Government of South Australia
Department for Energy and Mining

CONSULTATION PAPER ON PROPOSED RETAILER ENERGY PRODUCTIVITY SCHEME (REPS) ACTIVITIES, CREDITS AND TARGETS

APPENDICES

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September 2020

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Appendix 1: Proposed protocol for maintaining calculation methods, eligible activities and specifications

In reviewing the REPS calculation methods, activities and specifications, the Minister will have regard to the following principles:

Consider any activities that provide energy productivity benefits through:

- reduced household or business end-use energy consumption
- reduced household or business end-use energy costs for the same household or business outcome.

Maximise the number of activities that provide broader energy market benefits in South Australia, such as:

- reduced wholesale electricity prices
- reduced electricity network costs
- improved energy system security benefits.

Ensure that there are sufficient activities to provide a focus on low-income households and facilitate increased delivery to remote and regional areas.

Maximise the number of activities that obligated Retailers can implement to foster competition, innovation and market efficiency.

Calculation methods can include activity-specific deemed normalised energy credits or formulas, or activity-independent specific measurement approaches.

Calculation methods using deemed normalised energy credits or formulas are appropriate for an activity where there is:

- low or known variability of the activity and its resulting energy productivity benefits
- robust, independent, empirical data on baseline and post implementation activities, energy consumption, and other energy productivity benefits.

Calculation methods can deem future normalised energy credits:

- once the initial productivity benefits of an activity have been verified, and
- if there is robust, independent, empirical data on the likely persistence of productivity benefits.

If the above principles cannot be met, calculation methods will be based on empirical measurement and verification of actual delivered productivity benefits.

Measurement and verification-based calculation methods may be developed so as to apply at the level of implementation of an activity at an individual site or based on aggregate measurement across multiple sites.

Specifications for calculation methods will include, but are not be limited to:

- the specific activity or categories of activity for which the method can be used
- the detailed calculation steps to be undertaken, and specifications about how activities are to be conducted and calculations made, including, but not limited to, product and installation requirements, and records kept for audit.

Activities and calculation methods should be capable of being defined in ways such that they can be objectively audited simply and cost effectively.

Activities and calculation methods should align with other schemes as far as possible, where this is consistent with scheme principles.

Activities must be capable of uptake by households and/or businesses within South Australia.

Activity specifications should provide a means for ensuring quality assurance and participant satisfaction, typically through product or installation standards and guidelines.

Activities should leverage existing, state, national or international standards and accreditation frameworks wherever possible.

Specifications should require that:

- activities are undertaken by suitably qualified professionals
- appropriate levels of training are required for service providers
- products comply with relevant safety standards
- installations are in accordance with relevant installation standards, guidelines and/or manufacturer's instructions
- activities are designed and implemented in a way that minimises risks to service providers and participants.

Activity specifications should offer options to utilise good practice such as recycling and compliance with best practice installation guidelines.

Calculation of normalised energy credits from an activity should be evidence based and applicable to South Australia.

Calculation methods should provide a credible means of calculating normalised energy credits that balances compliance costs with accuracy of calculations.

Normalised energy credits should be additional to base case and the calculation method is designed in a way that minimises the scope for free riders through the use of appropriate baseline assumptions.

Calculation methods should provide greater rewards for products and services that deliver higher levels of performance (for example, scalability of deemed normalised energy credits to reward products and services with higher performance to maximise potential benefits).

Calculation methods using deemed productivity credits should:

- be informed by credible research and a defensible methodology
- adjust normalised energy credits to account for South Australia's climate zone/s, typical housing stock and energy use practices
- adjust normalised energy credits to account for: the extent to which the benefits will be taken as improved thermal comfort; likelihood of performance changes over time; changing business as usual scenarios; free riders; persistence; or planned future regulation.

Appendix 2 – Assumptions and profiling for activities in the REPS

This appendix summarises the applied updates to each of the existing REES activities that were identified for continuation under REPS post 2020, and the assumptions and profiling used for the new activities proposed for inclusion.

The following information is provided in relation to each of the above listed activities:

- **Overview**: an overview of the activity including to the normalisation factors.
- **Amendments**: where the activity were derived from the REES, details of any amendments to the scope of the activity or other relevant amendments that may have been undertaken.
- **Underlying assumptions**: details baseline assumptions.
- **Usage profiling**: details relating to the assumed usage patterns for the particular equipment used to determine the time of use normalisation factors applicable to the particular activity.

BS1A – Installation of Insulation in an Uninsulated Ceiling Space

BS1B – Installation of top-up Insulation in a Ceiling Space

Overview

The method for calculating credits for these activities is fundamentally unchanged. Pre-existing thermal simulation modelling on a set of representative dwellings with and without insulation applied was used to determine heating and cooling loads. The calculated heating and cooling loads were then applied to a representative stock of heating and cooling equipment so as to determine energy consumption reductions by fuel type.

For the 2020 REPS modelling, adjustments to load estimates were made based on the latest CSIRO simulation weather data. Also, the installed equipment profiles were updated. In addition, time of use (TOU) normalisation factors were applied to the results.

