

# *Residential Energy Efficiency Scheme Review of Energy Efficiency Activities Phase 2*

*Prepared for  
Essential Services Commission of South  
Australia*

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## *Executive Summary*

In August 2008, Regulations were made under the Electricity Act and Gas Act giving effect to the Residential Energy Efficiency Scheme (REES) announced by the South Australian Government in February 2008. An initial list of approved energy efficiency activities was established by the Minister which included a detailed specification for each activity and deemed CO<sub>2</sub> equivalent emission reductions applicable to each activity.

The Essential Services Commission of South Australia (the Commission) has the function of maintaining, reviewing and amending the list of approved activities (including specifications and deemed values) and must do so in accordance with requirements set by the Minister. The Minister has further specified in a Protocol in November 2008 that the Commission must complete a review of the entire list of approved activities by 1 July 2011. The review is being conducted in 3 phases and this report addresses the requirements of the second phase of the review.

The Phase 2 review was to consider the various contextual factors that influence the take-up of energy efficiency activities in the residential sector in South Australia. Specifically, it involved a review of trends in these factors that might lead to changes in the approved activities (including specifications and deemed values). It could include approval of new activities for further investigation.

The main contextual factors which impacted on existing activities were changes in regulatory standards, especially appliance MEPS, and changes in technical potential as market changes reduced the number of potential installations of some efficient technologies. These particularly affected lighting, air conditioning and showerhead replacement activities.

The review of the existing activities found all activities were recommended to continue, subject to recalculation of their deemed emission savings. Several activities will have significant reductions in their deemed emission impacts when recalculated for 2012-14, such as:

- Showerhead replacements, by around 40% depending on the continuation of the Waterwise and similar programs
- Removal of older refrigerators or freezers, by around 30%
- Installation of reflector lamps by 10% and of general purpose lamps by around 40%
- Installing efficient ductwork, by around 15-20%
- Installing or replacing cooling systems, by around 10%.

With regard to potential new activities, there are a considerable number of activities that are being adopted or investigated by other Australian energy efficiency schemes which may be applicable to South Australia. There are also a few additional activities yet to be

explored interstate. The list of activities which are recommended for further investigation in Phase 3 of the review includes:

- Purchasing high efficiency televisions
- Purchasing high efficiency electric clothes dryers and installing high efficiency gas clothes dryers
- Purchasing high efficiency dishwashers
- Installing thermally efficient windows
- A variety of lighting improvement measures
- Installing underfloor insulation
- Installing wall insulation
- Standby Power Controller<sup>1</sup>
- Installing high efficiency pool pumps
- Installation of an in-home display energy consumption device
- Installing down light caps.

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<sup>1</sup> Note: Also known as smart power boards or standby power savers

## *Introduction*

### *Background*

In August 2008, Regulations were made under the Electricity Act and Gas Act giving effect to the Residential Energy Efficiency Scheme (REES) announced by the South Australian Government in February 2008.

REES forms part of the Government's commitment to addressing the impacts of climate change. The Scheme is intended to reduce greenhouse gas emissions and energy costs for South Australian households by requiring licensed electricity and gas retailers to assist households to adopt energy efficiency improvements. The Regulations establish the Essential Services Commission of South Australia (the Commission) as the administrator of REES, and provide for the Minister for Energy (Minister) to set overall annual targets for residential sector energy audits and reductions in greenhouse gas emissions to be met by retailers through application of approved energy efficiency activities, commencing January 2009. As Scheme administrator, the Commission is required to apportion the overall annual targets amongst retailers, to assess retailers' performance against the specified targets, to manage the list of approved energy efficiency activities, and to monitor and report to the Minister on retailer progress in achieving the Scheme targets.

An initial list of approved energy efficiency activities was established by the Minister in accordance with the REES Regulations in October 2008. This approval included a detailed specification for each activity and deemed CO<sub>2</sub> equivalent emission reductions applicable to each activity.

The initial list of approved activities was as follows:

- Replace an inefficient showerhead with an efficient showerhead;
- Install ceiling insulation where no insulation has previously been in place;
- Install draught proofing products;
- Remove and destroy a primary or secondary refrigerator or freezer;
- Replace an incandescent lamp with a compact fluorescent lamp;
- Install insulated ductwork to a ducted reverse cycle air conditioner or gas central heater;
- Replace a ducted reverse cycle air conditioner with a ducted evaporative air conditioner;
- Replace an existing heating/cooling system with an efficient system; or install a small or large efficient system; and
- Install or replace a water heater with a water heater of specified type.

The Commission has the function of maintaining, reviewing and amending the list of approved activities (including specifications and deemed values) and must do so in accordance with requirements set by the Minister. The Minister has further specified in a Protocol in November 2008 that the Commission must complete a review of the entire list of approved activities by 1 July 2011, with any amendments to the list (including specifications and deemed values) to take effect from 1 January 2012. The Minister has specified in the Protocol various contextual factors and principles and other matters to which the Commission must have regard in the conduct of this review as well as more generally in its role of maintaining, reviewing and amending the list of approved activities.

### *Terms of Reference*

The Commission began the review of the current list of approved REES energy efficiency activities as at July 2010 in order to establish the list (including specifications and deemed values) to apply from 1 January 2012 in accordance with the Commission's powers under the Electricity and Gas Acts and Regulations, and having regard to the contextual factors and principles specified by the Minister in the Protocol of November 2008.

The review is being conducted in 3 phases as follows:

#### **Phase 1**

Phase 1 was to establish a baseline for the review. It involved documenting both the list of approved REES energy efficiency activities (including specifications and deemed values) as at 1 July 2010 and also the assumptions (e.g. relating to contextual factors) underlying the specifications and deemed values for these activities. Obviously documentation for the current list of activities already existed in a public form but the documentation for the assumptions did not exist in such a form.

The output of Phase 1 was a comprehensive statement of the currently approved energy efficiency activities and underlying assumptions for each.

#### **Phase 2**

Phase 2 is to consider the various contextual factors that influence the take-up of energy efficiency activities in the residential sector in South Australia. Specifically, it required a review of trends in these factors that might lead to changes in the approved activities (including specifications and deemed values). This could have included approval of new activities.

The current report will provide input for the conducting of Phase 3.

Contextual factors specified by the Minister include existing and planned regulatory requirements, changing Australian standards, experience of REES implementation over the first 1-2 years of the Scheme, relevant research outcomes, changes in business as usual (counterfactual) scenarios for residential energy efficiency, changing penetration potential



for energy efficiency activities, energy price movements, technological changes and innovations, and residential appliance mix and energy use.

It was recognised that there may be other relevant contextual factors (e.g. constraints to the adoption of specific activities), and these were to be identified and analysed as part of this phase of the project. Such contextual factors are of course strongly inter-related, and the review of trends in the factors was to account for the interactions. The review was also to consider residential energy efficiency developments, including the status of residential energy efficiency schemes similar to REES, in other jurisdictions.

The output of Phase 2 was to be a report that documents trends in the contextual factors, including REES experience, and draws conclusions regarding the implications of these trends for the take-up of residential energy efficiency activities in South Australia and the greenhouse gas emission reductions arising from these activities, both the activities already approved for REES purposes and activities that are not yet approved. It was to indicate possible amendments (additions and deletions) to the list of approved REES activities.

EnergyConsult were commissioned by the Commission to undertake the Phase 2 research and to provide the report which documents this output. The current report is the output of Phase 2.

### **Phase 3**

Phase 3 is to be conducted after Phase 2 has been completed.

Phase 3 will involve a detailed analysis of candidate energy efficiency activities (existing activities if not excluded through Phase 2 as well as any new activities that may have been nominated in Phase 2) to assess their suitability for inclusion in the approved list of activities to apply from January 2012 and to determine the appropriate specification and deemed value for each activity, having regard to the principles specified in the Ministerial Protocol and any other principles considered relevant to this matter.

In the consideration of activities, the Protocol requires that the Commission's review have regard to several key principles, including that a range of different activities are available for implementation; that energy savings arising from activities should be robustly determined, be additional to a business as usual scenario, and be achievable with a high degree of confidence; and that each activity should be capable of broad implementation, be accessible in the market, and be able to cost effectively reduce greenhouse gas emissions in the South Australian residential sector.

The Protocol also specifies that calculated deemed values should be informed by credible research, be based on a defensible methodology, and be appropriate to South Australian conditions. Specifications for approved activities should balance the energy savings and compliance costs, and provide appropriate installation requirements.

The output of Phase 3 will be a report that makes conclusions on approved REES activities (including specifications and deemed values) to apply from January 2012 and fully documents the basis of those conclusions, including the reasons for any amendments to the currently approved activities (including specifications and deemed values).

### *REES Protocol*

A Protocol was set by the Minister in November 2008 for establishing and maintaining the list of eligible energy efficiency activities under the REES. The Protocol provides requirements and guidance regarding the nature of the Phase 2 review.

The Minister set the list of eligible energy efficiency activities (including deeming values and minimum specifications) for the purposes of the REES by Notice in the Government Gazette on 30 October 2008 (“initial list”). Pursuant to regulation 7AN of Part 2AA Electricity (General) Regulations 1997 under the Electricity Act 1996, and regulation 8DK of Part 2AA Gas Regulations 1997 under the Gas Act 1997, the Commission has the function of maintaining, reviewing and amending this list. It must do this in accordance with any requirements set by the Minister.

The Protocol establishes the key principles and constraints which the Commission must have regard to in maintaining and reviewing the list of activities, their specifications and deeming values.

