or cool the house.

Downlight covers and enclosures have been developed which can be installed on the ceiling and cover the downlight fitting and surrounding area. This allows insulation to be installed so there is a smaller gap, or no gap, depending on the downlight cover specifications, between the ceiling insulation and the downlight fire resistant cover or enclosure. This reduces the heat escaping or entering the room and therefore decreases the energy used to heat or cool the room. Use of non-vented covers or enclosures may also prevent air venting into the roof cavity via the light fitting, further reducing energy losses.

### Potential Specification

A potential specification for this activity could be the combined installation of:

- recessed downlight covers or enclosures over recessed downlights, which meet the recessed luminaire barriers product standard AS/NZS 5110:2011, and
- ceiling insulation so there is no gap between the downlight covers or enclosures and the surrounding ceiling insulation.

The activity would need to be limited to installations in ceiling with a minimum of R2.5 insulation installed, otherwise the impact on energy losses of reducing the gaps in the insulations will be minimal.

However the specification would also have to stipulate a minimum energy losses through the downlight covers, or minimum installation R values for the covers, but at present there do not appear to be standards for measuring energy losses through downlight covers. It may be that all covers will meet a minimum R value, in order to meet the requirements of standard AS/NZS 5110:2011, but this needs to be confirmed by appropriate research or testing of covers.

### Energy Savings and Additionality

Thermal modelling has been commissioned by the proponent in order to estimate the energy savings that will result from the installation of downlight covers. However, the

modelling can only provide a very approximate indication of the energy savings, as it calculates energy savings by determining the energy losses through a ceiling, with/without the downlight cover, assuming average internal and external temperatures for the different seasons. This will give an approximation of the base energy savings, assuming the relevant room was always conditioned to the stated internal temperature, but in practice most rooms are only conditioned for part of the time. Consequently the base energy savings was calculated using the thermal modelling provided, but discounted by 60% to allow for rooms only being conditioned a minority of the time.

The revised base energy savings was then converted into a weighted energy savings and a weighted greenhouse emissions savings, by taking into account the penetration of the different types of heating and cooling systems and their conversion efficiencies. A 15 year operating life was assumed for the activity and the resulting approximate VEECs that would be created by this activity was estimated as 0.01 VEECs per downlight cover installation.

It should be noted that the energy savings and emission savings estimated above may only be relevant to the particular product where thermal modelling was undertaken. This is because part of the modelling involves determining the insulation properties of the downlight cover, and presumably these will vary with the different types of downlight covers and enclosures. However, the thermal qualities of the downlight caps are unlikely to greatly vary, so the estimated savings are probably reasonably representative of this activity.

Though the downlight covers may contribute to reducing the risk of fires in ceilings, by preventing flammable material from coming in contact with hot light fixtures, their impact on energy savings is small, and the VEECs they will produce will be around 0.01 VEECs per cover. This would mean the financial incentive for installation of these products from creating VEECs would probably be insufficient to justify activity providers installing the downlight covers or even completing installation compliance forms. The cost of administrating this potential activity would outweigh and societal energy and emission savings.

Any energy savings created by installing downlight covers will be additional to that obtained under the BAU scenario, as these covers are not normally installed.

## *Implementation and Quality*

There is now an Australian standard which includes downlight covers, the recessed lighting standard AS/NZS 5110, and this could be used to ensure the safety of downlight covers.

Due to the safely risks of installing the covers over live light fittings, it would be necessary for electricians to install the covers if this was to be an approved activity under the ESI.

## Innovation and Industry Development

There may be some innovation in further developing down light covers to improve their energy-saving qualities, and there could be some small amount of employment created through the installing of the covers.

## Compliance and Verification Issues

If the downlight covers are fitted by electricians, the electricians could complete the installation form and sign the form to confirm that the covers had been installed. The installations could be verified through periodic audits, though these would be difficult to execute as it would involve entering the roof space.

## Recommendation

It is not recommended that installation of downlight covers be made an approved activity in the VEET scheme, as the research so far suggests that any energy saving will be too small to justify their inclusion as an activity.

# Proposed Activity: Thermal Roof Coating

## Activity Description

This activity involves the application of a paint or coating on roof surfaces, which it is claimed has high solar and heat reflective properties and also insulation properties. The proponents claim on average 20% of heating energy savings and 30-45% of cooling energy savings.

The basis of the claimed high insulation values and energy savings claimed for the thermal coatings are a series of test results and case studies. However, the claimed energy savings seem to be extravagant and the test results cannot be used to determine the likely energy savings in real world conditions, and especially in the residential sector.

## Potential Specification

A potential specification for this proposed activity could be the application of a paint or coating on a roof surface to decrease solar heat gains and/or reduce heat losses. The energy savings would be determined by the coating's ability to reduce heat gains/losses, as measured by an appropriate standard, or a minimum standard could be introduced. There would also need to be some sort of quality standard for the paint, as some paints can deteriorate fairly quickly over time, which would affect their lifetime energy saving impacts.

The difficulty is that there is not currently a measurement method and standard which could be used for this activity. There are measurements and standards that can be used to measure the reflective and insulation properties of roof coatings under various conditions, but there does not appear to be a relevant standard that could be used to estimate energy savings in typical residential or SME buildings. Consequently defining this activity to create deemed energy savings is not possible, but the activity might be suitable for project measurement in SME buildings.

Ageing is also likely to be an issue for these products, as it is with most reflective insulation products. Testing would need to determine the thermal properties after the product has been installed for a period of time and any degradation in reflective surfaces has occurred.

## Energy Savings and Additionality

It is reasonable to assume that reducing solar gains in buildings by painting their roofs in bright or reflective coatings will have some impact on their cooling loads. However, if the buildings have adequate ceiling or roof insulation, the impact of paint or roof coatings on the energy usage of the buildings is likely to be minimal. Certainly the claimed average

20% energy savings are extremely unlikely and savings are likely to be much smaller. Also, if these products reduce solar gains in summer, they will also do so in winter and potentially increase the heating load of the buildings they are applied to. This is particularly important in Victoria where space conditioning energy use is dominated by heating rather than cooling.

Without a relevant measurement method or test standard which could be used to verify the energy savings properties of different thermal coatings, and relevant thermal modelling or extensive real-life test data, it will not be possible to predict what the energy savings of these thermal coatings might be, though, it is highly unlikely that installing thermal coatings will lead to significant energy savings. Consequently, it is not possible to predict or develop deemed energy savings for the installation of thermal coatings.

The additionality of any energy savings obtained by installing thermal coatings also needs to be investigated. Presumably the savings from such thermal coatings will be much less if the buildings already have light coloured or reflective roofing. Consequently it would be necessary to consider the existing roof colour and reflective properties in the BAU scenario in order to estimate energy savings from this proposed activity. This would mean research would need to be conducted to determine the BAU thermal properties of existing roofing, so as to determine the additionality of the proposed activity. Again, this is another reason why this potential activity is not suitable as a deemed activity.

The energy savings from thermal coatings could be project measured in the SME environment if proponents of this action desire. Commercial buildings which are uninsulated or poorly insulated may be the most applicable for such projects.

## *Implementation and Quality*

There will be relevant paint or coating standards which could be applied to the underlying product, to ensure the quality of the paint/coating meets minimum requirements. There will not be standards relevant to the quality of the application of the coating, and hence the application of this product will highly dependent on the skills and personal standards of the installers/painters. However, as this activity is not suitable as an additional deemed activity for the VEET scheme, these implementation and quality issues were not explored further.

## *Innovation and Industry Development*

As various thermal paints and coatings have already been developed, there would be minimal additional innovation that would result from this activity being included in the VEET scheme. As these products are already available on the market, it is unlikely that significant additional employment opportunities would be created by their inclusion as an activity.

## Compliance and Verification Issues

The thermal coating installers would be required to complete relevant compliance forms and to verify the coating had been applied. Descriptions and photos of the existing roof surfaces might also be needed. Further testimony (photographs, forms, invoices and owner's signatures) could provide further verification that the coating was applied.

## Recommendation

It is not recommended that the installation of thermal paints or coatings be included in the VEET scheme as an approved activity, as the savings from such activities are likely to be small and cannot be reliably quantified or predicted. Proponents of these products may wish to consider undertaking projects in the SME environment and measuring energy savings using appropriate project-based measurement techniques.

# *Proposed Activity: Draught Testing and Prevention*

## *Activity Description*

The VEET already includes some air sealing activities, but these are based on individual activities. There has been little uptake of these measures in VEET to date (a total of only around 6,600 certificates has been generated by this activity since the start of the scheme), and the existing measures are unlikely to lead to a comprehensive air sealing approach.