The TOU normalisation factors associated with summer cooling were relatively high (significant amounts of cooling occurs at times of high or maximum demand), this meant that for the warmer climate zone (BCA 4 & 5) there was a significant increase in the credit available rising from approximately 1 to almost 1.39 GJ/m^2. The impact on climate zone BCA 6 was by contrast more modest, rising from 1.6 to almost 1.69 GJ/m^2.

Amendments to Scope, Settings and Assumptions

Apart from the changes noted earlier relating to weather data and installed equipment assumptions the only other change related to the discount factors applied. The discount for non-compliance was effectively removed in line with the approach now taken in other schemes (VEU, EEIS). The revised discount factors are detailed below.

Discount Factor Settings Adopted for REPS 2020 (Activity BS1A)

Discount Factors	New Setting	Notes
Additionality/Free riders	0.95	Unchanged
Rebound (one off)	0.85	Unchanged
Discount for Non compliance	1	Previously 0.95

Amendments to Baseline Assumption

Building shell performance

Heating and cooling loads (for both the baseline and improved cases) were adjusted in line with the latest weather data available from CSIRO for use in NatHERS tools (yet to be published), known as the 2016 weather data set.

Analysis of the impact of the revised weather files for ABCB has shown the following adjustments in relation to the two main climate zones in South Australia. Heating and cooling loads used to estimate benefits associated with this activity under the current REES scheme were adjusted according to this table for use in the REPS scheme.

Heating and Cooling Adjustment Factors (Old NatHERS to New NatHERS)

BCA Climate Zone	Representative Nathers Climate Zone	Change in heating load (%)	Change in cooling load (%)
4 @ 5	Adelaide (16)	-8%	-5%
6	Mt Lofty (59)	-18%	+30%

Installed heating and cooling equipment performance

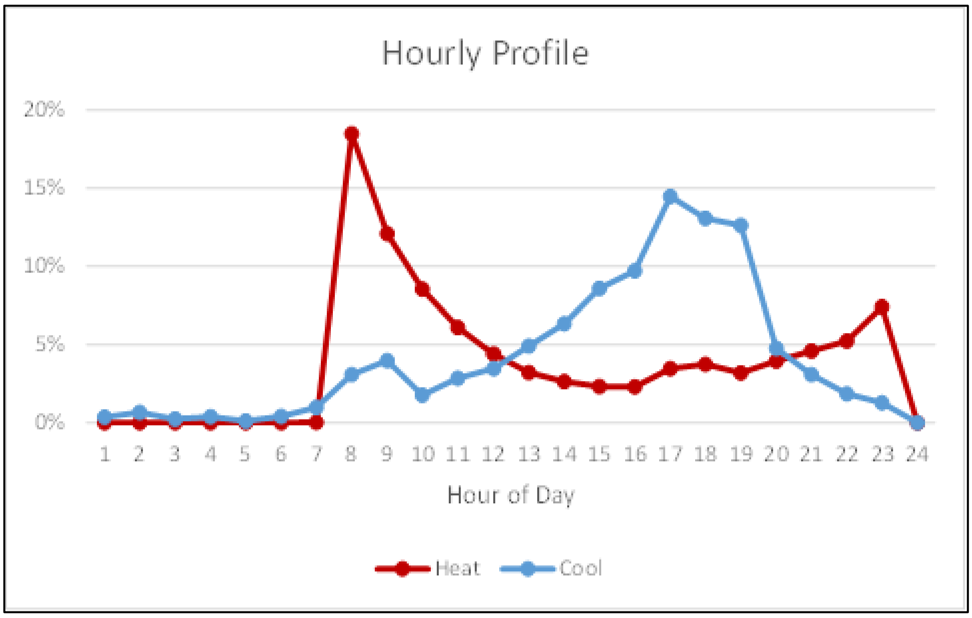
The assumed profile of the installed heating and cooling equipment was updated to reflect both the propensity and the performance characteristics of the main types of heaters and coolers installed in South Australian housing. Trends since 2017 (last update of this activity), toward higher efficiency equipment and a greater proportion of dwellings using electrical (heat pump) heating impacted to a small degree on the credit calculation.