The Protocol is not intended to be exhaustive. In particular it is not intended to prescribe the process by which the Commission will maintain the list of activities. This is for the Commission to determine in its function as scheme administrator.

#### Timing constraints

Some constraints established by the Protocol are:

- The Commission must not materially amend the initial list of activities as gazetted by the Minister within the first three years of operation of the REES.
- *Exception* - the “Guidance Notes” section of each activity may be amended at any time to provide additional explanation where appropriate as the scheme evolves. Whilst retailers are encouraged to give consideration to these, they are not mandatory for compliance purposes.
- The Commission may add new activities at any time, provided these are consistent with the principles outlined in the Protocol.
- The Commission must undertake a review of the whole of the list of activities once every three years. The first of these reviews must be completed prior to 1 July 2011, with changes not taking effect until 1 January 2012. The terms of reference for the

review must be developed in consultation with the Department for Transport, Energy and Infrastructure.

#### Structure and format:

The Commission should have regard to, and seek to maintain, the structure and format used in the initial list of activities as gazetted by the Minister.

#### Context for review

The purpose of maintaining and reviewing the list is to ensure it contains the most relevant activities and with appropriate specifications and deeming values. Key factors impacting on the list going forward will include:

- Existing and planned regulatory requirements - this landscape changes frequently, both at state and national levels, and impacts particularly on the extent to which REES activities result in “additional” savings beyond what would otherwise occur;
- Changing Australian standards – standards and best practice change, and new standards are introduced;
- Experience of implementation - the experience of REES participants in implementing activities in accordance with the minimum specifications, may inform the refinement of those specifications;
- Research – ongoing research will continue to inform activities, energy savings and deeming values;
- Changes in business as usual - for example, there is growing awareness of how household energy use and consumer choices impact on the environment. This is expected to contribute, in turn, to changes in habits, behaviours and choices going forward. Determining what is “additional” to this changing business as usual needs to be subject to ongoing review and analysis;
- Changing penetration potential - activities will reach a saturation point over time i.e. a point at which it is no longer practical to implement because most dwellings can be expected to have undertaken the activity;
- Tariff and cost increases – whether due to inflation, a price on carbon, or some other stimulus, energy prices are likely to rise going forward. This tends to improve the cost effectiveness of existing activities, and may make other activities more viable for implementation. Costs of undertaking activities also change over time;
- Technological changes and innovations – other opportunities to improve household energy efficiency are likely to emerge, and this may also make some existing activities more cost effective; and
- Appliance mix and energy use – the mix of household appliances and energy use practices changes markedly over time.

The above factors all needed to be considered in the Phase 2 review.

General principles for all activities:

In reviewing existing activities, and in considering adding new activities, the Commission should have regard to the following key principles:

- *Flexibility* – a range of different energy efficiency activities should be available for implementation.
- *Additionality* – activities should encourage energy savings which are additional to that which would otherwise be achieved under current and planned regulatory requirements; and/or which is otherwise occurring through business as usual or consumer behaviour. This includes consideration of what barriers or market failures prevent further uptake of the activity.
- *Verifiability* – potential energy and greenhouse savings from an activity should be robustly determined and verifiable, based on sound research applicable to the South Australia climate zone/s.
- *Consistency of the saving* - there should be a high level of confidence that the estimated savings could be achieved in the majority of circumstances. For example, the activity does not predominantly rely on variable human behaviour or accurate use by the household; hardware is likely to remain in place rather than be uninstalled by the household; or implementation is the subject of defined standards which underpin quality assurance and consistency of performance.
- *Penetration potential* – the activity should be technically capable of broad implementation and uptake by households within South Australia, within the Priority Group<sup>2</sup> and/or non-Priority Group.
- *Accessible and practical* – the activity should be accessible in the market and able to be practically and relatively easily implemented in the residential sector.
- *Cost effectiveness* – benefits from the activity should be capable of cost effectively contributing to achievement of greenhouse gas reduction targets for South Australia (cost per tonne saved). Costs includes consideration of hardware and installation costs; program or administration costs in delivering the activity to households; the type and level of incentive likely to be required to encourage uptake; and access to government or other rebates to reduce costs. Savings include direct financial savings

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<sup>2</sup> The Priority Group consists of households eligible for various Commonwealth Government concession or health cards, or eligible for the SA Government Energy Concession. Energy retailers are obliged to obtain 35% of their greenhouse reductions from Priority Group households.

from reduced energy use and associated financial savings, such as water savings from water efficient showerheads.

- *Other schemes* – the Commission should have regard to activities and specifications eligible in similar schemes in other state jurisdictions, striving for consistency wherever achievable and appropriate to allow synergies for participants operating in multiple jurisdictions. This should be regarded as secondary to all other principles.

#### Specific principles for calculating deeming values

Deeming values are typical greenhouse gas savings (tCO<sub>2</sub>-e) and must be informed by credible research, a defensible methodology and calculated having regard to the climate zone/s, typical housing stock, and energy use practices for South Australia. Calculations should include consideration of the following:

- Base case – current typical energy use where an inefficient product is used or where no efficient product is installed, using recognised benchmarks where available.
- Improvement on the base case – what, typically, would be the difference in energy use by installing or using an efficient product.
- Lifetime – the typical period of time the activity can realistically be expected to result in energy savings which are additional. To account for future uncertainties a maximum lifetime of 20 years should apply, although a longer lifetime may apply if substantiated through appropriate research findings.
- Adjustment factors – energy savings may need to be adjusted where it is necessary to account for, for example, the extent to which the energy savings will be taken as improved thermal comfort, likelihood of performance changes over time; changing business as usual, or an adopted regulatory change that is to be apply in the future.
- Climate zones – whether there is a material difference in the savings achieved when the activity is implemented in different South Australian climate zones.
- Greenhouse gas co-efficients, both current and projected over the life of the activity – these are as published by the Commonwealth Department of Climate Change.

These principles needed to be considered when undertaking the Phase 2 review.

#### Specific principles for specifications

The purpose of the specifications is to maximise the energy saving and greenhouse benefits to households in implementing activities, and assist in ensuring the deemed savings are achievable in most, if not all, circumstances. Specifications should:

- Strike a balance between maximising achievement of savings; and minimising cost of compliance;

- Recognise that most activities are also subject to other requirements at law, for example, electrical installation and safety requirements;
- Require any hardware associated with an activity to be installed (i.e. no giveaways), except where it is considered that in most, if not all, circumstances installation will result (for example, with the current exchange of showerheads activity);
- Wherever appropriate, expressly exclude the potential for the activity to be undertaken where it is otherwise required by law, for example, as part of a development approval;
- Use existing Australia/New Zealand (AS/NZS) standards for installation, performance and safety, wherever applicable and appropriate for quality assurance, consistency of implementation and compliance;
- Have regard to health and safety implications of undertaking the activity in the residential sector, making explicit provision where necessary;
- Endeavour to ensure any inefficient products which are replaced or removed are taken out of circulation and preferably destroyed;
- Minimise the potential for perverse results through misuse of the scheme or its requirements;
- Encourage recycling and best practice; and
- Have regard to how activities are specified in other schemes, wherever appropriate, with this being secondary to all other factors.

These principles also needed to be considered when undertaking the Phase 2 review.

## *Methodology*

The review and analysis of the contextual factors influencing REES activities involved a number of tasks, as follows:

- Project initiation meeting
- Identification and research of contextual factors
- Analysing impacts of trends or changes in contextual factors on energy efficiency activities
- Determine possible amendments to list of approved REES activities
- Prepare report

These tasks will now be described in further detail.

### **Project initiation meeting**

The project initiation meeting enabled EnergyConsult staff to meet with Commission project managers to discuss the nature of the project, further clarify the project background and deliverables, and to arrange project liaison and contact details.

A second important purpose of the project initiation meeting was for EnergyConsult to obtain copies of all relevant documentation concerning the contextual factors that the Commission had available. Such information included the most up to date information on the take up of REES activities, information on SA programs, background reports on the preparation of deeming values for activities etc.

### **Identification and research of contextual factors**

For each existing REES activity, and for any activities likely to be proposed, the potential contextual factors that may influence the impact of the activity and the approval of the activity, were identified. Each activity was then reviewed to identify the relevant factors and then consider potential interactions of the factors to identify other factors. Some of the factors to be considered include changes in appliance and building regulatory standards, changes in market trends affecting efficient appliance availability, price changes, energy cost trends, greenhouse intensity, customer usage trends, changes in consumer decision making, past take-up of REES activities, remaining technical potential, experience in other interstate residential energy efficiency programs, etc.

Having identified the contextual factors, research was conducted to determine the trends and changes in the contextual factors. Research was conducted via publicly available documents, through documents obtained from the Commission and through EnergyConsult's access to information on appliance regulatory programs through our

involvement with the E3 program<sup>3</sup>. Primary research, such as market research of trends, was not undertaken due to time and budget constraints. However, a number of activity suppliers were interviewed to obtain a better understanding of the factors currently affecting the market and activity uptake.

The output of this research was identification of trends and changes affecting the contextual factors which will influence the REES approved energy efficiency activities.

### **Analysing impacts of trends or changes in contextual factors**

The trends and changes in contextual factors were then analysed to determine how they will affect the up-take, approval and deemed greenhouse emission savings of the relevant REES approved energy efficiency activities. The impact on potential new activities was also considered. Each activity was reviewed in turn and the exact nature of the analysis varied depending on the nature of the activities and the trends identified.

For example, the progressive introduction of minimum energy performance standards for lighting was a critical trend requiring analysis for lighting replacement actions, but changing efficiency and fuel usage for water heating affected the showerhead replacement activity analysis.