Existing houses have quite high air leakage rates – work undertaken by Sustainability Victoria in which air leakage rates of houses were measured using a blower door test suggests that the average existing (pre-2005) house has an air leakage rate of two air changes per hour at atmospheric pressure. The use of draught testing of homes is potentially a very useful technique for understanding the extent of energy losses caused by air infiltration/exfiltration from buildings and identifying the major sources of air leakage, and draught testing combined with comprehensive draught prevention measures is potentially a very useful energy-saving activity.

The draught testing (or more correctly air pressurisation testing) would be used to measure the extent that draught prevention measures, as defined under Schedule 15 of the VEET Regulation, have reduced the rate of air infiltration/exfiltration in the building, which could then be used to estimate the resulting energy savings using the quantitative relationship between air infiltration/exfiltration rates and energy savings. A comprehensive air sealing measure would be additional to Schedule 15, and would not place any limits on the air sealing activities that could be undertaken.

## *Potential Specification*

A potential specification for this activity could be conducting pressurised draught testing of a building to determine the initial air leakage rate (in cubic metres per hour) at a certain pressure differential (e.g. 50 Pa), undertaking draught prevention measures and retesting the building to measure the reduction in air leakage rate (which will reduce energy losses from infiltration/exfiltration) from the building.

The pressurised draught testing would need to be conducted according to agreed infiltration/exfiltration testing standards. For dwellings, the testing standards proposed are the *ATTMA Technical Standard L1 (TSL1)*[5]; for non-dwellings, it is *ATTMA Technical*

[5] Air Tightness Testing & Measurement Association (ATTMA), Technical Standard L1, Measuring Air Permeability of Building Envelopes (dwellings )
http://www.attma.org/downloads/ATTMA%20TSL1%20Issue%201.pdf

*Standard L2 (TSL2)* [6]. These are British and not Australian standards but provided these were used for all testing, this would not be an issue.

The measured reduction in infiltration/exfiltration rates would then be converted to an energy savings and abatement estimate.

## *Energy Savings and Additionality*

To develop a deemed energy savings methodology for the action applied in the residential sector research using thermal modelling is probably required to estimate the likely range of energy savings from standardised reductions in infiltration/exfiltration rates for the average Victorian house.

However, research conducted for Sustainability Victoria on the potential energy savings from draught proofing 45 existing Victorian homes provides an initial estimation of what the potential energy savings and greenhouse emission reductions from this potential activity. The 45 homes were tested and found to have an average air leakage rate of approximately 2 air changes per hour at atmospheric pressure, and then an estimate was made of the actions and costs to reduce the air exchange rate to 0.5 air changes per hour, a moderately airtight home. Using a combination of thermal modelling and data from the energy use of the homes, the gas and electricity savings from undertaking the proposed draught proofing were estimated based on the heating and cooling equipment installed in the houses and occupant behaviour. The greenhouse emission savings were then calculated. On average it was estimated that undertaking draught proofing would have resulted in a savings of 0.66 $CO_2e$ tonnes p.a., or a 6.6 tonnes if the draught proofing actions are assumed to last 10 years.

An alternative estimation of the magnitude of the savings was developed by EnergyConsult based on:

- Specific heat characteristics of air
- Reduction in air exchange rate of 1.5 per/hour, based on the Sustainability Victoria research
- House size of 160 $M^2$.

This alternative formulae driven analysis suggests that moving from a draughty house to a moderately air tight house will result in an energy savings of 9.2 GJ/year and this activity could create on average 6.4 VEECs.

Both analyses therefore indicate a very similar savings potential from this activity with an emission savings of around 6.5 tonnes $CO_2e$ over 10 years for the average house. This is a significant savings, and the Sustainability Victoria research estimated it would result in

[6] Air Tightness Testing & Measurement Association (ATTMA), Technical Standard L2, Measuring Air Permeability of Building Envelopes *((Non-Dwellings)*
*http://www.attma.org/downloads/ATTMA%20TSL2%20Issue%201.pdf*

average energy bill savings of around $120 p.a. The financial viability of the activity is probably still marginal, as the cost of the activity (air leakage measurement and air sealing measures) is estimated at around $1600[7], but this cost would be expected to decrease if it was undertaken more frequently which could occur if it was supported by being included in the VEET. Also, if the activity is undertaken in homes with higher air leakage rates or in colder climates, then the activity may be cost effective for these homes even at current costs.

As both the research based and formulae driven have resulted in such close estimates of the emission savings from this activity, this suggests the formula approach can be regarded as a reasonably accurate estimate of the energy and emission savings which will occur in Victorian homes. The formula can be adapted to calculate an appropriate abatement factor for this activity, which can be used to predict the potential emission savings, hence VEECs, from any given reduction in air flow rate, in $M^3$ per hour at 50 Pa. The accuracy of the abatement factor and calculation can then be confirmed using the measurement and analysis work already undertaken by Sustainability Victoria on the reduction in heating and cooling energy use when air sealing existing houses. The number of VEECs allocated to any installation would then be the product of the measured reduction in air sealing rate (m3/hr at 50 Pa), the standard abatement factor and a regional factor.

This potential activity could also produce energy savings in SME buildings, but due to the variability of these buildings it will not be possible to calculate deemed savings from this activity. The use of project-based measurement of the energy savings will be more applicable for SME buildings.

## *Implementation and Quality*

This activity must require the use of the *ATTMA Technical Standard L1 (TSL1)*[8] standard for implementing the air tightness testing.

As this activity will encourage comprehensive air sealing, OH&S issues will need to be considered, especially potential issues relating to carbon monoxide (CO) from open flued gas appliances. There are some situations where ceiling exhausts fans or faulty installation of these devices in a chimney can cause back pressure which pushed CO back into the room, with potentially fatal consequences. In some situations sealing houses tightly could exacerbate this issue so it will be necessary to require CO testing to be done when undertaking this proposed activity. These issues need to be further explored with Energy Safe Victoria.

[7] Estimated as $1613 in a submission by the Air Tightness Testing & Measurement Association (ATTMA

## Innovation and Industry Development

Air pressurisation testing is a developing industry in Victoria and so if this activity was to become part of the ESI, this could potentially encourage the development of the industry and innovations regarding air pressurisation testing and draught proofing products and processes.

## Compliance and Verification Issues

A potential significant problem with this activity is that the organisation undertaking the air leakage testing is also (potentially) being rewarded for the extent of the draught proofing achieved. This creates a potential conflict of interest, and an incentive to overestimate the impact of the draught proofing. It is suggested that industry be consulted to determine appropriate methods to alleviate this problem.

It would be necessary for the air tightness testing reports to be signed and provided, together with signed installation forms detailing the draught prevention actions undertaken. Periodic audits could verify that the actions were being undertaken, together with desk-top audits to confirm that the energy savings claimed are consistent with the expected savings from the actions undertaken.

## Recommendation

It is recommended that further consultation be undertaken with industry in order to determine appropriate methods to resolve the potential conflict of interests involved in implementing this activity and to fully explore all occupational health and safety issues surrounding the activity. Provided these can be resolved, then this activity could be included in the VEET.

# Proposed Activity: Retrofitting Windows with Thermal Films

## Activity Description

This activity involves installation of thermal films on existing windows to reduce heat gains and losses from the windows. It differs from the existing VEET activity of 'Installation of product on single glazed windows raising thermal efficiency' as this activity does not involve the creation of an air gap between the thermal film and the existing window glazing.

## Potential Specification

A potential specification of the activity for the residential sector could be the installation of thermal film on existing single glazed windows in order to increase the insulation properties of the window to a minimum of 2 or 3 heating stars when rated using the Windows Energy Rating Scheme for Film Certified Products. The energy savings from 2 heating star products is too low in Victoria to warrant creating a VEET activity for such products, so a 3 heating star minimum would be needed. An alternative specification could focus on the cooling savings of thermal window films but, as discussed in the next section, these products are also unlikely to produce significant energy savings in the average Victorian home.

The installation of 3 heating star product could be set up as a new activity or alternatively, the existing specification of installing product on windows could be changed so there were two versions of this activity. The specification of the activity could become:

*Installing, on one or more single glazed windows in an external wall for a minimum glazing area of 5m2, a product that complies with the criteria specified as:*

*a) A product that, when installed on a single glazed window, results in a still air gap being created between the single glazed window and the product and raises the thermal efficiency performance of the window; or*

*b) A product that when installed on a single glazed window results in a reduction of heat losses due to its insulation properties increasing to a minimum of 3 heating stars when rated using the Windows Energy Rating Scheme for Film Certified Products.*

However, there are no products which produce a 3 heating star savings, and only one 2 heating star product, when applied to single glazed aluminium framed windows, which would have to be assumed to be the default window type on to which the film would be applied.

The implication is that though potential specifications could be developed for this activity, the product itself is currently unlikely to produce sufficient energy savings to warrant becoming an approved VEET activity.