Usage Profiling

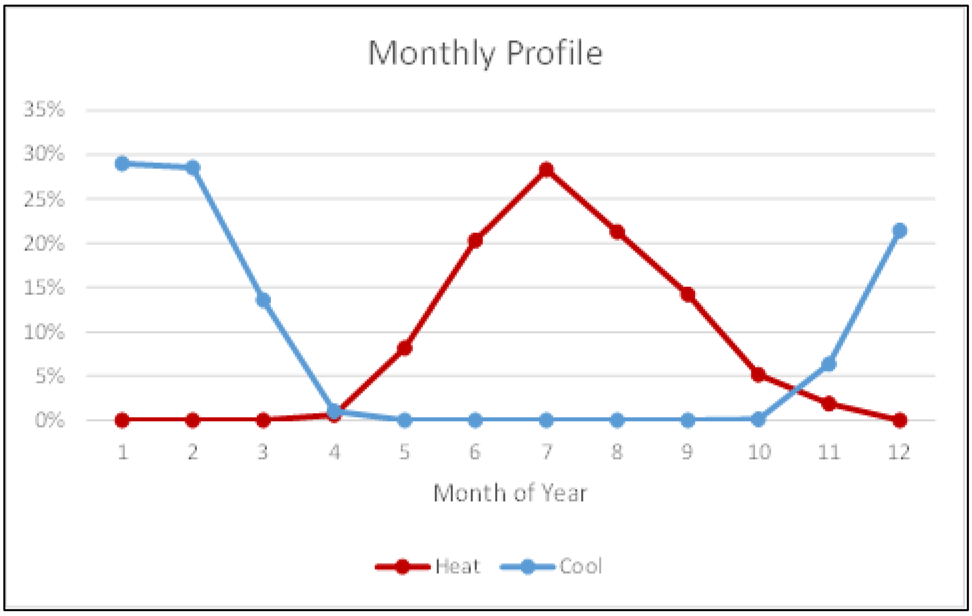
AccuRate simulation of the most common type of existing dwelling (i.e. pre regulation dwellings typically with heavyweight walls and timber floor) was undertaken using the latest version of AccuRate. AccuRate modelling included the latest (2016) CSIRO weather files. These were used to generate an hourly profile for both heating and cooling for an entire year.

The resultant profile provided percentage use by hour of the year. Graphically this profile is summarised below in the figures below.

Space Conditioning Usage Profile – South Australia – average hourly



SPACE CONDITIONING USAGE PROFILE – SOUTH AUSTRALIA – AVERAGE MONTHLY



BS2 - Building Sealing Activities (Various)

Overview

The method for calculating credits for this activity is fundamentally unchanged. Pre-existing thermal simulation modelling on a set of representative dwellings with and without the activities applied was used to determine heating and cooling loads. The calculated heating and cooling loads were then applied to a representative stock of heating and cooling equipment so as to determine energy consumption reductions by fuel type.

For the 2020 REPS modelling, adjustments to load estimates were made based on the latest CSIRO simulation weather data. Also, the installed equipment profiles were updated. In addition, time of use (TOU) normalisation factors were applied to the results.

Sealing activities provide benefits in both heating and cooling. The TOU normalisation factors associated with summer cooling were relatively high (significant amounts of cooling occurs at times of high or maximum demand), this meant that for the warmer climate zone (BCA 4 & 5) there was a more significant increase in the credits under REPS compared to the cooler Climate zone 6. In climate zone BCA 4 & 5 the credits increased by varying amounts depending on the particular activity type but averaged around 30% increase. In climate zone 6 the credits marginally increased or decreased by varying amounts depending on the particular activity type but averaged close to a net zero change. Noting that the credits in the more extreme climate zone 6 still remained greater than for climate zones 4 &5 but the margin of difference is now significantly less.

Amendments to Scope, Settings and Assumptions

Apart from the changes noted earlier relating to weather data and installed equipment assumptions the only other change related to the discount factors applied. The discount for non-compliance was effectively removed in line with the approach now taken in other schemes (VEU, EEIS). The revised discount factors are detailed in below.

Discount Factor Settings Adopted for REPS 2020 (Activity BS1A)

Discount Factors	New Setting	Notes
Additionality/Free riders	0.95	Unchanged
Rebound (one off)	0.925	Unchanged
Discount for Non compliance	1	Previously 0.95

Amendments to Baseline

Amendments to baseline assumptions are based on the latest weather data available from CSIRO for use in NatHERS tools (yet to be published), known as the 2016 weather data set.

Usage Profiling

Usage profiling adopted for this activity is based on AccuRate simulation.

BS3B – Glazing Retrofit

Overview

The method for calculating credits for this activity is fundamentally unchanged from the REES. Pre-existing thermal simulation modelling on a set of representative dwellings with and without high performance glazing was used to determine heating and cooling loads. The calculated heating and cooling loads were then applied to a representative stock of heating and cooling equipment so as to determine energy consumption reductions by fuel type.

For the 2020 REPS modelling, adjustments to load estimates were made based on the latest CSIRO simulation weather data. Also, the installed equipment profiles were updated. In addition, time of use (TOU) normalisation factors were applied to the results.

Glazing activities provide benefits in both heating and cooling. The TOU normalisation factors associated with summer cooling were relatively high (significant amounts of cooling occurs at times of high or maximum demand), this meant that for the warmer climate zone (BCA 4 & 5) there was a more significant increase in the credits under REPS compared to the cooler climate zone 6. In climate zone BCA 4 & 5 the credits increased from REES by varying amounts depending on the performance of the glazing retrofit ranging from 60% to 100% increase. In climate zone 6 the credits increased by varying amounts depending on the performance of the glazing retrofit ranging from 25% to just under a 60% increase.