The output of this research was an analysis and an understanding regarding whether the trends and changes in the contextual factors would influence each REES approved energy efficiency activities, and if so what the impacts will be.

### **Determine possible amendments to list of approved REES activities**

The analysis of the impacts on the REES activities was taken a further step when it was apparent that changes in their context was altering the impact of the activities on greenhouse emissions. The rationale and calculations of the relevant activities was then reviewed and possible amendments to the deemed savings, or the activity being approved, recommended. Indicative changes to deemed values or specifications were developed.

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<sup>3</sup> The E3 program is the Equipment Energy Efficient program which promotes and regulates energy efficiency improvements in appliances and equipment and forms part of the National Framework on Energy Efficiency.



## **Prepare report**

A report was prepared that:

- identifies the contextual factors researched;
- documents trends in the contextual factors;
- draws conclusions regarding the implications of these trends for the take-up of residential energy efficiency activities in South Australia and the greenhouse gas emission reductions arising from these activities; and
- documents possible amendments to the list of approved REES activities, including indicative specifications and changes in deemed values.

## *General Contextual Factors*

Some factors affected the impact of all the existing activities, and will affect future activities. These factors are:

- Greenhouse emission factors for energy sources; and
- Cost of energy.

## *Greenhouse Emission Factors*

Greenhouse emission factors for electricity are determined by examining the greenhouse intensity of the generation of electricity from different sources and determining a weighted average that reflects the proportional contribution of the different generation sources. To forecast greenhouse emission factors therefore requires that the nature and proportional contribution of different generation sources be predicted. Marginal emission factors are commonly used to determine the impacts of energy efficiency gains.

The forecast greenhouse emission factors for electricity are currently based on the emission factors forecast by the Commonwealth Department of Climate Change and Energy Efficiency (DCCEE) for the Regulatory Impact Statements concerning energy efficiency initiatives. The emission intensity of electricity is forecast to decline over the next twenty years as the proportion of renewable and lower emission generation plants increases. The forecast emission factors have been revised since the REES was first started in 2009 and now differ slightly from the original forecasts used for the REES. However the changes between the forecasts are relatively small, as for the next ten years there is a maximum of 2% difference between the forecasts for any given year, so they will not materially affect the deemed savings of any REES activity<sup>4</sup>.

Updated emission factors, sources from the DCCEE, can be used for determining deemed values for REES from 2012-2014. These forecasts include the predicted impacts of a Carbon Pollution Reduction Scheme (CPRS) or carbon price mechanism in 2013.

Emission factors for other fuels, such as natural gas, LPG and wood have also been used in calculating the deemed emission savings from REES activities but the forecasts for these factors have hardly changed since the forecasts that were originally used in 2008 to calculate deemed savings.

## *Cost of Energy*

The cost of energy, and projections of future costs, is a key determinant in estimating the cost effectiveness of potential energy efficiency activities, and hence whether activities

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<sup>4</sup> Note: This does not mean that the emission factors do not change by more than 2% over the ten years, but simply that the forecasts for a particular year are largely consistent with each other.

could be considered acceptable under the Minister's Protocol. Rising energy costs will result in energy efficiency activities becoming more cost effective.

Increasing energy costs will also affect the BAU counterfactual scenario which is used to determine the additionality of the energy efficiency activities. If energy costs rise sufficiently then this could cause a market transformation with householders adopting more energy efficient practices as main stream behaviour.

The cost of energy in South Australia continues to rise and, for example, the cost of electricity for an average household will rise by an estimated 12% in 2011 according to announcements by the Commission in December 2010. Such energy cost increases are probably not sufficient to transform the market but they may make it easier to promote and encourage energy saving activities, such as those supported by REES.

## *Contextual Factors and Existing Activities*

With the exception of the general contextual factors previously mentioned, for each of the existing activities the set of contextual factors that will influence the energy and emission reductions resulting from the activity will vary. There are factors that are common across several activities, but for simplicity in presentation the factors relevant to each activity will be discussed in relation to the activity. Where some of these factors have been previously discussed in relation to another activity, this previous discussion will be referred to in order to reduce repetition.

The slight change in the forecast emission factors for the different energy sources will need to be taken into account when recalculating the deemed emission savings from activities in Phase 3 of the REES review. However, the impact of these changes have been ignored when estimating changes in deemed impacts in the discussion of existing activities below as the impact is very small and probably will be negated when the impacts are being rounded to the nearest 0.1 tonne.

## *Showerheads*

### *Activity Description*

The activity involves the supply of efficient, low flow showerheads to replace existing inefficient showerheads. The inefficient showerheads would eventually be replaced under the South Australian Water Heater Standards requirements, so this REES activity brings forward their replacement. The emission savings comes from reduced hot water use.

### *Regulatory Changes and Australian Standards*

Low flow shower heads dominate the retail market, so the majority of showerhead replacements can be expected to be to efficient showerheads. However, the normal turnover of showerheads will be low as showerheads last a long time, as they are highly durable. This situation has remained unchanged since the beginning of the REES.

Since July 2008 householders replacing their water heaters have been required to install low-flow showerheads or flow restrictors with a maximum water flow of 9 litres per minute. Consequently, the turnover of showerheads since 2008 will have been increased by these regulations and this was incorporated into the BAU scenario for the REES showerhead activity. The existing calculation for the impacts of showerhead replacements, via water heater replacement requirements, was for the activity to have median life till 1/1/2016. For the next stage of the REES, as three years have passed since the start of the REES, the median life of the remaining years will be shorter, which will affect the deemed value of any energy savings. In addition, the replacement of showerheads in response to the regulations will be affecting the penetration of low flow showerheads, as discussed in Penetration and Technical Potential below.

### *Implementation Experience*

The REES is expected to have implemented around 37,500 showerheads by the beginning of 2012, with 12,490 having been installed in 2009 and an anticipated further 12,500 for 2010 and 2011.

There was concern expressed by some REES activity providers that the market was reaching saturation for showerhead installations. The number of programs targeting this activity; i.e. H2OME Rebate Scheme, Waterwise Communities Program and REES scheme; and the regulatory requirements will have pushed the market towards saturation. There was also some concern that the hoarding of showerheads might be occurring and

that the offering of “free showerheads” by various programs does not guarantee that all or even many of the showerheads are ever installed<sup>5</sup>.

These concerns about market saturation and possible lack of installations will need to be considered when recalculating the impact of this activity, possibly by increasing the discount factor for the activity.

### *Research Findings*

No relevant findings.

### *Changes to BAU Scenario*

The BAU scenario has been that the inefficient showerheads will not be replaced except when the water heater is replaced. When the water heater is replaced under South Australian Water Heater Standards this means that inefficient showerheads in the vast majority of situations must be replaced with a low-flow showerheads or a flow restrictor fitted. This has meant that for the BAU scenario, the medium replacement date for inefficient showerheads was calculated to be 1/1/2016 and a lifetime of savings of 5.5 years. For Stage 2 of the REES, for 2012-2014, the lifetime of savings will decrease to 4.0 years as all remaining water systems will be three years older than when the original REES calculations were done.

The BAU situation has been modified by the presence of the H2OME Rebate Scheme which has been providing rebates to householders to encourage them to change their inefficient showerheads. Approximately 4,000 showerheads p.a. have been replaced under this program. The Waterwise Communities Program working with local councils has exchanged a further 32,000 during the last two years. This means a total of around 36,000 showerheads have been replaced independently from the REES since the scheme began in January 2009. A further 10,000 additional replacements are expected to occur under the Waterwise and H2OME programs in the first half of 2011. Assuming these programs continue, they will result in around 20,000 showerheads p.a. being replaced. Therefore a total of around 56,000 showerheads are expected to be replaced between Waterwise and H2OME by the end of 2011.<sup>6</sup>

As the operating life of a water heater is assumed to be twelve years, this implies 8.33% of heaters are replaced annually. This means in South Australia approximately 54,000 water heater replacements will occur annually. As approximately 50% of houses in 2008 will have needed to install low flow showerheads,<sup>7</sup> the South Australia Water Heater Standards will have been leading to around 27,000 low flow showerheads installations

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<sup>5</sup> Based on interviews with REES activity suppliers.

<sup>6</sup> The REES will also lead to a further 37,500 by the end of 2011, but these are not included in the BAU scenario.

<sup>7</sup> ABS 4602.0.55.003, *Environmental Issues: Water Use and Conservation*, March 2010

annually. The impact of the H2OME Rebate Scheme and the Waterwise Communities Program therefore have been to increase the rate of replacement of showerheads by 75% compared to what would occur under the South Australia Water Heater Standards alone. This means the assumed BAU average replacement date of showerheads will be brought forward.

The deemed savings from the REES showerhead replacement action is a function of the average effective lifetime of the action, and this is determined by the difference between the average time to replace a showerhead under the BAU scenario and when the showerhead is replaced under the REES. By Stage 2 of the REES, 2012-2014, the remaining hot water systems, and their showerheads, that have not been replaced under the BAU will be older than during Stage 1. This means the number of years before the showerheads are replaced under the BAU scenario is shorter, and hence the effective life of the REES replacement activity will be reduced. For Stage 1 of the REES, 2009-2011, the average effective lifetime of showerhead activities was 5.5 years, but For Stage 2 of the REES, the average lifetime of the savings will be 4.0 years. This reduction in the effective lifetime of the action between the two Stage is due only to the passage of time.