## Energy Savings and Additionality

As previously discussed, there are no film products available that will produce a significant heating energy savings but there are a number of films which are rated as having a high cooling energy savings. However, the difficulty is that the energy used in an average Victorian home for cooling is much less than that used for heating, i.e. around 15% of the heating energy used, which means that even highly efficient thermal films will only save a small amount of energy in a Victorian home.

An additional problem of using thermal film for its cooling properties is that the film often will produce decreases in solar gains in winter, which could lead to increases in heating energy requirements that outweighed any energy savings from reduced cooling requirements. All but three of the films currently available produce increases in heating requirements when applied to the default window type of single glazed aluminium framed windows, and generally the increases in the percentage heating energy requirements due to using the films are a third to a half of the decrease in the percentage cooling energy produced. As at least five times more energy is spent on heating than cooling in an average Victorian home, this means almost all the thermal films would produce an overall increase in energy needed for heating and cooling.

Given the small number of film products that are likely to produce a net energy reduction from being applied, and the small net energy savings even these products would produce in the residential environment, there is insufficient evidence of energy and emission savings to justify the installation of thermal films for inclusion as an VEET approved activity.

There may be some situations in the SME sector where overheating of conditioned environments due to excessive solar gain is occurring, and in these situations the use of thermal films may produce a net energy savings. The energy savings from such applications could be measured with appropriate project-based energy savings measurement methodologies.

## Implementation and Quality

The quality of the thermal film and of its insulation will be determined by the manufacturers and the installers they use, so will be covered by normal product warranties. This is the same situation for the retrofitting of double glazing and films on windows in the present VEET activities.

The WERS rating on the thermal film could be used to decide which films would satisfy any minimum requirements for this activity, but at present this activity is not justified for the residential sector.

## Innovation and Industry Development

The development of the thermal films probably does not take place in Victoria, but encouraging the use of films with higher heat retention properties may encourage the market for such films in Victoria. Given that the installation of thermal window films already exist as an industry, potentially adding this as an VEET scheme activity is unlikely to significantly affect industry development or employment.

## Compliance and Verification Issues

If thermal films were to be used in the VEET scheme then signed installation records which recorded the type of thermal film installed would need to be kept to ensure appropriate thermal films are being installed, and to confirm individual installations. Some minimal verification of the installations, such as through periodic physical surveys, will also be required.

## Recommendation

It is not recommend that the installation of thermal films be made an approved activity in the VEET at present, due to the small net savings that is likely to result from this activity in the residential sector. This activity may be suitable for SME conditioned environments where overheating is a problem, and any energy savings would then be assessed using a project-based measurement methodology.

# Water Saving Activities

## Proposed Activity: Water Flow Controllers for Showers

### Activity Description

The activity involves the installation of a flow controller device in the pipe or hose connected to a non-low flow shower head. The flow controller device reduces the flow of water to the shower head and therefore attempts to save energy in a similar way to the installation of low flow shower heads. These devices can be voluntarily registered with WELS, so their maximum water flow can be quantified.

An issue with this proposed activity is that the existing non-low flow shower head is not removed, so there is a risk that the water aerator could be removed by the householder if they are not satisfied with the resulting shower operation. This is different to the situation with the installation of low flow shower heads, as the existing showerhead is required to be decommissioned.

New low flow shower roses are required to meet Australian Standards, *AS/NZS 3662:2005,* and part of this tests for the adequacy of the spray pattern from the shower rose. Existing shower roses have been designed for higher flow rates, and there is a risk that they may give unacceptable spray patterns when a flow control valve is installed. This means it will be important to prove than the existing showerheads with the flow controller device installed also produce an adequacy of the spray pattern from the shower rose that meets Australian Standards.

Another potential difficulty is that by using aerated water, the water travelling from the showerhead to the person will cool faster than non-aerated water. This can mean that a hot shower is required for the user to obtain the same comfort from the water delivered. Another issue is that aerated water tends to produce a 'misty' shower that is not always liked by users.

### Potential Specification

The challenge in preparing a specification for this activity is that it is important that the specification contain the requirement that the resulting shower must comply with the requirements of AS/NZS 3662:2005 as otherwise the installing of the low-flow water aeration device may create a shower that is unsatisfactory for the householder. However, the difficulty with this activity then is that the proponents, of using water aerators to reduce water usage in showers, will need to prove that their devices work effectively for the full range of showerheads available. This would mean installing and testing the water aerators with the full range of existing non-low flow showerheads in the market, and proving that all the showerheads with water aerators installed will meet the requirements of AS/NZS 3662:2005.

As existing shower roses have been designed for higher flow rates, it is highly unlikely that all showerheads will give acceptable spray patterns when a flow control valve is installed, so it is unlikely that a specification can be developed for this proposed activity.

## Energy Savings and Additionality

If the installation of low-flow water aerators to create water efficient showers was to proceed, then the water saving should be the same as for the installation of low flow showerheads. This is because in both cases the resulting shower met similar requirements in terms of water flow, hence the water and energy saving should be identical. However, it is considered that there is a considerably greater risk that the water flow controllers would be removed compared to the installation of low flow showerheads. Consequently, the greenhouse emission abatement savings from the installation of water flow controllers would need to be significantly discounted compared to the savings calculated for low flow showerheads, in order to account for this risk.

The result is that installing low-flow water aerators are expected to on average produce less emission savings than the existing installation of low flow showerheads. This raises the issue of why an additional VEET activity should be approved which targets the same energy-saving as an existing activity, but which produces less energy savings, yet from the consumer's viewpoint is provided at the same cost, i.e. "free"?

## Implementation and Quality

As discussed in the proposed specification for this activity, the installation of flow controller devices should be restricted to showerheads which have been proven to then produce a shower that meets the requirements of AS/NZS 3662:2005. This will probably mean that the flow controller devices need to be tested with all non-low flow showerheads, and all showerheads would need to be shown to meet the requirements of AS/NZS 3662:2005. There are significant practical problems in conducting such research, and it is unlikely that all existing on-low flow showerheads will prove to satisfy this requirement.

The low-flow water aerators probably can be installed by people with minimal skills or training. It will be important though that the flow controllers are install properly to prevent water leakage or the showers operating unsatisfactorily. The quality of these installations and with the devices themselves will rest with the activity providers.

There is a considerable risk that the water controllers will be removed by some householders, a risk that does not exist with the installation of low flow showerheads.

## Innovation and Industry Development

There will be no innovation and no additional employment created by this activity, as the water flow controllers are already developed and any employment created by their

installation would otherwise probably have occurred through the installation of low flow showerheads.

## Compliance and Verification Issues

Of considerable concern is the problem that the flow controllers can easily be removed, potentially eliminating energy saving from this activity. It will be necessary to survey households where the water flow controllers had been installed on a periodic basis to ensure that the rate of removal of these devices was not significant.

## Recommendation

It is not recommended that flow control, water aerator devices installed in showers become an approved VEET deemed activity. This proposed activity targets the same energy savings as the existing installation of low flow showerheads activity, but contains a much greater risk that the water aerator devices will be removed, so on average will produce small savings. It is also considered likely that the resulting shower will not satisfy the requirements of AS/NZS 3662:2005 in many cases.

# Proposed Activity: Water Efficient Pre Rinse Spray Valves

## Activity Description

Pre-rinse spray valves (PRSV) are handheld rinsing devices used to remove food scraps and grease from dishes before they are washed in a dishwasher. PRSVs are most commonly found in cafes, restaurants and other hospitality businesses.

The proposed activity involves replacing existing water inefficient PRSV with a WELS 6 star rated PRSV. It is estimated this will yield a minimum saving of 5 L/min of water use, which results in a reduction in hot water use and hence and energy savings.

## Potential Specification

A potential specification for this proposed activity would be:

> *Decommissioning an existing non-low flow PRSV (defined for the activity as a PRSV rated as having a 1, 2 or 3 star water efficiency) and replacing it with a low flow WELS 6 star rated PRSV, when assessed and labelled in accordance with AS/NZS 6400, or alternatively installing a low flow WELS 6 star rated PRSV on an existing fitting for a PRSV when no PRSV is currently fitted.*

## Energy Savings and Additionality

The research available suggests the water efficient PRSV devices can save a considerable amount of hot water, so this potential activity could be of considerable benefit to SMEs, by reducing their water and energy costs.

The energy savings from this proposed activity can be calculated from estimates of the water savings that will occur. The water and energy savings will be dependent on:

- Average flow rate of existing PRSV in the market (i.e. BAU performance): A Sydney Water study found average flow rates to be 10-15 L/min. A conservative estimate of the BAU flow rate has been chosen at 9 L/min.
- Average temperatures of water used: The required minimum temperature for sanitising utensils is 54ºC (*Safe food Australia* 2012), so this has been used.
- Flow rates of efficient PRSV: A 6 star PRSV has a flow rate of 4 L/min.
- Average minutes the PRSV are operated per day: An Australian manufacturer estimates this to be 45-60 minutes per day, which is consistent with a USA study by

Tso and Koeller (2005). It is also consistent with the recently completed USA EPA, 2011, study.