Amendments to Scope, Settings and Assumptions

Apart from the changes noted earlier relating to weather data and installed equipment assumptions the only other change related to the discount factors applied. The discount for non-compliance was effectively removed in line with the approach now taken in other schemes (VEU, EEIS). The revised discount factors are detailed in the following table.

DISCOUNT FACTOR SETTINGS ADOPTED FOR REPS 2020

Discount Factors	New Setting	Notes
Additionality/Free riders	0.95	Unchanged from REES
Rebound (one off)	0.925	Unchanged from REES
Discount for Non compliance	1	Previously 0.95

Amendments to Baseline

Amendments to baseline assumptions are based on the latest weather data available from CSIRO for use in NatHERS tools (yet to be published), known as the 2016 weather data set.

Usage Profiling

Usage profiling adopted for this activity is based on AccuRate simulation.

HC2A - Install an Efficient New Reverse Cycle Air Conditioner (Non-Ducted)

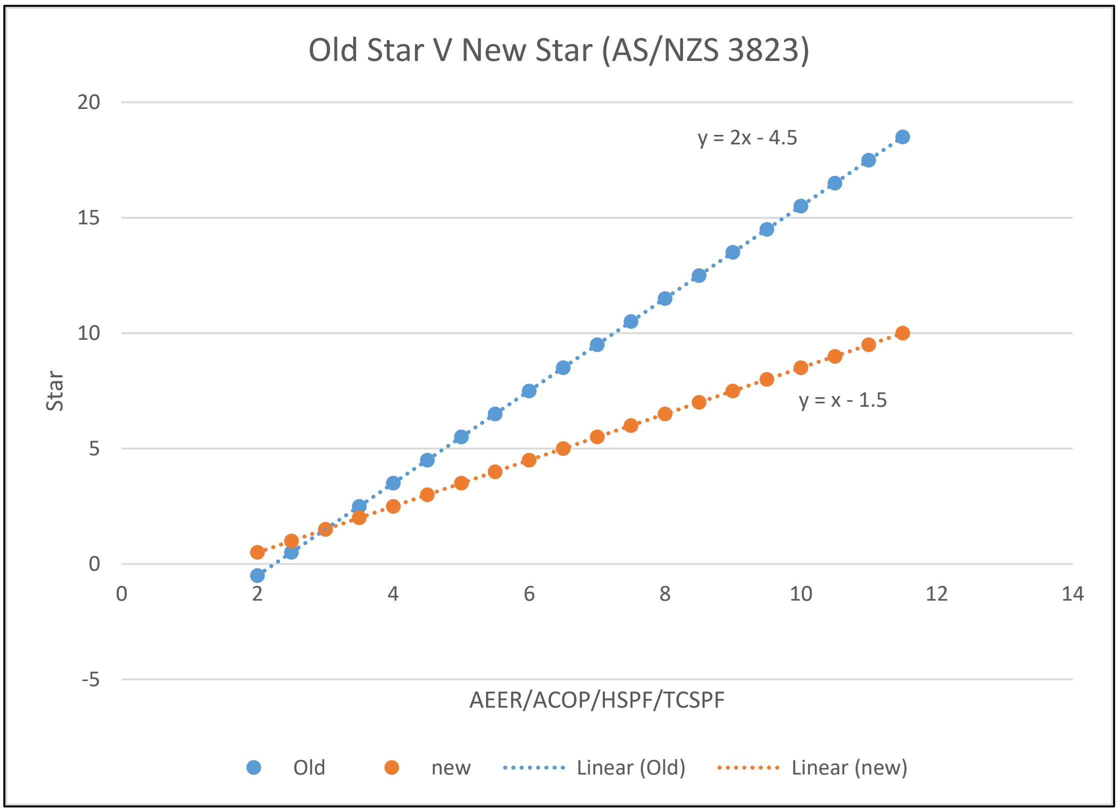
Overview

The method for calculating credits for this activity is fundamentally unchanged. Pre-existing thermal simulation modelling on a set of representative dwellings was used to determine heating and cooling loads. The performance characteristics of both the base case (pre-existing heater) and the improved case (new heater) were then applied to those loads to determine energy savings / additions by fuel type.

For the 2020 REPS modelling, adjustments to load estimates were made based on the latest CSIRO simulation weather data. Also, time of use (TOU) normalisation factors were applied to the results.

The performance requirement standards for air-conditioners are currently in a 5 year transition process from the old standard (AS/NZS 3823.2 (2013)) to the new standard (GEMS Air Conditioners up to 65kW Determination 2019). This presents an issue in that the two standards use different metrics for determining performance as well as different star rating structures. This has meant that the new provisions now allow for users to select a product either on the basis of the old or the new standard.

COMPARISON OF OLD AND NEW STAR RATINGS (GEMS AIR-CONDITIONERS)



In line with the revised objectives of the scheme a new requirement has been included in the specification that the installed product must have “built-in” demand response capability, in accordance with AS 4755. In either heating or cooling mode, the device must be capable of operating in DR modes 1, plus mode 2 and/or 3 as defined in AS 4755.