However, any changes in the BAU replacement rate of showerheads will affect the average number of years before they are replaced, which in turn will affect the average lifetime of the REES action. The Waterwise Communities program has increased the replacement rate of showerheads, and so has effectively decreased the forecast average life of any remaining inefficient showerheads. This will in turn decrease the effective lifetime of the REES action. So for Stage 2 of the REES, the average lifetime of the savings will be 4.0 years but it will drop to 2.2 years if the Waterwise Communities program continues to replace showerheads as quickly as it has been. In addition, the activity may need to be further discounted to address the concerns over installations not occurring.

### *Penetration and Technical Potential*

The penetration of low-flow showerheads has not been recently surveyed, so it must be estimated from existing survey data and information on the uptake of low-flow showerheads since the survey.

The ABS 4602.0.55.003 Environmental Issues: Water Use and Conservation survey reports that in October 2004 49.1% of households had low-flow showerheads. By 2008 this percentage was estimated at 55.2% and by March 2010 at 64.5%, which equates to approximately 425,700 households with low-flow showerheads and 234,200 without.

Since the March 2010 survey approximately 15,000 households can be assumed to have received low-flow showerheads from the H2OME Rebate Scheme and the Waterwise Communities Program, given the number installed over 2009 and 2010 as previously discussed, and a further 20,000 can be expected to be installed during 2011. This equates to an additional 35,000 showerheads installed as part of the H2OME Rebate Scheme and the Waterwise Communities Program by the end of 2011.

As previously discussed, under the South Australia Water Heater Standards, around 27,000 low flow showerheads installations occur annually due to these regulations. This means it can be expected that around 47,000 households will have had low flow showerheads installed between when the March 2010 ABS survey was conducted and the end of 2011. The REES can also be expected to add another 22,000 during this period, assuming around 12,500 p.a. are installed under the scheme.

The above figures indicate a further 104,000 households will install low flow showerheads by the end of 2011 since the ABS survey was taken. This means around 530,000 homes will then have low flow showerheads and around 130,000 will be without low flow showerheads at the beginning of 2012. However, this forecast may overstate the number of houses being converted to low flow showerheads as not all showerheads given away under the H2OME Rebate Scheme and the Waterwise Communities Program will be installed and the annual number installed under the South Australia Water Heater Standards will decline as the penetration of low flow showerheads increases. This means the forecast of the technical potential is conservative and may somewhat understate the potential.

This forecast though suggests there is considerable technical potential to reduce the energy and water usage through further installation of low flow shower heads under the REES, but this potential will be exhausted by the end of 2014, assuming the REES activities continue at their current installation rate. If the Waterwise program continues to replace showerheads at the rate it has been then this potential will be exhausted by early 2014.

### *Cost and Benefit Changes*

The cost of showerheads will not have significantly altered since the start of the REES but the energy cost saving benefits will have increased for householders due to the increased gas and electricity prices since the start of the REES. Also, the median lifetime of the activity savings has significantly decreased, from 5.5 to 4.0 years, assuming the Waterwise and H2OME programs do not continue past 2011, and to approximately two years if they do. However, using the original estimates of the energy savings from low flow showerheads and revised energy costs, the benefits were found to still comfortably exceed the costs for this activity, even if the Waterwise programs continue.

### *Technical Innovation*

Technical innovation is largely not an applicable factor for this activity. However, there is now 6-7 litre/minute, 3 star showerheads available<sup>8</sup> and the suitability of these for this activity should be further explored.

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<sup>8</sup> [www.waterrating.gov.au/products/index.html](http://www.waterrating.gov.au/products/index.html)



## *Appliance Mix and Energy Use*

As previously mentioned, the regulatory requirement to replace failed water heaters with efficient heaters will mean that a smaller proportion of householders will now have electric resistive water heaters, and larger proportions will have high efficient gas, solar electric or heat pump water heaters. However, this will not affect the water heaters where the REES activity is targeted, as the activity will only target households who have not had their water heater replaced, and hence a low flow showerhead installed.

### *Summary*

Due to the passage of time between Stage 1 and Stage 2 of the REES, and due to the impact of the South Australia Water Heater Standards, the effective lifetime of this activity will be much smaller during 2012-2014. The effective life of the action has decreased from 5.5 years to 4.0 years. As the effective life of an activity is related to its deemed impact, this decrease in its effective life will decrease its deemed impact to around 70% of its Stage 1 impact. However, the activity should remain cost effective but the impact of the activity will need to be recalculated.

In addition, the Waterwise Communities program has increased the replacement rate of showerheads, and so has effectively decreased the forecast average life of any remaining inefficient showerheads. This will in turn decrease the effective lifetime of the REES action and hence its deemed impact. Its impact will decrease to around 40% of the Stage 1 deemed impact if Waterwise and H2OME programs continue during 2012-2014.

It is recommend that this activity be retained, subject to a review of their deemed impact. In addition, the introduction of a more efficient technology standard, such as 3 star or 6-7 litre of water per minute maximum flow, should also be investigated, though these will not be suitable for some instantaneous systems.

## *Ceiling Insulation*

### *Activity Description*

The activity involves the installation of insulation in the ceiling area above living or habitable space, which has not been previously insulated.

### *Regulatory Changes and Australian Standards*

There have been no regulatory changes affecting this activity.

### *Implementation Experience*

As a result of REES ceiling insulation was installed in approximately 4,500 houses during 2009, with 461,291 square metres of insulation installed. During 2010 at least a further 1,906 had insulation installed.

Activity providers initially found this activity financially attractive as a result of the Government Rebate being offered and the large emissions savings per house, hence there was the financial incentive for them to market and manage this activity.

Concerns about the safety of installing insulation and the removal of the federal grant have led to a major reduction in installation numbers and the industry is only now starting to recover from this. These changes may continue to affect installations in 2011, again causing low rates of take up.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

The BAU scenario could have changed if the rate of retrofitting ceiling insulation altered since the REES began. During 2009 this would have occurred due to the Commonwealth Government Home Insulation Program, but as that program has discontinued, the BAU rate of retrofitting is expected to have returned to similar levels to that originally assumed for the REES activity.

The rate of BAU retrofitting of ceiling insulation is not included explicitly in the original deemed impact of activity calculations, but ABS survey report 4602.0.55.001<sup>9</sup>, reveals no

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<sup>9</sup> ABS survey report 4602.0.55.001, *Environmental Issues: Energy Use and Conservation*, March 2008

significant variation in the proportion without ceiling insulation between 2005 and 2008, suggesting there was minimal BAU retrofitting of ceiling insulation.

### *Penetration and Technical Potential*

The ABS 4602.0.55.001 survey also indicated around 56,000 homes were uninsulated and a further 95,400 were unsure if they were insulated.

Since 2008 the Commonwealth Government Home Insulation Program has resulted in approximately 35,000-40,000 homes being insulated in South Australia. Approximately 4,500 homes were included under the REES during 2009 but these probably were also part of the Commonwealth scheme. A further approximately 1,800 homes in 2010 were done under REES. This makes a total of around 40,000 homes that have been insulated since 2008.

The result of this insulation of homes is the number of uninsulated homes in South Australia, and hence technical potential in the State, has probably decreased by around 40,000 homes since the ABS survey conducted in March 2008. However, this information and the survey results suggest there are probably still more than 16,000 homes that still require ceiling insulation. For these uninsulated homes the potential to reduce energy consumption remains unaltered.

### *Cost and Benefit Changes*

The cost of insulation will not have significantly altered since the start of the REES, and the energy costs saving benefits will have increased due to the increased energy prices since the start of the REES. So this activity is still expected to be cost effective. However, since the removal of the Government Rebate, the effective cost to the home owner has greatly increased so the activity is now less attractive to householders.

### *Technical Innovation*

Not applicable to this activity.

### *Appliance Mix and Energy Use*

The appliance mix, of heating and cooling, will not have changed significantly from 2008 when the original REES deemed impacts for the activities were calculated. There will have been some slight increase in the proportion of homes with air conditioning, but this increase was anticipated in the original calculations.

Cooling energy use is around 7% of the energy use affected by ceiling insulation, and the new national MEPS for air conditioning introduced in April 2010, and proposed MEPS for October 2011, will reduce the energy used by new air conditioners installed post 2011. However, as the MEPS only affect new air conditioners, which means around 30% of the stock in 2014, and only will improve their efficiency by 10% to 20%, the end impact will be small, i.e. 3% to 6% of the 7% cooling energy use making a reduction of at most 0.4%.

This impact will be ignored in the deeming calculations as deemed impacts are rounded up or down to the nearest 0.1 tonne CO<sub>2</sub>e.

### *Summary*

Though the technical potential of the activity has decreased slightly, there is more than sufficient remaining demand to justify this activity. The impact of the activity remains effectively unchanged, and it is recommended that it continue.

## *Draft Proofing*

### *Activity Description*

Install products to doors, windows, chimneys of open fireplaces or to exhaust fans to restrict or prevent air flow. This is to decrease heating/cooling losses, and hence to decrease heating/cooling energy use.

### *Regulatory Changes and Australian Standards*

No changes applicable since 2008. Changes to the Building Code since 2008 will not affect existing homes.

### *Implementation Experience*

There were 82 installations relating to this activity in 2009. Feedback from activity providers suggests this activity is not economically viable for them at this stage. The activity results in a relatively small emission saving, hence there is a relatively small financial return from the greenhouse gas emission equivalent reductions (tCO<sub>2</sub>-e) able to be claimed, but for the activity providers the management and administration costs for this activity are similar to activities producing larger savings. Consequently, providers are more attracted towards other activities which can produce greater emission savings and financial returns.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

There have been no new programs, regulatory changes or market changes that will affect this activity.