- Operating life of the PRSV activity: The life is estimated to be 5 years, based on an Australian manufacturers estimate of a minimum life for these devices being 3 years.

Based on these assumptions, and assuming the stock and performance of commercial water heaters match those of the residential sector, the deemed abatement of a high efficiency WDG will be 5.0 tonnes Victorian average. However this average value of abatement is based on the average penetration of water heaters and fuels in residential sector. If commercial sector water heaters are considered to be gas fuelled, the deemed abatement would be 1.6 tonnes.

## *Implementation and Quality*

To ensure that only PRSV devices of adequate quality are installed, it is suggested that all devices need to be tested and achieve a 'cleanability' score of 26 seconds or less under ASTM F2324 - 03(2009) Standard Test Method for Prerinse Spray Valves, CUWCC-FSTC VS1.0 or similar testing standard. This should ensure that performance is not sacrificed for the purpose of water and energy savings. This testing would need to be undertaken by an independent testing company and the results documented.

The PRSV devices would also be required to meet the WaterMark Certification Scheme requirements, that confirms the product complies with the Plumbing Code of Australia and the relevant Australian Standards, which relate to product quality, including health and safety, and warrant that it is fit for purpose. WaterMark certification is mandatory for products to be legally installed in accordance with state and territory plumbing regulations. PRSVs come under WaterMark Level 1 certification. WaterMark Level 1 includes a product review which addresses:

- Materials used for the product.
- Design specifics
- Performance and functionality, including durability
- Marking and installation instructions.

The PRSV will also need to be tested and certified to prove they meet the WELS requirements contained in the activity specification.

It is suggested that the implementation of the activity should involve the following:

- Conduct onsite testing to confirm that flow rate of any existing PRSV exceeds 7.5 litres/minute, hence the existing PRSV would be rated as a 1, 2 or 3 star WELS product.
- The PRSV should be replaced by a qualified plumber. The installer of the new PRSV and business should certify that this has occurred. This attestation should be incorporated in or accompany the assignment form.

- The installing plumber should ensure all fittings and fixtures are fit for purpose as per the plumbing code of Australia and the technical requirements found in AS/NZS 3500.
- A certificate proving the recycling or destruction of the removed PRSV should be required to accompany the assignment form.

If this implementation process was followed, there should be minimal concerns about the quality of the resulting installations. As standard plumbing skills are required to installation there are no concerns about skill shortages or additional training requirements.

## *Innovation and Industry Development*

As the water efficient PRSV devices have already been developed, no innovation will be created by this activity. Even if the activity became popular only a minimal amount of additional employment is likely to be created through the installation of the devices.

## *Compliance and Verification Issues*

The installations of the PRSV devices would be accompanied by the signing of the assignment form, by a relevant representative of the SME, attesting to their installation, and if the plumber also signed a form confirming a non-low flow PRSV (where installed) had been replaced, there should be minimal compliance issues regarding this proposed activity. Ensuring the PRSV devices met minimal flow rates can also be easily determined providing the devices are WELS tested and rated.

Verifying the installation of the devices could also be done through periodic audits of the claimed installations, to prove installation was conducted as required.

## *Recommendation*

It is recommended that the installation of water efficient PRSV devices become an approved activity in the VEET scheme.

# Proposed Activity: Water Efficient Wash Down Guns

## Activity Description

Water efficient Wash Down Guns (WDGs) are handheld cleaning devices used to wash down surfaces with hot water, getting rid of any liquid or solid wastes to collection drains. They are used heavily in a wide range of organisations from sectors including:

- Commercial
- Education
- Government and Council
- Health
- Hospitality, and
- Manufacturing.

As an average WDG will be used approximately 22 minutes per day, replacing an inefficient WDGs which can use upwards of 30L/min of use by a water efficient WDG can save water and energy. The water for washing down surfaces can reach up to 90°C in some applications, so there is potential for considerable energy saving by reducing the hot water used by these devices.

## Potential Specification

A potential specification for this proposed activity could be:

> *Decommissioning a non-low flow WDG, which is defined as a WDG not approved under the Smart Approved Watermark scheme and with a maximum water flow requirement of equal to or greater than 12 L/min, and replacing it by installing a low flow WDG approved under the Smart Approved Watermark scheme.*

The Smart Approved Watermark scheme does not measure devices against specified standards, but will not certify a WDG that does not meet a maximum water flow requirement of 9 L/min.

## Energy Savings and Additionality

The energy savings from this proposed activity can be calculated from estimates of the water savings that will occur. The water savings will be dependent on:

- Average flow rate of existing WDG in the market (i.e. BAU performance): This was found to be 20 l/min in a Sydney Water survey of 239 WDG, all of which had a

flow rate of more than 14.5 l/minute (Jones, A 2009). A conservative estimate of the BAU flow rate of 13.5 l/min has been used.

- Average temperatures of water used: Temperatures found have ranged from around 60C if using domestic HWS, through to 90C for specialist operations. A conservative BAU of 60C has been used in the calculations

- Flow rates of the efficient WDG: The survey of the Sydney Water pilot program found the rates ranged from 6.3 to 8.9 l/min, with an average rate of 7.4 l/min. A conservative estimate of the efficient WDG flow rate of 9.0 l/min has been used.

- Average minutes the WDG are operated per day were found to be 22 minutes/day, based on the Sydney Water survey.

- Stock and performance of relevant water heaters matches those of the residential sector. WDG will have an operating life of 5 years.

Based on these assumptions, and assuming the stock and performance of commercial water heaters match those of the residential sector, the deemed abatement of a high efficiency WDG will be 2.4 tonnes for the Victorian average savings. If the stock of commercial water heaters is consider to be gas fuelled, the deemed abatement would be 0.8 tonnes.

## *Implementation and Quality*

The WDG should be certified under the Smart Approved WaterMark scheme to ensure the WDG's water efficiency and durability.

It is suggested that the implementation of the activity should involve the following:

- The WDG should be replaced by a qualified plumber. The installer of the new WDG and business should certify that this has occurred. This attestation should be incorporated in or accompany the assignment form.

- The installing plumber should ensure all fittings and fixtures are fit for purpose as per the plumbing code of Australia and the technical requirements found in AS/NZS 3500.

- An onsite test be conducted to confirm that flow rate of the existing WDG matches or exceeds 12 litres/minute.

- Only WDGs using hot water should be considered and the plumber should attest that the installation uses hot water during operation

- A certificate proving the recycling or destruction of the removed WDG should be required to accompany the assignment form.

If this implementation process was followed, there should be minimal concerns about the quality of the resulting installations. As standard plumbing skills are required to undertake the installation there are no concerns about skill shortages or additional training requirements.

## *Innovation and Industry Development*

As the water efficient WDG devices have already been developed, no innovation will be created by this activity. Even if the activity became popular only a minimal amount of additional employment is likely to be created through the installation of the devices.

## *Compliance and Verification Issues*

The installations of the WDG devices would be accompanied by the signing of the assignment form, by a relevant representative of the SME, attesting to their installation. If the plumber also signed a form confirming a non-low flow WDG (where installed) had been replaced, then there should be minimal compliance issues regarding this proposed activity. Ensuring the WDG devices met minimal flow rates can also be easily determined providing the devices are Smart Approved Watermark certified.

Verifying the installation of the devices could also be done through periodic audits of the claimed installations, to prove installation was conducted as required.

## *Recommendation*

It is recommended that the installation of water efficient WDG devices become an approved activity in the VEET scheme.

# Refrigeration Equipment Activities

# Proposed Activity: Temperature Mimicking Sensor

## Activity Description

This activity involves installing a temperature mimicking sensor (TMS) or 'food simulant' device in walk-in cool rooms and freezers. The TMS is inserted over the thermostat to mimic the temperature of the stored goods, thereby introducing thermal mass around the sensor, reducing temperature fluctuations and as a result it reduces the cycling of the compressor and energy consumption.

The large majority of walk-in cool rooms and freezers are chilled by refrigeration equipment with controllers that sense and respond to the temperature of the refrigerated space rather than the product temperature. The temperatures sensed can fluctuate significantly as doors are opened and closed, and ambient air rushes in. With fewer fluctuations the compressor will potentially have less cycles per hour (e.g. 12 versus 20 cycles per hour), and as the start-up of refrigeration compressors uses (startup current that lasts less than a second can be as much as 3 times the rated current) more power than normal run operation, less and longer cycles per hour (delivering the same cooling energy) will save some energy. Further evidence though is required to establish the magnitude of energy saving potential from this effect.