The TOU normalisation factor associated with summer cooling was relatively high (approximately 3.0) as significant amounts of cooling occurs at times of high or maximum demand). For heating the factor remained close to 1 (0.95) i.e. slightly less than the value assumed under the current REES normalisation process, this meant that

- for the warmer climate zone (BCA 4 & 5) there was a significant increase in the credit available for both the early retirement option (HC1A (i)) and the installation of a new reverse cycle air-conditioner (HC1A (iii)). For the replacement of a resistance electric heater alone however (HC1A (ii)) the credits were somewhat reduced (by approximately one-third) because the dis-benefit in energy terms of adding cooling to a system that previously had no cooling was amplified by the greater weighting given to the cost of cooling during periods of high demand.
- for the cooler climate zone (BCA 6) there was a modest increase in the credit available for both the early retirement option (HC1A (i)) and the installation of a new reverse cycle air-conditioner (HC1A (iii)). For the replacement of a resistance electric heater alone however (HC1A (ii)) the credits were somewhat reduced because the dis-benefit in energy terms of adding cooling to a system that previously had no cooling was amplified by the greater weighting given to the cost of cooling during periods of high demand.

Amendments to Scope, Settings and Assumptions

Scope, settings and assumptions were largely unchanged from those adopted in the 2017 REES review just three years ago, all discount factors remained the same.

Amendments to Baseline

Heating and cooling loads were adjusted in line with the latest weather data available from CSIRO for use in NatHERS tools (yet to be published), known as the 2016 weather data set.

In addition, the minimum performance standard in cooling mode was lifted from 3.0 stars to 3.5 stars (old stars) in recognition of ongoing performance improvements and also because under the new (less granular) star rating scheme there is no equivalent star rating performance level for the current REES minimum ACOP requirement of 3.75 (i.e. there is no 2.25 star option under the new standard), consequently this was lifted to an ACOP of 4.0 which equates to a new star rating of 2.5 stars (3.5 stars under the old scheme).

Usage Profiling

Usage profiling adopted for this activity is based on AccuRate simulation.

HC2B - Install an Efficient New Reverse Cycle Air Conditioner (Ducted)

Overview

The method for calculating credits for this activity is fundamentally unchanged. Pre-existing thermal simulation modelling on a set of representative dwellings was used to determine heating and cooling loads. The performance characteristics of both the base case (pre-existing heater) and the improved case (new heater) were then applied to those loads to determine energy savings / additions by fuel type.

For the 2020 REPS modelling, adjustments to load estimates were made based on the latest CSIRO simulation weather data. Also, time of use (TOU) normalisation factors were applied to the results.

The performance requirement standards for air-conditioners are currently in a 5 year transition process from the old standard (AS/NZS 3823.2 (2013)) to the new standard (GEMS Air Conditioners up to 65kW Determination 2019). This presents an issue in that the two standards use different metrics for determining performance as well as different star rating structures.This has meant that the new provisions now allow for users to select a product either on the basis of the old or the new standard.

In line with the revised objectives of the scheme a new requirement has been included in the specification that the installed product must have “built-in” demand response capability, in accordance with AS 4755. In either heating or cooling mode, the device must be capable of operating in DR modes 1, plus mode 2 and/or 3 as defined in AS 4755.

The TOU normalisation factor associated with summer cooling was relatively high (approximately 3.0) as significant amounts of cooling occurs at times of high or maximum demand). For heating the factor remained close to 1 (0.95) i.e. slightly less than the value assumed under the current REES normalisation process, this meant that

- for the warmer climate zone (BCA 4 & 5) there was a significant increase in the credit available for the installation of a new reverse cycle air-conditioner (HC1B (iii)). For the replacement of a resistance electric heater alone however (HC1B (i)) or HC1B (ii)) the credits were significantly reduced because the dis-benefit in energy terms of adding significant cooling to a system that previously had no cooling was amplified by the greater weighting given to the cost of cooling during periods of high demand.
- for the cooler climate zone (BCA 6) there was a marginal increase in the credit available for the installation of a new reverse cycle air-conditioner (HC1B (iii)). For the replacement of a resistance electric heater alone however (HC1B (i)) or HC1B (ii)) the credits were marginally reduced because the dis-benefit in energy terms of adding a modest cooling requirement to a system that previously had no cooling was amplified by the greater weighting given to the cost of cooling during periods of high demand.

Amendments to Scope, Settings and Assumptions

Scope, settings and assumptions were largely unchanged from those adopted in the last review three years ago, all discount factors remained the same.

Amendments to Baseline

Heating and cooling loads were adjusted in line with the latest weather data available from CSIRO for use in NatHERS tools (yet to be published), known as the 2016 weather data set.

In addition, the minimum performance standard in cooling mode was lifted from 3.0 stars to 3.5 stars (old stars) in recognition of ongoing performance improvements and also because under the new (less granular) star rating scheme there is no equivalent star rating performance level for the current REES minimum ACOP requirement of 3.75 (i.e. there is no 2.25 star option under the new standard), consequently this was lifted to an ACOP of 4.0 which equates to a new star rating of 2.5 stars (3.5 stars under the old scheme).