### *Penetration and Technical Potential*

The technical potential for this activity has remained largely unchanged since 2008.

### *Cost and Benefit Changes*

The cost of the activity will remain largely unchanged but the increasing cost of energy will make this activity more cost effective than previously calculated.

### *Technical Innovation*

No findings are applicable.

### *Appliance Mix and Energy Use*

The changes affecting heating and cooling discussed under Ceiling Insulation will also be applicable to this activity. However, as these changes are not large, they will not significantly affect the deemed emission savings from this activity.

### *Summary*

There have been no significant changes to this activity and it is recommended that it continue.

## *Removal of Older Refrigeration*

### *Activity Description*

The activity involves the removal of older primary or secondary refrigerator or freezer, manufactured before 1996. The intention is to bring forward the replacement of the refrigerator or freezer, as new appliances operate more efficiently. The emission savings relates to the energy savings that occurs from operating a newer refrigerator/freezer compared to the old appliance continuing to operate for its remaining operating life.

### *Regulatory Changes and Australian Standards*

No significant changes applicable since 2008. A new standard for MEPS and labelling for refrigerators was published in April 2009 and came into force on all products in April 2010, but this did not significantly alter the MEPS levels for refrigerators from those of 2005.

### *Implementation Experience*

There were no installations relating to this activity in 2009. Feedback from activity providers suggests this activity is not economically viable for them at this stage. The activity is relatively costly to undertake, due to the labour required to remove refrigerators and decommission them, but the activity does not produce sufficient emission savings (tCO<sub>2</sub>-e) able to be claimed to justify these costs.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

There have been no new programs or market changes that will affect this activity.

As previously mentioned, new MEPS have been introduced in April 2010, but these MEPS are broadly in line with the previous 2005 MEPS, though they involve a new measurement/testing approach. It is unlikely these changes will significantly affect the deemed emission savings from this activity.

By 2012 the age of refrigerators and freezers eligible for removal under this activity will three years older, which will affect the average life time of the savings from the activity, reducing the lifetime of this activity from 5.5 years to 4.0. This will need to be taken into consideration when recalculating the deemed emission savings from the activity.

### *Penetration and Technical Potential*

The numbers of stock of older pre 1996 refrigerators and freezers will have declined by around 20% since the REES began, assuming normal scrappage of older appliances has continued to occur. This is based on the minimum age of eligible appliances being 15 years at the start of the REES and hence, after three years of the Scheme, on average three of the fifteen years of appliance stock will have passed the 25 year age limit and will have been scrapped. This reduction in the amount of older stock will reduce the technical potential of the activity by approximately 20%.

The average remaining life of the appliances will also have decreased by 1.5 years, from 6.75 years in Stage 1 of the REES to 5.25 years in Stage 2. The remaining life of the refrigerators has declined, so the effective period for potential energy savings from the removal of individual units will also decrease. As the average remaining life of the refrigerators has declined by around 30%, this will decrease the deemed emission savings by around 30%.

### *Cost and Benefit Changes*

Energy cost savings from any energy efficiency activity is related to the energy saved multiplied by the cost of energy. As energy prices have increased since the start of the REES, the energy costs saving benefits from this activity will have increased for householders. The cost of refrigerators and freezers will probably have declined slightly from when the cost effectiveness of the action was first calculated, based on prevailing trends in this appliance group<sup>10</sup>. However, the decrease in the average lifetime of the savings will mean that the emission savings, hence energy savings, will decline by around 30%.

On balance the increase in energy costs will offset some of the decline in the energy savings, so this activity is expected to remain cost effective, but its cost effectiveness will need to be reviewed when recalculating deemed savings.<sup>11</sup>

### *Technical Innovation*

Not applicable to this activity.

### *Appliance Mix and Energy Use*

No significant change will have affected this activity.

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<sup>10</sup> Kevin Lane and Lloyd Harington, "Long Term Evaluation of Energy Efficiency Policy Measures for Household Refrigeration in Australia", July 2010, p51.

<sup>11</sup> Note: The cost effectiveness discussed here is based on the costs and benefits from a societal viewpoint, and may not be consistent with whether an activity provider considers the activity financially profitable to implement from their perspective.



## *Summary*

There are no significant changes to the nature of this activity. However, as the targeted refrigerators are now older and their remaining life has been reduced by around 30%, their replacement will produce an effective energy savings for a shorter period. This means there will be a decrease in the deemed value of the activity of approximately 30%. It is recommended that the activity continue.

## *Installation of Efficient Lighting*

### *Activity Description*

The activity involves the installation of CFL lamps to replace reflector or non-reflector incandescent lamps. The activity is to target high use lamps in the first instance. The activity saves energy, and hence emissions, as CFL lamps are more efficient than tungsten incandescent lamps or halogen lamps.

### *Regulatory Changes and Australian Standards*

Changes in regulatory requirements will greatly affect this activity. The import ban on general purpose incandescent lamps in February 2009, followed by the MEPS on lighting in November 2009 which eliminated general purpose standard incandescent lamps, will already have affected the activity. The MEPS requirements will also be extended to other lamps, including probably Mains Voltage Halogens in January 2011 and Mains Voltage Reflector Lamps October 2012, which will affect the activity post 2011.

The regulatory changes enacted and planned are listed in the table below.

**Table 1: Current and Planned MEPS for Lighting**<sup>12</sup>

<b>Lamp Types</b>	<b>MEPS Restriction From</b>
Tungsten incandescent GLS lamps ELV halogen non reflector	1-Nov-09
>40W Candle, fancy round and decorative lamps ELV halogen reflector	Oct-10
Mains voltage halogen non-reflector	1-Jan-11
Mains voltage reflector lamps including halogen (PAR, ER, R, etc.) >25W Candle fancy round and decorative lamps	Oct-12
Pilot lamps 25W and below	To be determined depending on availability of efficient replacement

<sup>12</sup> Sourced from <http://www.energyrating.gov.au/incand-lamps2.html>

The most significant impact for this activity is it will change the BAU type of lamp being replaced, hence the energy savings that will occur by installing high efficiency lighting. This is discussed further in Changes to BAU Scenario.

### *Implementation Experience*

There were 244,332 lamp installations relating to this activity in 2009 and presumably a similar number also occurred in 2010.

Feedback from suppliers suggests this market is nearing saturation, especially for the non-reflective lamps. They suggest all homes can be assumed to have some CFL lamps already installed and this is consistent with the information on imports of lighting types, discussed in the Penetration and Technical Potential section below.

A further difficulty is that suppliers may be installing CFL lamps in homes that have already had these installed as part of the REES. This can occur because one supplier fits CFLs, but not on all lamps as there is maximum of 8 lamps that can be fitted per home. Later a second supplier visits the home and the householder does not tell them they have previously participated in the REES (e.g. may not recall, or because a different household member is spoken to, or there has been a change in occupancy), so a second lot of CFLs are installed. Potentially this may be placing suppliers at risk of conducting installations they cannot claim emission credits for.

The reflector lamp market will not be as saturated, as there has been less attention focused on this market to date.

### *Research Findings*

New more efficient lamps are entering the market. For example, LED lamps are now becoming more commonly available and these lamps are more efficient than CFLs. LED lamps are especially suitable for replacing reflector lamps.

### *Changes to BAU Scenario*

The import ban on general purpose incandescent lamps in February 2009, followed by the MEPS on lighting in November 2009, has significantly altered the lighting market. This has altered the BAU scenario, as for 2012-14 the default replacement lamps for general purpose and most reflector lamps will be efficient lamps. This means the energy savings from replacing existing lamps will be reduced compared to that obtained during 2009-2011.

The main elements of the BAU scenario for 2012-14 are:

- Any high use, general purpose incandescent lamps can be assumed to have been replaced.
- General purpose lamps can be assumed to be either CFL or efficient, MEPS compliant MVH lamps, as will be their replacements. However, the original

calculations for the deemed impact of this activity assumed a 50/50 replacement of lamps with CFL and MVH, but import data<sup>13</sup> suggests at least 67% of replacements are by CFL and 33% by MVH.

- Mains voltage reflector lamps can be assumed to be 90% incandescent until 2013 after which they will be replaced by 90% MEPS compliant MVH and 10% by CFL, according to the original BAU scenario. It is possible that the take up of CFL lamps will be higher than this, given their popularity in the general service lamp market, but this remains unproven so it is assumed the original BAU assumptions will still hold. Hence, the deeming calculations for REES activities during 2012-2014 will remain valid.

### *Penetration and Technical Potential*

As mentioned above, it can be assumed by 2012 that there will be effectively no legacy incandescent general purpose lamps in any high use residential rooms. The relative market share of the CFL and MVH general purpose lamps is slightly different from that originally predicted. Recent analysis of import data by Steven Belitich (personal communication, 2010) suggests that the sale of CFL lamps is higher than expected, relative to MVH, and CFL lamps make up around 67% of the general purpose lamp market. This will need to be taken into account when calculating the deemed impact of general purpose lamp replacements.

Assuming that households tend to choose either MVH or CFL lamps for their general purpose lighting, this suggest around 30% of households have the technical potential to replace their MVH with CFL lamps. However, if we assume the 30% of the market for MVH is spread across households, most households will have a mix of CFL and MVH lamps. This will mean it will be increasingly difficult to find households with multiple incandescent or MVH lamps which can be replaced by CFL lamps. Supplier feedback on implementation of the REES activity suggests that the market is approaching saturation for CFL, which is consistent with the preceding market analysis.