The concept of this technology is it mimics the product temperature, which is typically higher than the coolroom or freezer and evaporator air off temperature. The proponents of this activity did not propose adjusting the controller set point (i.e. around 2$^{o}$C), however it is not clear what portion (if any) of the energy saving claims of 10% to 30% is attributed to raising the set point.

## Potential Specification

There are no standards or specifications that relate to the energy savings of this activity, as the savings would vary significantly depending on the size of the cool room, efficiency of the refrigeration equipment, thermal efficiency of the structure, effectiveness of the controller and application (produce, storage arrangement, air flow, etc.) or usage (number of door opening per hour, etc.).

The main suppliers of controls and sensors into coolrooms applications in Australia include Phasefale, Carel, Elliwell and other brands supplied by refrigeration equipment wholesalers. The features of these products range significantly from basic on-off thermostats to sophisticated PID (proportional, integral and differential) that use two sensors; one to measure coolroom temperature and one to simulate product temperature. These controllers are programmed to minimise overshoot and efficiently reach the desired set point, taking into consideration other important factors such as refrigeration defrost

cycles. These specialised controllers with two sensors would deliver better energy saving results than a simple temperature mimicking sensor applied to a basic on-off thermostat.

The only technical standard found that relates to this activity is NSF Protocol P235: Temperature Mimicing Sensor.[9] The standard includes minimum sanitation requirements for the materials, design, construction, along with minimum performance requirements of temperature mimicking sensors. This protocol does not cover potential energy savings, however it appears to cover other important food safety considerations that should be considered as part of the product specification criteria.

As there are no Australian and/or industry product standards that specifically cover this activity, it is not possible to develop potential specification of this activity. At best a set of criteria covering both energy and food standards requirements might be developed for guiding the implementation of this type of energy savings project, but the assessment of energy savings would need to be undertaken with project-based methodologies.

## *Energy Savings and Additionality*

This activity may have technical merit, however further technical evidence is required to support energy savings claims of 10% to 30%.

There is certainly significant energy savings potential from improving the control and performance of the existing fleet of walk-in coolrooms (possibly using this technology or different or a combination of techniques). The applicant states there are a number of TMS products available with products distributed in the UK, US and Australia, that the TMS has undergone testing in the UK, the US and in Australia, and a series of case studies and independent laboratory tests support the estimated abatement claims.

However, the estimates of 10% to 30% seem very high and experienced refrigeration practitioners suggest 5% to 10% is more realistic, but the energy saving potential depends on the existing cool room, controller and many other factors. It is possible that the higher energy savings are achieved by raising the set point by around 2$^{o}$C, rather than because of the use of the TMS. (A report by the British Frozen Food Federation (BFFF) highlighted a significant opportunity for the food service industry to reduce energy consumption by up to 15% by managing Cold Chain temperatures more effectively without reducing food quality or food safety[10]).

Given the uncertainty concerning the energy savings from TMS, and the number of factors that could influence the potential energy savings from the use of a TMS, there is likely to be a large variation in any resulting energy savings. All these factors will make accurately predicting the energy savings from this activity extremely difficult, if not

certification body that tests and certifies products to verify they meet public health and safety standards.

impossible. The use of TMS in the VEET scheme may therefore be better addressed through project measurement of energy and emission savings.

## Implementation and Quality

This activity could be implemented by refrigeration mechanics or suitably briefed unskilled personnel that are aware of the OHS risks in these applications. Using qualified refrigeration mechanics who have an understanding of the applications, associated OHS risks (electrical devices, evaporator fans switching on automatically) and end users' needs, would certainly enhance the implementation quality and minimise the associated risks.

One associated risk is that the controllers are also used to provide an alarm when the coolroom or freezer goes above a certain temperature. Introducing additional lag will delay the alarm and may provide less leeway for corrective action before the products spoil. Coolrooms and freezers are predominantly used in the refrigerated Cold Food Chain and in some instances can contain tens of thousands of dollars of produce. Warranty may need to be given by suppliers or installers to cover potential losses of produce.

## Innovation and Industry Development

There is no innovation potential associated with installing these devices, the activity simply involves inserting a TMS over the existing thermostat.

## Compliance and Verification Issues

One method to increase compliance would be to specify refrigeration mechanics as the accredited installers. In addition, further testimony (photographs, technician and forms) could provide further verification that the device was installed correctly and in use.

A refrigeration mechanic would certainly have a greater understanding of the applications and minimise associated OHS issues, however engaging refrigeration mechanics to complete verification work may be challenging.

## Recommendation

It is not recommended that the installation of the temperature mimicking device be made and approved, deemed VEET activity at this time.

This activity needs further research to verify and quantify the actual energy savings potential. Energy savings depend on a wide range of factors and proper performance standards would need to be developed before this activity could be included as a deemed measure. At present the impacts from the installations of TMS will need to be measured using project measurement methodologies. Technical standards would also need to be developed that could support the defining of the activity.

# Proposed Activity: Installing Timers and Energy Management Systems on Drinks Fridges

## Activity Description

This activity involves the installation of two types of devices to reduce energy consumption on refrigeration equipment. The devices are:

- A generic 24 hour or 7 day timer programmed to switch off the refrigeration appliance or equipment containing non-perishable products outside business hours. The installation of the timer is estimated to reduce equipment operating time by 9.5 hours per day (e.g. 11.00 P.M. to 8.30 A.M) seven days per week.

- Purpose designed/built technologies - described as Energy Management Systems (EMS) - that are specifically designed for the intended equipment class, and designed to monitor activity and reduce energy consumption when the fridge is not actively being used. An EMS can have night setback features (i.e. raise set point outside business hours from 2-5$^{o}$C to 7-11$^{o}$C) rather than switching off, refrigeration load management capability and can include motion sensors or other means of establishing the level of activity such as a remote temperature sensor in the display case. These devices can have self learning features (i.e. fuzzy logic) that learn and adapt from activity detected from motion sensors or changes in refrigerant loads from a lack of activity (e.g. outside business hours). The motion sensors can also be used to switch lights on when passing traffic is detected.

The advantage of offering two types of energy saving devices is it caters for a wider range of installed equipment and abatement potential. The types of refrigeration equipment covered by this activity include:

1. Water dispensers;

2. Glass door merchandisers (GDM), and

3. Refrigerated beverage vending machines (RBVM).

This activity has been discussed as three separate activities as the potential specifications, energy savings and implementation methods can vary significantly for each equipment class. The intended equipment can be found in a wide variety of locations and businesses including food retail, supermarkets, convenience stores, service stations, hotels, gymnasiums, offices and many more locations.

As there is considerable variation in the types of technologies available within these three categories of equipment, and the energy savings potential of the different technologies varies considerably, an introduction to the equipment is given for each activity, before a potential specification is provided. This is done to clarify why a particular version of the

potential activity is being advocated, and to avoid in the discussion having to explain and discard additional varieties of the activity.

# Proposed Activity: Water Dispensers

## Equipment Variation and Potential Activity

There are a wide variety of water dispensers available, but they vary on two main dimensions - whether the dispenser uses bottled water or is "plumbed in", and whether the dispenser provides cold water, hot and cold water, or hot water. This activity will need to concentrate on bottled water dispensers, as the variation in the designs and specification of plumbed dispensers makes it too difficult to forecast the potential energy savings from changes to these products.

Dispensers which provide hot water only are water heaters, and will almost invariably be plumbed. Though there may be potential to make energy savings through controlling the timing of the operation of these devices, such an activity is not related to installing drink fridge timers, so it is not explored further. That leaves cooling only and hot & cool water dispensers, and the analysis presented below in Energy Savings and Additionality shows that there is only significant energy savings to be had by installing controllers on hot & cool water dispensers. Consequently the potential specification is only for hot & cool water dispensers, though the small potential savings from cool only dispensers is further discussed.

Water dispensers could it theory be controlled by timers or by more sophisticated energy management systems and by systems using occupancy sensors. However, the difficulties with more sophisticated energy management systems and systems using occupancy sensors are the additional cost of these systems will out-weigh the energy cost savings, and the design of the dispensers does not facilitate location of the various sensors required by such systems. The market for water dispensers are also driven by cost, so the installation of internal energy management systems would not be supported by dispenser suppliers. Consequently the potential specification is only for the installation of timer devices on water dispensers.

## Potential Specification

The potential specification of this revised activity might be:

"I*nstallation of a timer device on approved combination hot and cold bottle water coolers to switch off the equipment during non-business hours".*

The potential specification would need to include:

- The activity be limited to combined hot and cold bottle water coolers that refrigerates using the vapour compression refrigeration cycle (excludes thermo-electric cooling technology) and boils water with an electric heating element

- Exclude all types of cold only water dispensers, as well as units that supply water at ambient temperature as well chilled water, and hot water only units
- Requirement that units must not be plumbed in and includes bottle units with refillable filtration bottles.
- Requirement that both hot and cold water temperatures are controlled with adjustable thermostats with water supply temperatures ranging from 5 to 10$^{o}$C for cold water and 80 to 100$^{o}$C for hot water.