Usage Profiling

Usage profiling adopted for this activity is based on AccuRate simulation.

WH1 - Replace or Upgrade Water Heater

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014'.

As with all other pre-existing REES activities, energy modelling results were overlaid with TOU based normalisation factors.

The combined effect of the new normalisation factors and some amended discount factors resulted in a modest increase in credits ranging from approximately 5% to a maximum of 30% depending on the product type.

Amendments to Scope, Settings, Assumptions and Baselines

Scope, settings and assumptions and baselines were largely unchanged from those adopted in the last review.

Discount factors were however modified. The discount for non-compliance was effectively removed in line with the approach now taken in other schemes (VEU, EEIS). The revised discount factors are detailed below.

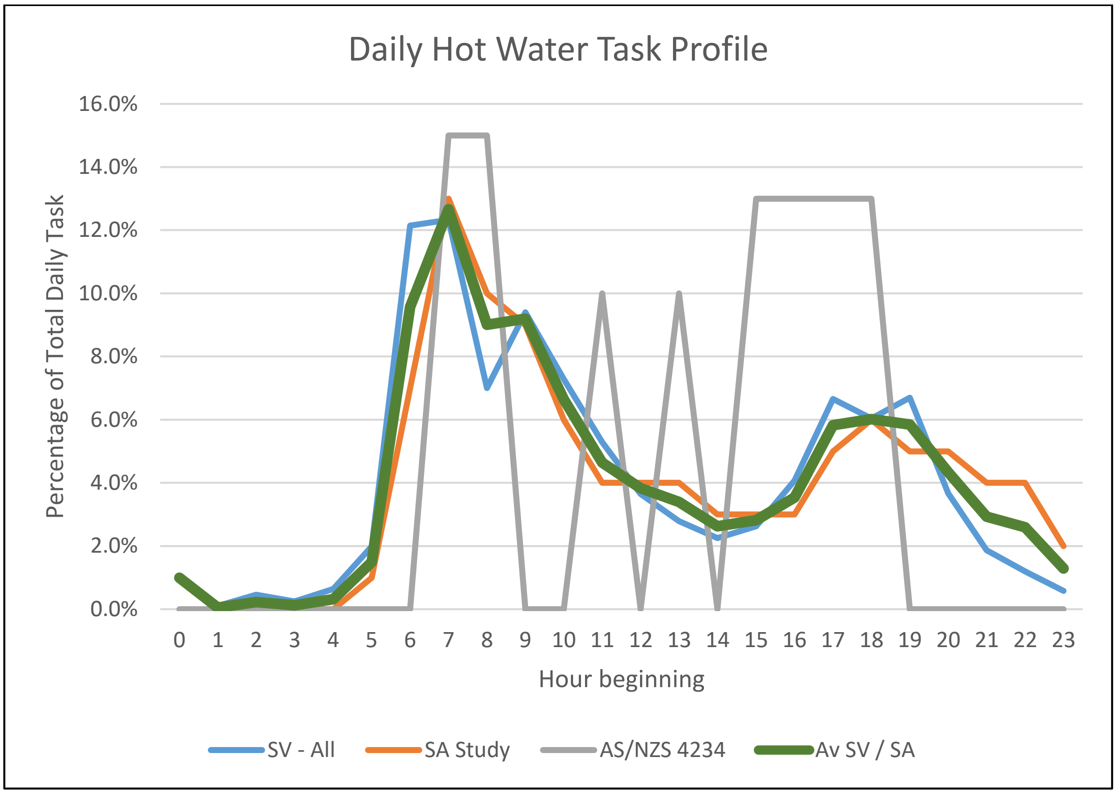
DISCOUNT FACTOR SETTINGS ADOPTED FOR REPS 2020 (ACTIVITY WH1)

Discount Factors	New Setting	Notes
Additionality/Free riders	0.95	Unchanged
Rebound (one off)	0.925	Unchanged
Discount for Non compliance	1	Previously 0.95