For reflector lamps, the market appears to have remained the same as when the 2008 deeming calculations were undertaken. The market is dominated by low voltage halogens, so the actual technical potential in the market is significantly reduced. However, the reflector market is estimated to be about 14% of the total lamp market, so even if only a third of the market are main voltage lamps, this still constitutes nearly 5% of the total market, and hence 100,000's of lamps.

In addition, the Extra Low Voltage (ELV) lamps could also be targeted, by substituting 35W lamps instead of 50W, or by installing LED lamps if cost effective. This could offer an expansion to the existing lighting activities and is an activity acceptable under the New South Wales Energy Saver Scheme.

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<sup>13</sup> Steven Belitich, analysis of ABS import data, personal communication December 2010.

### *Cost and Benefit Changes*

The energy costs saving benefits will have increased for householders due to the increased energy prices since the start of the REES. However, the energy savings will be less in the 2012-14 period, due to changes in the BAU lamp replacements following the MEPS regulations. Energy savings for reflector lamps are expected to decrease by 10-20% and by around 40% for non-reflector lamps. Lamp prices are expected to be largely unchanged.

This means the cost effectiveness of the activity will need to be reviewed but as this activity was originally highly cost effective, it is expected its benefits will still exceed its costs.

### *Technical Innovation*

Not applicable to this activity, with the exception of the development of LED lamps. LED lamps are becoming more widely available and their cost is rapidly declining, which may allow for this technology to be adopted into a REES activity in the near future.

### *Appliance Mix and Energy Use*

The changes in the lamp technologies used in the market have been already commented upon.

### *Summary*

The lighting activity is the REES activity which has been most affected by changes over the last three years, through regulatory changes via MEPS and by market changes through the rapid take up of CFL lamps. This has significantly affected the installation of the general purpose CFL lamps, and will mean a decrease of approximately 40% in the deemed emission savings from this activity. In addition, there are concerns that the market is becoming saturated for this activity, and there is still twelve months to go before the second stage of the REES, 2012-2014. These changes may make it more difficult for activity providers to provide CFL installations cost effectively, but the installation of CFL lamps still should produce energy savings and benefits which exceed costs from a societal perspective.

Regarding the reflector lamp market, the assumptions for the BAU scenario have not changed for these lamps, for stage two of the REES. Consequently it is assumed the estimated savings is still valid, which are approximately a 10% decrease on the stage one savings for reflector lamps. The deemed savings will need to be recalculated but assuming they are correct then it is recommended that this activity continue.

There is potential to create energy savings in the ELV reflector market, for example by replacing 50W halogens with 35W lamps. Consequently the inclusion of such options in the lighting activity should be further explored.

## *Install Insulated Ductwork for Ducted Reverse Cycle Air Conditioner or Gas Central Heater*

### *Activity Description*

The activity involves installing ductwork of higher than standard insulation, R1.5, to a small or large reverse cycle air conditioner or gas central heater.

### *Regulatory Changes and Australian Standards*

The 2010 Building Code of Australia (BCA 2010) has introduced new minimum duct requirements which may affect the relevance of this activity to reverse cycle air conditioners. The BCA 2010 requires that all ducts for reverse cycle systems now must be R1.5, except in climate zone 5. However, climate zone 5 covers most of urban Adelaide and most of the northern coastal regions, so the vast majority of households in South Australia will be exempt from this requirement. This requirement also applies only to new installations and only to reverse cycle air conditioning systems.

The air conditioner MEPS levels for air conditioners were changed in April 2010 and are expected to change again in October 2011. This will affect all new installations and will require the recalculation of the deemed impacts for the activity. These MEPS changes may reduce the deemed savings by around 15-20%, but the reduction will need to be calculated when the MEPS are finalised.

No changes have occurred that affect ducted gas heaters, though MEPS for gas ducted heating are under review.

### *Implementation Experience*

There were no installations relating to this activity in 2009.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

The regulatory changes affecting MEPS for air conditioners will affect this activity, so the deemed impact calculations will need to be reviewed. This could reduce the deemed impact of the activity for air conditioning ductwork by around 15-20%.

The effect of changes to duct work standards will not affect the deemed impacts, as houses that are required to comply with the R1.5 ductwork requirement would be excluded from claiming air conditioning ductwork installation as a REES activity.

### *Penetration and Technical Potential*

The technical potential for this activity was originally estimated at 5% of households and this potential may have increased slightly since then as the penetration of ducted heating and cooling grows. An exact estimate of the change is not possible but it is unlikely that any change in technical potential will be significant.

### *Cost and Benefit Changes*

The cost of installing more efficient ducting may have marginally increased from 2009 estimate by 2012, but the proportional increase in energy costs will be much greater, so the cost effectiveness of this action will have improved for 2012-14.

### *Technical Innovation*

Not applicable for this activity.

### *Appliance Mix and Energy Use*

Not applicable for this activity.

### *Summary*

The deemed impact of this activity is expected to decrease by approximately 15-20% for air conditioning duct work, due to the impact of two MEPS changes, but the deemed values will need to be recalculated once the MEPS are finalised. There will be minimal changes to deemed savings from gas heater ducting. It is recommended that the activity continue with revised deemed impacts.

## *Replace Reverse Cycle Air Conditioner with Evaporative Cooling*

### *Activity Description*

The activity involves the replacement of older ducted reverse cycle air conditioners with ducted evaporative air conditioning.

### *Regulatory Changes and Australian Standards*

No changes applicable since 2008. Though the MEPS for reverse cycle air conditioning has changed, these changes will not affect this activity as the BAU scenario assumes the householder would continue to use their existing air conditioner unless replaced through this REES activity. Also the new MEPS do not affect evaporative air conditioning, so the new MEPS do not affect the air conditioner that is being installed.

### *Implementation Experience*

There were no installations relating to this activity in 2009.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

There have been no new programs, regulatory changes or market changes that will affect this activity. The market trend appears to be to replace evaporative air conditioners with reverse cycle air conditioners, rather than the reverse which is encouraged by this activity.

### *Penetration and Technical Potential*

The penetration of ducted refrigerative air conditioning systems was estimated at 24% of households in 2008, and this penetration level will have increased according to air conditioning sales and stock analysis conducted for the latest air conditioner MEPS (EnergyConsult, 2010)<sup>14</sup>. The technical potential for this activity will therefore have marginally increased by 2012.

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<sup>14</sup> Available from <http://www.energyrating.gov.au/library/details201004-consult-ris-ac-2011.html>



### *Cost and Benefit Changes*

The cost of replacing a reverse cycle air conditioner may have marginally increased by 2012, but the proportional increase in electricity costs will be much greater, so the cost effectiveness of this action will have improved for 2012-14.

### *Technical Innovation*

Not applicable to this activity.

### *Appliance Mix and Energy Use*

Any changes to the average air conditioner being replaced will be very slight and will not significantly affect this activity or its deemed impact.

### *Summary*

There have been no significant changes to this activity and it is recommended that the activity be retained.

## *Replace an Existing Heating/Cooling System with an Efficient System*

### *Action Description*

The action is to remove and decommission older room reverse cycle air conditioners, gas heaters or electric storage heaters, and replace them with an efficient system.

### *Regulatory Changes and Australian Standards*

The algorithms for rating air conditioner system efficiency have changed in April 2010, so the classification of appropriate replacement air conditioning systems, via energy star ratings, may need to be revised.

MEPS levels have also altered for air conditioning systems since 2008 when deemed impacts were calculated, and these changes will affect what is regarded as efficient air conditioners, i.e. more efficient than MEPS requirements. The changes in MEPS levels will also affect the BAU scenario, hence the calculations of deemed savings.

There have not been regulatory changes to gas or electric storage heating that are relevant, though gas heating MEPS are being reviewed.

### *Implementation Experience*

There were no installations relating to this activity in 2009.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

There have been no new programs or market changes that will affect this activity, but there have been regulatory changes affecting air conditioning.

The increase in air conditioning MEPS in 2010 and 2011 will mean the BAU standard for 2012-14 is improved and the energy and emission impacts from the replacement of the air conditioners will decrease. The deemed savings will need to be recalculated in light of the changes to the MEPS and to the measuring standard for efficient air conditioners. The definition of what is an efficient air conditioner will also need to be revisited to ensure the defined models exceed the revised MEPS requirements.

There have been no changes affecting gas or electric storage heating.

### *Penetration and Technical Potential*

It was originally estimated that 43% of households had the technical potential to undertake this action and this potential will not have changed significantly.

The changes in the air conditioning MEPS will probably result in around 10% decrease in deemed savings for cooling systems replacement, as though the MEPS efficiency changes are around 20%, only half the lifetime savings from the activity are calculated with reference to a BAU new air conditioner.

### *Cost and Benefit Changes*

The cost of replacing heating or cooling system may have marginally increased from the 2009 estimate by 2012, but the proportional increase in electricity costs will be much greater, so the cost effectiveness of this action will have improved for 2012-14. However this change will be somewhat offset by the decrease in the deemed emission savings from new air conditioners, but the activity should remain cost effective.

### *Technical Innovation*

Not applicable.

### *Appliance Mix and Energy Use*

No significant changes were relevant.

### *Summary*

There are not significant changes affecting the replacement of heating systems. The energy and emission savings from replacing cooling systems will change as a result of the changes to air conditioner MEPS and standard changes, and deemed energy savings are expected to be reduced by around 10%. The definition of an efficient air conditioner may also change, and will need to be reviewed.

Nevertheless, this action has the potential to produce emission savings and it is recommended that the action be retained.

## *Install an Efficient Non-ducted Heating/Cooling System*

### *Action Description*

The action is to install more efficient room reverse cycle air conditioners or gas heaters than required by MEPS or BCA standards.