Technical specification for a suitable timer will also be required, though at present such technical specification has not been developed. This would need to define the range of permitted settings (i.e. off for a minimum of 9.5 hours between 7 pm and 8.30 pm, 7 days per week) and require that the timer meet Australian Electrical standards and the timer not require resetting in the event of a power outage.

Features could be built into a bottled water dispenser that mimicked a 24 hour or 7 day timer. If the VEET activity was specified to cover new models with built in switch off timer features, as well as retrofitted timers, this would encourage this energy saving feature to become standard practice. This activity would need a process in place to guarantee the timer was programmed to switch off during the designated times and remain unchanged for its lifespan.

## *Energy Savings and Additionality*

Water coolers have three distinct operating modes that consume energy at different rates, "Start up"; "Standby" and "Draw off and recovery". The net energy savings of fitting a switch off timer is the difference between the start-up energy consumption and the standby energy consumption over the period the unit is switched off.

The energy consumption of cold water dispensers can vary widely due to usage rates, ambient conditions, feed water temperatures, chilled water set-point (i.e. factory set and adjustable from 5 to 10$^{o}$C or more), design (i.e. standby efficiency, compressor size, tank capacity, thermal insulation on the tank, etc.) and rated capacity of the units. (As previously noted, the potential equipment specification has been confined to bottled water coolers in order to make it possible to calculate savings based on a deemed methodology.)

The energy saving benefit from fitting a switch off timer to a cooling only unit is very small, however the energy savings potential of this activity in a combined hot & cold unit is far more significant and hence hot & cold units are specified in the potential specification for this activity. The energy savings from switching off the individual boiling dispenser can be up to 10 times higher than the benefit from switching off the cooling dispenser. In addition, combined boiling and chilled water dispensers can consume up to

60% more power than the sum of energy consumed in individual boiling or chilled dispensers, due to greater heat losses between the adjacent tanks of hot and cold water.[11]

There are no Australian standards or test methods covering efficiency levels of water coolers, and relatively few overseas policies targeting energy efficiency of water dispensers. The US ENERGY STAR program rates bottled water dispensers based on a "Standby Energy Consumption" test. The standby energy consumption of an Energy Star rated cooler is ≤0.16 kWh/day versus a conventional unit of around 0.29 kWh/day. Hot and cold units have significantly higher standby energy consumption rates of ≤1.2 kWh/day for an ENERGY STAR rated model versus 2.19 kWh/day for a conventional model. The primary difference between that the ENERGY STAR rated units are better insulated and have higher efficiency refrigeration units than conventional units.[12]

A conservative estimation of the deemed energy savings has been calculated by assuming that the average bottle water dispenser in Australia meets the ENERGY STAR ratings, so the energy savings can safely be assumed to be obtainable from all water dispensers. The energy saving from switching off a cooling only bottled water cooler with a standby energy consumption of 0.16 kWh/day for 9.5 hours would be 23 kWh/year. The startup energy penalty of a typical cooling only unit (power input typically 50W to 100W) is around 6 to 12 kWh/year based on the compressor taking approximately 20 minutes to reach set point (i.e. 1.5 litre cold water tank and delivery rate of 5 litres per hour). The difference between standby and start up is around 11 to 17 kWh/year, which equates to only 0.1 t $CO_2$-e over a lifespan of five years and too small to justify this activity.

Undertaking a similar calculation for a hot and cold unit with a standby energy consumption of 2.19 kWh/day and heating element of 450 to 575W will achieve net savings of around 1.5 t $CO_2$-e over a lifespan of five years. If the energy wastage between the adjacent hot and cold water tanks were considered this saving would be significantly higher. The predicted energy savings from this activity would be additional to the BAU scenario as no major suppliers of bottled water coolers offer timed switch off features.

Industry sources suggest that hot and cold water dispensers represent around 20% of total bottled water dispenser sales and that current sales levels of all bottle water coolers are around 20,000 to 25,000 units per annum. In 2003 the stock of combined hot and cold bottled water coolers was estimated to be 40,000 Australia wide.[13] If Victoria represents 25% of the fleet, this equates to a potential abatement of 15 kt $CO_2$-e if timers were fitted to all hot and cold bottle water dispensers.

[11] Prepared for PG&E by the Davies Energy Group, 2004

## Implementation and Quality

For retrofitted timers, this activity simply involves plugging the pre-set timer into the wall socket and has the benefit of not requiring specialized skills for installation.

The deployment of this activity could be rapid, particularly if the activity was coordinated through companies that frequently visit bottled water dispensers to resupply water or service equipment. This would mean the implementation cost of this activity is likely to be minimal.

For the installation of water dispensers with built-in timers, manufacturers/suppliers would provide technical specifications that could be used to verify the dispenser model meet the activity specifications, and then all such model units installed would meet the activity requirements.

## Innovation and Industry Development

There is limited potential for innovation associated with fitting a basic timer to bottled water coolers, however if an activity was created for new equipment to include an integral 24 hour or 7 day timer this could lead to a micro product innovation and encourage this feature to become standard practice for all bottled water coolers sold in Australia.

Switch off timers features are common on hot water boilers, however have not migrated to hot and cold bottle water coolers as they are a highly price sensitive appliance sold by specialists water companies, equipment manufacturers and even major retailers (i.e. Aldi, Office Works, etc.).

## Compliance and Verification Issues

The compliance and verification requirements for a 24 hour or 7 day timer for combined hot and cold water dispensers could be similar to those outlined for standby power controllers including:

- Site and authorised signatory details, serial number of the timer, type of equipment the timer is plugged into, etc.
- Verification that the equipment is an approved type
- The installer to provide the authorised signatory with product information including an explanation about how the timer works and warranty details
- Confirmation from the installer and end user that the timers has been set up to switch off for a minimum of 9.5 hours per day outside business hours
- Provide evidence that the device has been physically installed.

## Recommendation

It is recommended that the activity of fitting a generic 24 hour or 7 day timer to combination hot and cold bottled water coolers become a VEET approved activity in the future, post-2012, when further information and clarification has been obtained.

Items that require further clarification in order to introduce this activity include:

- Prepare a more detailed activity specification and implementation plan for rapid deployment of this activity through existing supply channels.
- Combined boiling and chilled water dispensers can consume up to 60% more power than the sum of energy consumed in individual boiling or chilled dispensers. Preliminary abatement calculations did not include these losses. Explore to what extent industry has addressed this issue, and if a nominal allowance that reflects the typical stock should be included in the abatement value.
- As suppliers of hot and cold water coolers are likely to fit timers to newly installed units as well, assess if there is merit in expanding this activity to cover new models with built in switch off timer features and what criteria would be required to guarantee the timer was programmed to switch off during the designated times.
- The answers to these items would require further consultation with key industry stakeholders (i.e. Aquacooler, Zip Industries, Neverfail/Coca-Cola Amatil, Waterworks, etc.).

# Proposed Activity: Glass Door Merchandisers (GDM)

## Equipment Variation and Potential Activity

The ownership of the equipment varies between privately owned and those owned by beverage supplies. Privately owned equipment is common in the independent supermarket, master grocers and convenience store sectors, and such equipment is older and likely to be amenable to retrofitting of either timers or Energy Management Systems (EMS).

Beverage supplier owned equipment is often newer and more sophisticated, and may include communication links to advise suppliers on restocking requirements. Such equipment can not have simple timers installed, but the retrofitting of Energy Management Systems may be applicable. However, beverage suppliers have had programs in place to refurbish their existing fleet with EMS and more efficiency lighting technology for several years, so the market potential for this activity may be much less in this market segment. As timers or EMS will therefore not be suitable to be retrofitted to all equipment, it will be important to be able to define which models of equipment are appropriate for such installation.

Another issue is the technical specification of the features of the EMS. Certain minimum features in the EMS need to be defined in order to be assured that the installation of the EMS will create a minimum energy savings. These specification form part of the potential activity specification.

## Potential Specification

The potential description of this revised activity might be:

*"Installation of either a generic timer device on approved glass door merchandisers containing non-perishable products to switch off the equipment during non-business hours or the retrofit of a purpose designed Energy Management System approved for use with specified glass door merchandisers".*

The Energy Management Systems could include a range of systems that employ night set-back features and motion sensors coupled with fuzzy logic self-learning pattern capabilities, purpose designed to reduce the amount of energy used by the GDM.