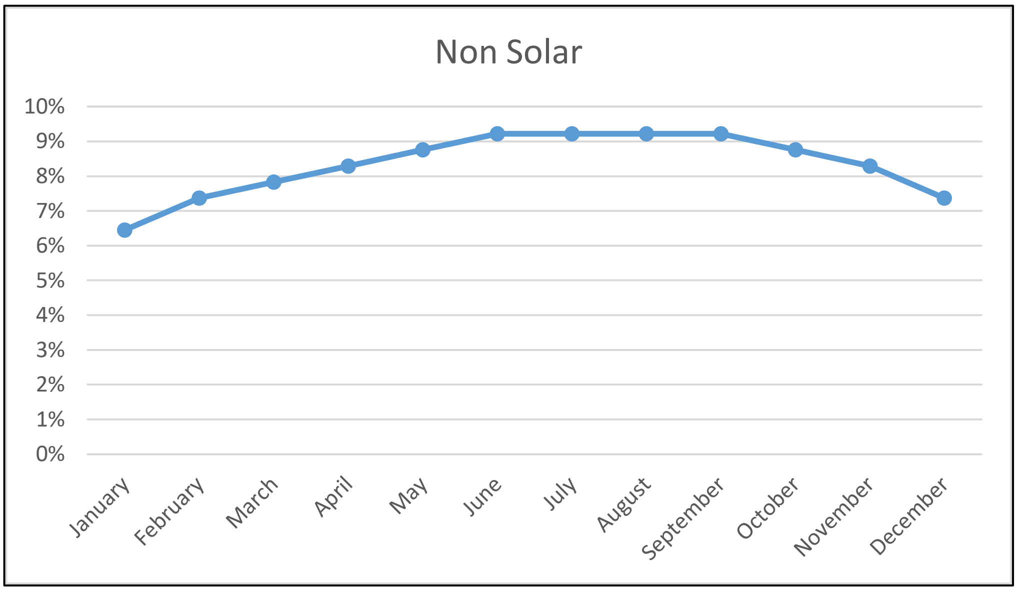
Usage Profiling

In terms of daily draw off profiles reference was made to data previously supplied from Sustainability Victoria which included metering data from both a Victorian study and a South Australian study. The results from those two studies for the daily hot water task profiles, plus the daily hot water task profile assumed in AS 4234:2008 Zones 1 -4 are shown in the figure below. In addition, also included in this figure is an average of both the Victorian and South Australian profiles (which are very similar in any case). This averaged draw-off profile was used as the basis of daily profiling.

Daily hot Water Task Profiles (Various sources)

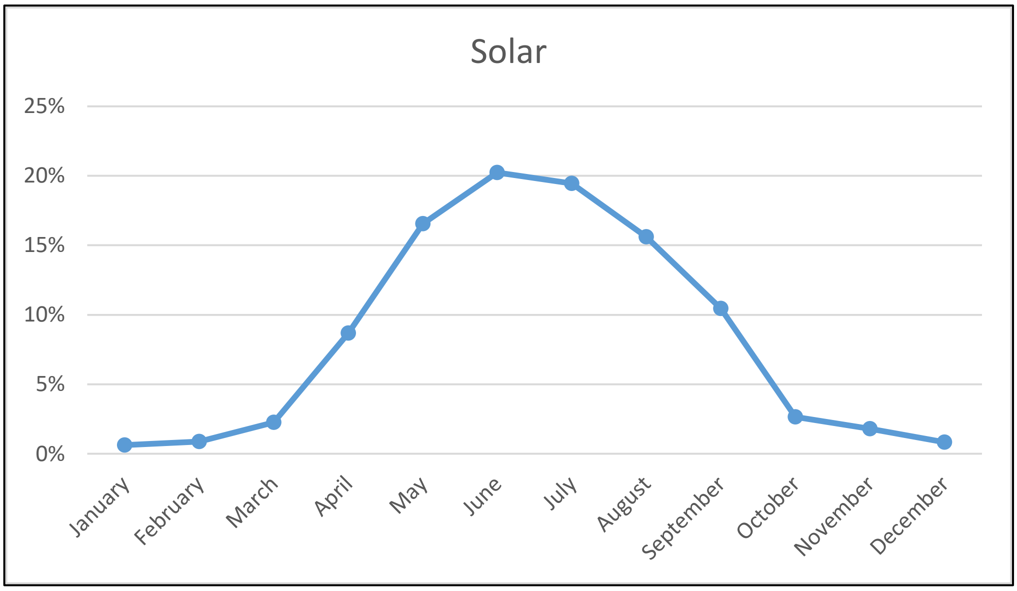


Seasonal Energy Demand Profile – Non Solar (AS4234:2008)



In relation to seasonal profiling, separate profiles were developed for non-solar and for solar boosted systems as these systems exhibit quite different energy demand by season. These profiles were based on data from AS 4234:2008 and are graphically illustrated in the figures below.

Seasonal Energy Demand Profile – Solar (AS4234:2008)



WH2 - Replace an Inefficient Showerhead with an Efficient Showerhead (Residential or commercial)

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.)

As with all other pre-existing REES activities, energy modelling results were overlaid with TOU based normalisation factors. The basis for these factors is based on the energy profile of a representative range of water heater types.

The net effect of the new normalisation factors and some amended discount factors and flow rate assumptions (see following sections) resulted in minimal change to the credits available for each of the activity options.

Amendments to Scope, Settings, Assumptions and Baselines

Scope, settings and assumptions and baselines were largely unchanged from those adopted in the last review.

Discount factors were however modified. The discount for non-compliance was effectively removed in line with the approach now taken in other schemes (VEU, EEIS). The revised discount factors are detailed in below.