### *Regulatory Changes and Australian Standards*

The algorithms for rating air conditioner system efficiency have changed in April 2010, so the classification of appropriate replacement air conditioning systems, via energy star ratings, may need to be revised.

The standards for rating air conditioner system efficiency will be changed in April 2011, so the classification of an efficient air conditioning systems will need to be revised. MEPS levels have also altered for air conditioning systems since 2008 when deemed impacts were calculated, and these changes may affect what is regarded as efficient air conditioners, i.e. more efficient than MEPS requirements.

There have not been regulatory changes to gas heating that are relevant, though gas heating MEPS are being reviewed.

### *Implementation Experience*

There were no installations relating to this activity in 2009.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

The increase in air conditioning MEPS in 2010 and 2011 will mean the BAU standard for 2012-14 is improved and the energy and emission impacts from the replacement of the air conditioners will decrease. The deemed savings will need to be recalculated in light of the changes to the MEPS and to the measuring standard for efficient air conditioners. The definition of what is an efficient air conditioner will also need to be revisited to ensure the defined models exceed the revised MEPS requirements.

There have not been BAU changes that affect gas heating. There have been no new program or market changes that will affect this activity.

### *Penetration and Technical Potential*

It was originally estimated that 13% of households had the technical potential to undertake this action and this potential will not have changed significantly.

The changes in the air conditioning MEPS will probably result in around 10% decrease in deemed savings for cooling systems replacement, as though the MEPS efficiency changes are around 20%, only half the lifetime savings from the activity are calculated with reference to a BAU new air conditioner.

### *Cost and Benefit Changes*

The cost of replacing heating or cooling systems may have marginally increased from the 2009 estimate by 2012, but the proportional increase in electricity costs will be much greater, so the cost effectiveness of this action will have improved for 2012-14. However this change will be somewhat offset by the decrease in the deemed emission savings from new air conditioners, but the activity should remain cost effective.

### *Technical Innovation*

Not applicable.

### *Appliance Mix and Energy Use*

No significant changes were relevant.

### *Summary*

There are not significant changes affecting the replacement of heating systems. The energy and emission savings from replacing cooling systems will change as a result of the changes to air conditioner MEPS and standard changes, and deemed energy savings are expected to be reduced by around 10%. The definition of an efficient air conditioner may also change, and will need to be reviewed.

Nevertheless, this action has the potential to produce emission savings and it is recommended that the action be retained.

## *Install or replace a water heater with a water heater of specified type*

### *Activity Description*

This activity has two types, the installation or replacement of water heaters. The installation of water heaters involves installing a water heater type that results in less greenhouse gas emissions than a conventional electric water heater in a Class 2 building. The replacement activity involves either early retirement or replacement of a conventional electric water heater with a water heater type that results in less greenhouse gas emissions. The activity does not cover installations of high-efficiency gas, solar or electric heat pump water heaters, where these are required under South Australia's water heater installation requirements.

### *Regulatory Changes and Australian Standards*

Since 2006 regulations have been in place in South Australia setting out requirements regarding the installation of water heaters in certain new homes. From 2008, these were expanded to cover all new homes and certain replacements. From July 2009, the requirements were extended to cover a broader range of replacement situations, such that water heaters installed into most homes in South Australia are required to be low greenhouse gas emission types, such as high efficiency gas, solar or electric heat pump. As part of this requirement, shower outlets connected to the water heater being installed need to be water efficient. In most cases, this involves the use of water efficient shower heads or flow restrictors.

However, these changes in the regulations were anticipated in the calculations of the deemed impact of the replacement of water heaters. So effectively there have been no regulatory changes affecting this activity.

In December 2010, the Ministerial Council on Energy agreed to a national 2-stage phase-out of conventional electric water heaters in class 1 dwellings. South Australia's current requirements are consistent with the first stage. South Australia has not yet adopted the second stage, which is scheduled to commence in 2012. Phase 2 involves a broader phase-out in class 1 dwellings.

If Phase 2 is adopted in South Australia, this may affect that aspect of this measure that relate to installations in class 1 dwellings where high-efficiency gas, solar or electric heat pump systems are currently not required.

Further information on South Australia's requirements for residential water can be found on DTEI website at [http://www.energy.sa.gov.au/government\\_programs/waterheaters](http://www.energy.sa.gov.au/government_programs/waterheaters)

### *Implementation Experience*

There were 993 installations relating to this activity in 2009.

### *Research Findings*

No findings are applicable.

### *Changes to BAU Scenario*

The offering of RECS on heat pump and solar water heaters effectively provides a rebate to support the installation of these low emission heaters. However, this rebate has been available since 2009, so it has not affected the BAU scenario.

The federal government since February 2010 have also been offering a rebate of \$1,000 for a solar hot water system or \$600 for a heat pump hot water system to eligible households for the replacement of electric hot water systems, called the Renewable Energy Bonus Scheme - Solar Hot Water Rebate. Prior to this a rebate was offered under the Solar Hot Water Rebate Program. To the extent that this has accelerated the replacement of water heaters, it could be seen as altering the BAU scenario. However, these rebates are unlikely to lead on their own to the replacement of water heaters of less than five year of age, or to the installation of heaters that exceed the South Australia Water Heater Standards, so it can be assumed that they will have no significant impact on the BAU scenario.

Three years will have passed since the REES started by 2012 but this will not affect the assumed lifetime of emission savings from this activity. Replacement of operational water heaters already assumed that these heaters would be 4 years old, and this use of a conservative assumption means the lifetime of the emission savings remains unchanged. The replacement of other heaters is based on the new heater exceeding the Water Heater Standards, and life of the new heater, so the lifetime of the emission saving also remains unchanged.

Finally, the introduction of a national MEPS for water heaters should not affect the BAU scenario that was used to calculate the deemed savings as the South Australia Water Heater Standards that were introduced in 2008 were anticipated in the BAU scenario. As these Standards required that water heaters installed into most homes in South Australia be low emission systems, the introduction of the national MEPS is unlikely to affect the BAU scenario as they are expected to have similar requirements. The only exception might be if the national MEPS is stricter than the South Australian Standards for houses in remote areas, but this detail concerning the MEPS is currently not available.

### *Penetration and Technical Potential*

The impact of the South Australia Water Heater Standards will be to gradually enforce the replacement of low efficiency water heaters with high efficiency water heaters. By 2012

the Standards will have been in place for 2 ½ years and can be assumed to have led to 20% of the stock of low efficiency water heaters being replaced with heaters of higher efficiency, due to the ongoing cycle of heaters failing and being replaced.

Considering the early retirement activity for electric water heaters, 40.7% of households in South Australia in 2008 (ABS survey 4602055001, 2008) used electric water heaters. The percentage that would be less than five years old and hence eligible for upgrading under the REES activity requirement is estimated to be 17%. By 2012 the number of eligible years will have fallen, as now all of the once eligible heaters will be three years older, so only 40% of the original 17% will be eligible. So by 2012 6.8% would be eligible, approximately 44,000 households.

Regarding the early retirement for gas water heaters with more efficient heaters, 46.2% of households in South Australia in 2008 (ABS survey 4602055001, 2008) used gas water heaters. Those less than five years old and hence eligible for upgrading under the REES activity requirement would be 19.2%. By 2012 the number of eligible years will have fallen, so 7.7% would be eligible, approximately 49,000 households.

The 6% of households in South Australia that are in regional/remote areas or Class 2 buildings are not required to comply, or need to comply with reduced, South Australia Water Heater Standards. Here the REES activity of upgrading any replacement water heating system is applicable, so these households constitute a further technical potential for this activity. In addition, the REES activity of upgrading any replacement water heating system is applicable for all gas water heaters replaced, which further increases the technical potential for this activity.

### *Cost and Benefit Changes*

The costs of water heater upgrades will not have greatly altered since the REES was introduced but the proportional increase in electricity costs will be much greater, so the cost effectiveness of this action will have improved for 2012-14.

### *Technical Innovation*

Not applicable.

### *Appliance Mix and Energy Use*

No significant changes were relevant.

### *Summary*

There are no apparent changes which will have significantly affected the activity, though its technical potential has been reduced, and it is recommended that it be retained.





## *Summary of Existing Activities*

At present, it is recommended that all existing actions be retained, though for a few this will be subject to a review of their deemed impact and cost effectiveness. It is also recommended that options for replacing ELV reflector lamps be explored further.

## *Contextual Factors and Potential New Activities*

### *General Contextual Factors*

Since the REES was started, the most significant changes in broader factors which affect the REES will be the increase in energy costs and the increasing cost of undertaking REES activities. The increase in energy costs, especially electricity costs, has already been discussed but the impacts of these increases are to:

- make potential activities that were marginally cost effective in the past, more cost effective; and
- increase householder attention and interest in reducing their energy use, which will make the implementation of REES activities easier for providers.

To date, retailers have concentrated on those activities that achieve the highest greenhouse gas emission reductions per dollar (\$) cost of the activity. As access to low cost activities reduces over time due to increasing levels of saturation, in the absence of new low cost activities being identified, the cost/tCO<sub>2</sub>-e would be expected to rise. This would in turn be expected to increase the financial feasibility of implementing activities not adopted to date. Another important factor is technology improvements and inventiveness regarding identifying and packaging residential emission abatement actions. Improvements in the efficiency of appliances and technology create new opportunities to accelerate the replacement of older, less efficient appliances and technologies; e.g. lighting or televisions. The identification of new potential abatement options in part relies on these improvements in technologies but also results from the recognition that the 'easy' savings have already been identified and now more effort is being applied to the less obvious but still important areas of potential savings, such as reducing standby power consumption.