The potential specification might be dissected into two parts and contain references to:

1. Installation of a generic timer device:

- Being applicable to vertical refrigerated display cabinet with glass doors used to display and refrigerate non-perishable beverages within prescribed temperature limits (i.e. typically from 2 to 5°C).
- The technical specification for a suitable timer is required and the range of permitted settings (i.e. off for a minimum of 9.5 hours between 7 pm and 8.30 pm, 7 days per week), plus that the timer would need to meet Australian Electrical standards and not require resetting in the event of a power outage
- Contain a definition of non-perishable goods.

2. Retrofit of an Energy Management System:

- Technical specification which defines the technical characteristics (i.e. night set-back feature and fuzzy logic with self-learning pattern capability) that the EMS must have in order to be approved as a EMS that will produce a minimum energy saving of 20%[14].
- Only the installation of approved EMS will be accepted as an approved VEET activity.
- The EMS must have a turn up or night setback features (i.e. raise set point outside business hours from 2-5°C to 7-11°C) and a deemed turn up temperature, to be determined, or refrigeration load management features.
- The EMS must have the ability to identify the level of activity with a motion sensor or a sensing probe used to sense the temperature inside the display case (some controllers use wireless sensors).
- A list of GDM models and which EMS is approved for use by the equipment manufacturers will be required.

These devices can be plug in devices or retrofitted in the equipment. An example of a plug in device that includes these features is the DFx 2eRT. Other solutions could include controllers mounted in a junction box or retrofitted in the GDM. The list of approved products would need to detail the full product codes of controllers rather than the generic family model numbers as specialised energy management features are not typically standard features.

Further investigation is required with beverage suppliers to confirm what temperature setting or constraints may need to be considered for perishable or long life beverages.

For both timers and EMS activities, the following would be excluded from being used in this VEET activity:

[14] Note: Advanced EMS can achieve savings of 30%, but without a standardised method of accurately measuring the energy savings achieved by the EMS, it will be assumed al EMS achieve a 20% savings.

- All vertical glass door merchandisers with an existing Energy Management System
- Open display cabinets (i.e. no doors) as they are poorly insulated, very inefficient and consume too much energy re-chilling the beverages.

## Energy Savings and Additionality

The main energy saving opportunity with this activity is from switching off ancillary components such as the lights, fans and standby power as some of the compressor run time savings would be consumed bringing the product (beverages) back to temperature.

The magnitude of the energy savings depends on the size of GDM (i.e. 1 door, 2 door or >2 doors) and many other factors including the rated energy performance under test conditions, test temperature, insulation (cabinet and doors), equipment vintage, maintenance, door seals, controller (advanced or mechanical), lighting type (fluorescent T8 or T5, or LED), climate zone, air flow around condenser, end user behaviour (number of door openings, temperature of the beverage on entry), etc. In addition many of the devices operate in ambient or close to ambient conditions that are subject to seasonal variations and are typically harsher than laboratory test conditions.

**Savings from a generic timer device**

The proponents estimated energy savings potential for 1 and 2 door GDM to be 800 kWh and 1,200 kWh per annum respectively, based on installing a timer that turns the refrigerators off for an average of 9.5 hours per day, seven days per week. The carbon abatement for the 1 door GDM was estimated to be 3.9 t $CO_2$ and the 2 door 5.8 t $CO_2$, both calculated over a 5 year lifespan. The deemed lifespan of 5 year takes into account the expected life of the equipment and assumes that once the timers are in place, the devices are unlikely to be removed for an estimated 5 year period. These estimated savings were based on field trails undertaken by the proponents.

*AS 1731 Refrigerated display cabinets* covers glass door merchandisers and part 14 provides MEPS requirements and maximum energy consumption for high efficiency self-contained display cabinets for a range of refrigeration display cabinet categories. The efficiency levels in *AS 1731* are expressed as the total energy consumption (TEC, kWh/day/$m^2$) per 24 hours per total display area (TDA). The main categories covering GDM are IVC4. AS *1731* is currently under review by the ME008 standards committee.

Deemed savings can be estimated using this standard if we assume that the average efficiency level of a GDM is between MEPS and HEPS levels, and the typical TDA of a single door and twin door unit is 0.8 and 1.2 respectively. Switching the equipment off for 9.5 hours reduces the operating time by around 40%, however an energy penalty needs to be included that equates to around 10% for restarting requirements. The net savings equates to estimated energy savings of 1,200 kWh/year for the single door unit and 1,800 kWh/year for the two door unit. This equates to a carbon abatement potential of 5.8 to 8.8 t $CO_2$-e respectively over a 5 year period. Providing the equipment did not have an

existing EMS, the savings from the switch off timer would be additional to the BAU scenario.

**Savings from retrofit of an Energy Management System**

Estimating savings from specialised controllers is more complex as there are more variables to consider, however field trials from equipment manufacturers and owners demonstrate significant savings across large and diverse samples. For example, one trial consisted of 84 coolers, located in different trading environments, air conditioned and non-air conditioned, and fitted to different models and generations of equipment and resulted in averaging a saving of more than 20% of total energy consumption per annum.[15] This and other research undertaken by GDM suppliers indicates a 20% or more saving for equipment fitted with appropriate ERM is to be expected.

Using the same assumptions as those used in calculating the energy savings for the switch-off timer, and assuming a EMS with an annual saving of 20%, the savings from ERM installations equates to a carbon abatement potential of 3.9 t $CO_2$-e for the single door unit and 5.8 t $CO_2$-e for the two door unit over a 5 year period.

## *Implementation and Quality*

The activity of fitting a 24 hour or 7 day timer simply involves plugging the device into the wall socket and has the benefit of not requiring specialized skills for installation. However, the activity is not as straight forward as installing standby power controllers on TVs and videos, as it could involve moving a heavy 2 or 3 door drink cabinet that contains products for resale to consumers.

Options should be explored to minimise the OHS risk such as involving service agents or practitioners that are familiar with the equipment or excluding equipment over a certain size. This activity has been trialled in the supermarket industry with IGA stores and some lessons could be learned from this trial concerning any OH&S issues and with what cabinet types or sizes.

The ownership of the equipment is likely to affect the willingness to install timers and the resulting energy savings, as ownership often affects the age and efficiency of the equipment. A high proportion of GDM are owned by beverage suppliers (i.e. Coca-Cola Amatal and Schweppes-Pepsi) and they have had programs in place to refurbish their existing fleet with Energy Management Systems and more efficiency lighting technology for several years. However, some beverage display equipment is privately owned, particularly in the independent supermarket, master grocers and convenience store

sectors. The deployment of timers could even be coordinated through independent chains and fitted by storeowners, providing the compliance and verification conditions were met.

Installers would need to check that the equipment does not contain perishable goods. Some types of orange or fruit juices may be an issue, and will need to be defined in the product specification for the activity. An option that could be considered is to combine a label with this activity along the lines of "Non-perishable goods only".

Fitting of specialised controllers may require a technician, however some control devices simply plug into the wall like a timer and only require a wireless sensor to be fitted in the display case or the attachment of a motion sensor nearby to detect activity. There may be controllers that will require service agents or practitioners that are familiar with the equipment to perform this activity as an upgrade or retrofit. Using skilled practitioners will certainly minimise the OHS risk associated with the activity of fitting Energy Management Systems.

A potential concern was raised by the proponents associated with installing generic timers, due to the impact of switching off the refrigeration equipment mid cycle and the effect this may have on the compressor and components. Some energy management systems contain a current sensor which determines if the refrigeration compressor is operating, and will delay power-down. Consultation with several compressor (Sanden, Danfoss and Kirby) and equipment manufacturers (Coca-Cola Amatal), and the Air conditioning and Refrigeration Equipment Manufacturers Association (AREMA) suggested switching off the refrigeration equipment mid cycle is not a concern. The general explanation given is these refrigeration systems are designed to stop and start, plus they have capillary systems that allow the pressures to balance out and restarting several hours later is unlikely to cause any issues. The same technical explanation would apply to refrigerated beverage vending machines and water coolers.

## *Innovation and Industry Development*

There is limited potential for innovation associated with fitting a basic timer to GDM, however there is potential to develop specialist bolt-on control devices or retrofit kits, which have been designed specifically for this application. Some of these already exist, but further improvements may be possible.

## *Compliance and Verification Issues*

The compliance and verification requirements for a generic 24 hour or 7 day timer for GDM could include:

- Site and authorised signatory details, serial number of the timer, type of equipment the timer is plugged into, etc.

- Verification that the equipment is an approved type and has not been refurbished in a way that limits the energy saving potential of the activity
- The installer to provide the authorised signatory with product information including an explanation about how the timer works and warranty details
- Confirmation from the installer and end user that the timers has been set up to switch off for a minimum of 9.5 hours per day outside business hours
- The installer would need to explain that only non-perishable goods can be used in the equipment and if deemed necessary place a non-perishable goods label on the equipment (placement to be determined)
- Provide evidence that the device has been physically installed.