### *Potential New Activities*

#### *Applications for new schemes under REES*

The Commission may add new energy efficiency activities at any time, provided they are consistent with the principles outlined in the Ministerial protocol (refer Schedule 7 of the REES Code)<sup>15</sup>, as discussed in the introduction to this paper. In accordance with clause 7.2.1 of the REES Code, a person may make an application to the Commission seeking the Commission's determination that a new energy efficiency activity should be approved.

The Commission has received a number of formal applications for the approval of new REES energy efficiency activities in the following areas:

- ▲ an air conditioning refrigerant additive;

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<sup>15</sup> A copy of the REES Code can be located at: <http://www.escosa.sa.gov.au/library/100729-REESCode03.pdf>.

- ▲ standby power controllers; and
- ▲ down light covers, which improve the efficacy of insulation.

A submission has also been received to modify a component of the REES lighting activity specification to bring it into line with the requirements in the Victorian Energy Efficiency Target (VEET) Scheme, to enable the replacement of 12volt halogen lamps with a more efficient alternative<sup>16</sup>.

More work is required on the down light covers and halogen lamp proposals.

The work undertaken by the Commission, with the assistance of expert review, on the standby power controller proposals indicates it is a promising potential new activity, noting that there are a number of forms this activity could take (e.g. passive and active). The potential deemed emission savings value per device range could be up to around 2.0 tCO<sub>2</sub>-e.

### *Interstate and Overseas schemes*

The most obvious way to identify viable potential new REES activities is to examine what other Australian residential energy efficiency reduction programs are using as activities. Though activities of programs in other countries could also be used to identify activities, the differences in residential energy use between countries, in their climates, in the availability of technologies, in their interest in energy efficiency, and in their appliance and energy markets all will reduce the relevance of their programs to South Australia.

There are a number of activities in the New South Wales Energy Savings Scheme (ESS) and the Victorian VEET or Energy Saver Incentive (ESI) schemes that are common to the REES scheme. The activities not currently covered by REES though include:

- Purchasing high efficiency televisions
- Purchasing high efficiency electric clothes dryers and installing high efficiency gas clothes dryers
- Purchasing high efficiency dishwashers
- Installing thermally efficient windows
- Installing LED lamps to replace linear fluorescent and 50W ELV halogen lamps
- Replacing ELV 50W halogens with mains voltage high efficiency lamps
- Replacing 50W ELV halogens with 35W halogens, and replacing magnetic transformers with electronic transformers.

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<sup>16</sup> Note: This initiative is consistent with the previously mentioned recommendation to explore replacing Extra Low Voltage (EVL) lamps with more efficient lamps.

In addition there are a number of other potential activities, some of which have been explored by different states, including:

- Retrofitting high power factor lighting
- Top up of ceiling insulation
- External wall shading and window covers
- Installing standby power controllers
- Installing high efficiency pool pumps
- Installation of an in-home display energy consumption device.

It is understood that the NSW Government is due to soon release a discussion paper on proposed new activities, which may add to this list of potential activities.

### *Proposed REES New Activities*

Drawing on the activities undertaken and proposed by other State programs, and on potential activities being proposed to the Commission, a list of potential additional activities has been developed, which includes:

- **Purchasing high efficiency televisions:** Retailers could offer consumers a rebate to encourage them to purchase televisions which were of higher efficiency than the norm for televisions of the same size. Any energy savings, and hence emission savings, would result from the difference in energy consumed between the high efficiency and a 'normal' television.
- **Purchasing high efficiency electric clothes dryers and installing high efficiency gas clothes dryers:** Retailers could offer consumers a rebate to encourage them to purchase high efficiency electric clothes dryers which were of higher efficiency than the norm for electric dryers of the same size, or to purchase and install gas clothes dryers of the same size. Any energy savings, and hence emission savings, for the electric dryer would result from the difference in energy consumed between the high efficiency and a 'normal' dryer. The gas dryer may produce lower emissions due to gas heating having a lower emissions intensity than conventional electric heating using in a standard dryer.
- **Purchasing high efficiency dishwashers:** Retailers could offer consumers a rebate to encourage them to purchase high efficiency dishwashers which were of higher efficiency than the norm for dishwashers of the same size. Any energy savings, and hence emission savings, would result from the difference in energy consumed between the high efficiency and a 'normal' dishwasher.
- **Installing thermally efficient windows:** This activity would involve installing windows or glazing which exceeded a minimum thermal efficiency specification, in the conditioned part of existing dwellings. This might involve installing double

glazing, but this is likely to be too expensive. Alternatively, it could involve fitting insulating film on the windows or installing special glazing to reduce thermal gains or losses. Installing the thermally efficient windows may result in reduced heat losses/gains from the dwelling and hence lower the total heating/cooling energy demand of the dwelling, resulting in energy and emission savings.

- **A variety of lighting improvement measures:** Several options could be included under this measure, including installing LED lamps to replace linear fluorescent and 50W ELV halogen lamps, replacing ELV 50W halogens with mains voltage high efficiency lamps, replacing 50W ELV halogens with 35W halogens, replacing magnetic transformers with electronic transformers, and the retrofitting of high power factor lighting. All of these options may result in lower energy consumption from the more efficient lighting compared to the existing lighting, hence in energy and emission savings.
- **External awnings and shading options:** This activity would involve installing external awnings or shading to impact on the in the conditioned part of existing dwellings. The awnings and shading may result in reduced heat gains from the dwelling and hence lower the total cooling energy demand of the dwelling, resulting in energy and emission savings.
- **Top up of ceiling insulation:** This activity could involve installing additional insulation in houses in the conditioned part of the house where insulation had already been installed, but where the existing insulation had become compacted due to age or otherwise had deteriorated. Installing top up insulation may result in reduced heat losses/gains from the dwelling and hence lower the total heating/cooling energy demand of the dwelling, resulting in energy and emission savings.
- **Installing underfloor insulation:** This would involve installing insulation under timber flooring in the conditioned part of the house, where there is sufficient access to install the insulation and no insulation currently present. Installing underfloor insulation may result in reduced heat losses/gains from the dwelling and hence lower the total heating/cooling energy demand of the dwelling, resulting in energy and emission savings.
- **Installing wall insulation:** This would involve installing insulation into the wall cavities of external wall in the conditioned part of the house, where no insulation is currently present. Installing wall insulation may result in reduced heat losses/gains from the dwelling and hence lower the total heating/cooling energy demand of the dwelling, resulting in energy and emission savings.
- **Installing standby power controllers:** This could either involve the installing of power controllers in the home for no or reduced cost, or offering rebates on the

purchase of power controllers which homeowners then install. The intention of the power controllers is to lower energy consumption, especially standby power consumption, hence to create energy and emission savings.

- **Installing high efficiency pool pumps:** Rebates could be offered to pool service specialists or to consumers to encourage them to purchase pool pumps of higher efficiency than the norm for pumps of the same capacity. The installation of more efficient pumps may result in lower energy consumption, hence in energy and emission savings.
- **Installation of an in-home display energy consumption device:** This activity would involve the installation of an in-home display energy consumption device, probably linked to the dwelling's 'smart' meter. The intention is that the in-house display will encourage behavioural change that results in lower energy consumption, hence energy and emission savings.
- **Installing down light caps:** Most down lights are installed into the ceilings of rooms, and to reduce fire hazards the ceiling insulation is cut away or removed in the area surrounding the lights. However, this creates a series of holes in the ceiling insulation, which can significantly reduce its effectiveness. The intention of the down light caps is to reduce this loss in the effectiveness of the ceiling insulation. If effective, this would result in reduced heat losses/gains from the dwelling and hence lower the total heating/cooling energy demand of the dwelling, resulting in energy and emission savings.

These options will need to be screened against the selection criteria that must be abided by, as outlined in the Minister's Protocol for the REES, which include:

- Flexibility
- Additionality
- Verifiability
- Consistency of the saving
- Penetration potential
- Accessible and practical
- Cost effectiveness
- Other schemes (consistency across jurisdictions).

The safety of any of the options which involve the installation or modification of insulation, electrical or gas appliances would also need to be considered.

To undertake an initial screening of these options, to decide if further investigation is required, the options were screened against the penetration potential, accessible and practical and cost effectiveness criteria. There appeared to be considerable penetration

potential for all activities, and under the appropriate circumstances, the options also appeared accessible and practical.

These options were then screened for their cost effectiveness, based on several cost-benefit analyses previously conducted by EnergyConsult for such activities. This review of their cost effectiveness is not meant to be conclusive, but simply to highlight options with a low likelihood of being cost effective. Based on the outcome of a Victorian study into the impacts and costs of retrofitting a sample of existing homes<sup>17</sup>, the top up of ceiling insulation and installing external awnings options were discarded as options because of their poor cost effectiveness. Otherwise the remaining actions in appropriate circumstances could be cost effective under the right circumstances and are recommended for further analysis.

The potential actions that are therefore recommended for further investigation are:

- Purchasing high efficiency televisions
- Purchasing high efficiency electric clothes dryers and installing high efficiency gas clothes dryers
- Purchasing high efficiency dishwashers
- Installing thermally efficient windows
- A variety of lighting improvement measures
- Installing underfloor insulation
- Installing wall insulation
- Installing standby power controllers
- Installing high efficiency pool pumps
- Installation of an in-home display energy consumption device
- Installing down light caps.

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<sup>17</sup> E.g. In *On Ground Assessment of the Energy Efficiency Potential of Victorian Homes* conducted for Sustainability Victoria, 2009