The compliance and verification process for specialised EMS could include:

- Verifying the EMS fitted is an approved device, as indicated by the list of approved EMS that meet the technical and other specifications
- Verification that the equipment is approved by the equipment manufacturer for the specific EMS to be fitted
- Confirmation that the activity detection device (i.e. temperature sensor or motion sensor) is set up correctly
- Confirmation from the installer and end user that the EMS has been set up to achieve the deemed energy saving potential of the activity
- A requirement that the installer explain that certain perishable goods cannot be used in the equipment

Further consultation with beverage companies is required to assess which beverages (i.e. fruit juices, long life products, dairy, etc.) may be affected (if any) and need to be excluded.

## *Recommendation*

It is recommended that the activity of fitting either a generic 24 hour/ 7 day timer or a purpose designed EMS to glass door merchandisers become an approved VEET activity when further information and clarification has been obtained.

In order for the activity to become an approved VEET activity, it is recommended that:

- Prepare a more detailed activity specification that provides greater detail of the target equipment (i.e. generic definition with a list of equipment to be included) and EMS specifications (including essential features, setup and minimum energy saving potential)

- Prepare an activity implementation plan that enhances the opportunity of success and minimises the associated risks of implementing this activity. This would enhance the understanding and define what circumstances it is essential for a skilled

practitioner undertake this activity, and how appropriate GDM for timers or EMS can be identified.

- Further consult with key industry stakeholders (i.e. beverage companies, Independent Supermarket Chains, EMS suppliers and equipment manufacturers/suppliers such as Williams Refrigeration, Sanden, Skope Refrigeration, etc.) in order to provide clarification on potential OH&S issues connected with EMS installations, identify risks to GDM products or GDM functioning and how these can be reduced, reducing any other compliance and verification issues, and develop the list of approved EMS and the list of which EMS can be fitted to which GDM.

# Proposed Activity: Refrigerated Beverage Vending Machines

## Equipment Variation and Potential Activity

There are two major types of beverage vending equipment:

- Closed RBVM
- Glass fronted RBVM.

The most common beverage vending machine is the closed front machine, used to vend cans and/or bottles. With closed front machines, the product cannot be seen and the machine either has signage or a backlit panel on the front advertising the contents.

The use of timers on RBVM was considered but rejected due to the sophistication of current RBVM stock. More recently produced RBVM equipment can have stock and income management systems with GPS and communication technology. The use of a timer may interfere with these features or business practices. However, a specialised EMS specifically designed for this application and approved for use by equipment manufacturers could produce greater energy savings than a generic timer and would not interfere with the RBVM functioning.

The Energy Management Systems could include a range of systems that employ turn up or refrigeration load management features, motion sensors, purpose designed control algorithms and fuzzy logic with self-learning pattern capabilities to reduce the amount of energy used by the GDM.

An example of an EMS in wide use in North America is the VendingMiser. This device commonly incorporates a Passive Infrared Sensor (PIR) to power down the machine when the area surrounding it is vacant. It then monitors the room's temperature and automatically re-powers the cooling system at one to three hour intervals, independent of sales, to ensure that the product stays cold. This product has been extensively field tested with independently documented energy savings of around 35% and more in specific applications.

## Potential Specification

The potential description of this revised activity might be:

*"Installation or retrofit of a purpose designed Energy Management System approved for use with specified Refrigerated Beverage Vending Machines".*

The potential specification might include:

- Defining that the activity includes both closed and glass fronted RBVM.

- A list of RBVM models and which EMS is approved for use by the equipment manufacturers.
- A technical specification so the EMS will achieve the expected 35% energy savings, and the specification will need to include that the EMS must have refrigeration load management features, (i.e. raise set point from 2-5$^{o}$C to 7-11$^{o}$C or switch off outside business hours), motion sensors to detect activity levels and fuzzy logic with self-learning pattern capability.
- Excludes all RBVM that are currently equipped with an Energy Management System.

Further investigation is required with beverage suppliers to define what will be deemed to be perishable products and which could be damaged through the changing of storage temperatures.

## *Energy Savings and Additionality*

The main energy saving opportunity with RBVM is from switching off ancillary components such as the lights, fans and standby power as some of the compressor run time savings would be consumed bringing the product (beverages) back to temperature. However this is not the case with all designs – for example, equipment that only refrigerates the bottom drinks ready to be dispensed would require less energy to re-chill the beverages.

Efficiency levels of RBVM are covered under *AS 4864, Part 1: Performance of refrigerated beverage vending machines* and *Part 2: Minimum energy performance standard requirements*. The standard provides energy performance calculations in kWh/day based on vending machine capacity of 355 ml cans. These test methods and MEPS levels for RBVM were published in 2008, however they have not been subject to energy efficiency requirements in Australia. The MEPS requirements and high efficiency levels proposed are the same as US ENERGY STAR Tier 1 and Tier 2 respectively. In 2008 it was estimated that US RBVM manufacturers have about 80% market share of equipment sold in Australia and the majority of this equipment was US ENERGY STAR rated. However, the other 20% of annual sales are dispersed amongst small importers/suppliers and many small business vending operators who typically import less efficient equipment.[16]

For the purposes of calculating deemed carbon abatement we have assumed the average efficiency level of the existing stock targeted by this activity is equal to the MEPS level. A typical RBVM with a capacity of 425 cans that meets the MEPS level will consume 2,506 kWh/year under test conditions. When fitted with a specialised controller that achieved a

minimum energy saving of 35%, this equates to a saving of 877 kWh/year and carbon abatement potential of 4.2 t $CO_2$-e operated over a 5 year period. Providing the equipment did not have an existing EMS, the savings would be additional to the BAU scenario.

The majority of the fleet of RBVM is owned and leased out by the major beverage companies (Coca-Cola Amatil and to a lesser extent Schweppes-Pepsi) and independent vendor operators (i.e. Smiths Snack Vend, Dixie Narco, Royal Vendors-CoinCo, Automatic Vending Specialists, Brivend, Professional Vending Services, R.P Vending, etc.). In 2005 the installed stock of RBVM in Australia was estimated to be 100,000 to 120,000. Further consultation is required with the major equipment owners and the Independent Vending Machine Association to gain a better understanding of size of the fleet with potential for fitting Energy Management Systems.

## *Implementation and Quality*

Products such as the VendorMiser, which has been widely deployed in North America have installation kits to simplify fitting and guidelines concerning how the motion sensor must be located. In some instances fitting or retrofitting a purpose designed controller will require service agents or practitioners that are familiar with the equipment to perform upgrades. Using skilled practitioners will certainly minimise the OHS risk associated with the activity of fitting Energy Management Systems.

The solutions and deployment of this activity is likely to be driven by the major market participants that own, lease and restock the equipment, and smaller independent operators with small fleets (on average ten machines) can mimic the major participants.

## *Innovation and Industry Development*

There is some potential for innovation to develop specialist bolt-on control devices or retrofit kits which have been designed specifically for this application. Some of these already exist, but further improvements may be possible.

## *Compliance and Verification Issues*

The compliance and verification requirements for fitting a specialised EMS to RBVM requires further consultation with equipment owners, manufacturers and suppliers. Some important considerations for implementation compliance will be as follows:

- Obtaining site and authorised signatory details, serial number of the EMS, type of equipment the device is to be fitted, etc.
- Verification that the equipment and EMS is an approved type and has not been refurbished in a way that limits the energy saving potential of the activity.

- The installer to provide the authorised signatory with product information including a manufacturer's manual about how the EMS works and warranty details.
- Confirmation from the installer and end user that the EMS has been set up to achieve the deemed energy saving potential of the activity.
- The installer may need to explain that certain perishable goods cannot be used in the equipment.
- Provide evidence that the device has been physically installed.

Further consultation with beverage companies is required to assess what constitutes perishable products (i.e. fruit juices, long life products, dairy, etc.) that may be affected by temporary increases in storage temperature.

## Recommendation

It is recommended that the activity of installing or retrofitting a purposed designed EMS to RBVM become an approved VEET activity in the future, post-2012, when further information and clarification has been obtained.

In order for the activity to become an approved VEET activity, it is recommended that:

- A more detailed activity specification be prepared that provides greater detail of the target equipment (i.e. generic definition with a list of equipment to be excluded) and EMS technical specifications (including essential features, setup and minimum energy saving potential).
- Prepare an activity implementation plan to enhance the opportunity of success and minimises the associated risks. This would aim to increase the understanding of OH&S issues and define in what circumstances it is essential for a skilled practitioner undertake this activity.
- Research be undertaken to determine what constitutes perishable products used in RBVM.

Further consultation with key industry stakeholders (i.e. beverage companies, major equipment owners, Independent Vending Machine Association, EMS suppliers and equipment manufacturers/suppliers such as Williams Refrigeration, Sanden, Skope Refrigeration, etc.) will provide clarification on these items.

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