Discount Factor Settings Adopted for REPS 2020 (Activity WH2)

Discount Factors	New Setting	Notes
Additionality/Free riders	0.87875	Unchanged
Rebound (one off)	0.97	Unchanged
Discount for Non compliance	1	Previously 0.95
Household shower number factor	0.749	Unchanged

One further amendment was made in relation to the in service flow rate assumed for a showerhead with a flow rate of less than 7.5 litres per minute. In 2014 DEM made a revised estimate of the relevant flow rate at 5.4 litres/minute. Examination of the calculation basis however indicates that this is incorrect and the true value should have been 6.08 litres/minute. The 2020 calculations use this corrected figure.

Usage Profiling

The usage profile details are the same as the profile used for the activity WH1 - Replace or Upgrade Water Heater.

L1, L2, L3 and CL1 (Lighting Activities)

Overview

The method for calculating credits for these three lighting activities is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.) with further updates as applied in 2017.

The main changes related to 3 aspects:

1. the baseline lamp efficacy assumptions (see Section 0)
2. the assumed efficacy of the replacement lamps (see Section 0)
3. TOU based normalisation factors (see section 0)

Note that the only change applicable to activity CL1 was the application of the TOU normalization factors.

Whilst the application of the TOU productivity normalization factor gives additional credit of approximately 20%, changes in baseline assumptions and installed equipment performance generally results in a significant reduction in credits in relation to activities L1, L2 and L3. For activity CL1 the credits derived from the approved calculation methods are simply increased by the normalization factor i.e. approximately 20%.

Amendments to Scope, Settings and Assumptions

Replacement lamp performance levels were updated based on market analysis. The new levels are described in the following four tables.

Replacement Lamp Efficacy Levels (L1A Non Directional)

Proposed Efficiency Tiers	REES 2017 (lumens/W)	REPS 2020 (lumens/W)
Baseline Level	65	105
Standard Level	90	140
High Efficiency Level	125	155

Replacement Lamp Efficacy Levels (L1B Directional)

Proposed Efficiency Tiers	REES 2017 (lumens/W)	REPS 2020 (lumens/W)
Baseline Level	65	80
Standard Level	85	115
High Efficiency Level	100	130

Replacement Lamp Efficacy Levels (L2 Downlights)

Proposed Efficiency Tiers	REES 2017 (lumens/W)	REPS 2020 (lumens/W)
Baseline Level	65	80
Standard Level	85	115
High Efficiency Level	100	130

REPLACEMENT LAMP EFFICACY LEVELS (L3 EXTERNAL FLOOD LIGHTS)

Proposed Efficiency Tiers	REES 2017 (lumens/W)	REPS 2020 (lumens/W)
Baseline Level	Unknown*	110
Standard Level	Unknown*	150
High Efficiency Level	Unknown*	170

* Note: Existing values for these parameters were unavailable

Amendments to Baseline

Baseline assumptions were revised in line with estimates made by Beletich and Associates in relation to the efficacy and proportion of existing stock. These assumptions are detailed in the following four tables:

BASELINE PROPORTION AND EFFICACY ASSUMPTIONS (L1A NON DIRECTIONAL)

	REES 2017		REPS 2020	
Type	Proportion	Efficacy (Lm/W)	Proportion	Efficacy (Lm/W)
CFL	50%	55	20%	55
Halogen	50%	15	0%	15
LED	0%	65	80%	100
Weighted	Average	35		91

BASELINE PROPORTION AND EFFICACY ASSUMPTIONS (L1B DIRECTIONAL)

	REES 2017		REPS 2020	
Type	Proportion	Efficacy (Lm/W)	Proportion	Efficacy (Lm/W)
CFL	20%	55	0%	55
Halogen	40%	15	0%	15
LED	40%	65	100%	100
Weighted	Average	43		100

BASELINE PROPORTION AND EFFICACY ASSUMPTIONS (L2 DOWNLIGHTS)

	REES 2017		REPS 2020	
Type	Proportion	Efficacy (Lm/W)	Proportion	Efficacy (Lm/W)
CFL	0%	50	0%	50
Halogen	30%	15	13%	15
LED	70%	65	87%	100
Weighted	Average	50		88.95

Baseline proportion and Efficacy Assumptions (L3 Floodlights)

	REES 2017		REPS 2020	
Type	Proportion	Efficacy (Lm/W)	Proportion	Efficacy (Lm/W)
CFL	Unknown*	Unknown*	0%	55
Halogen	Unknown*	Unknown*	0%	15
LED	Unknown*	Unknown*	100%	100
Weighted	Average			100

* Note: Existing values for these parameters were unavailable

Also amended were the assumptions relating to transformer replacements in relation to downlights. These are detailed in the two tables below.

Baseline Transformer Assumptions REES 2017 (Downlights)

Incumbent			**Replacement**		
Type	Proportion	Efficacy (Lm/W)	Type	Proportion	Efficacy (Lm/W)
Ferromagnetic	50%	0.8	Ferromagnetic	0%	0.8
Electronic	50%	0.93	Electronic	100%	0.93
Other	0%		Other	0%	
Weighted		0.865	Weighted		0.93

Baseline Transformer Assumptions REPS 2020 (Downlights)

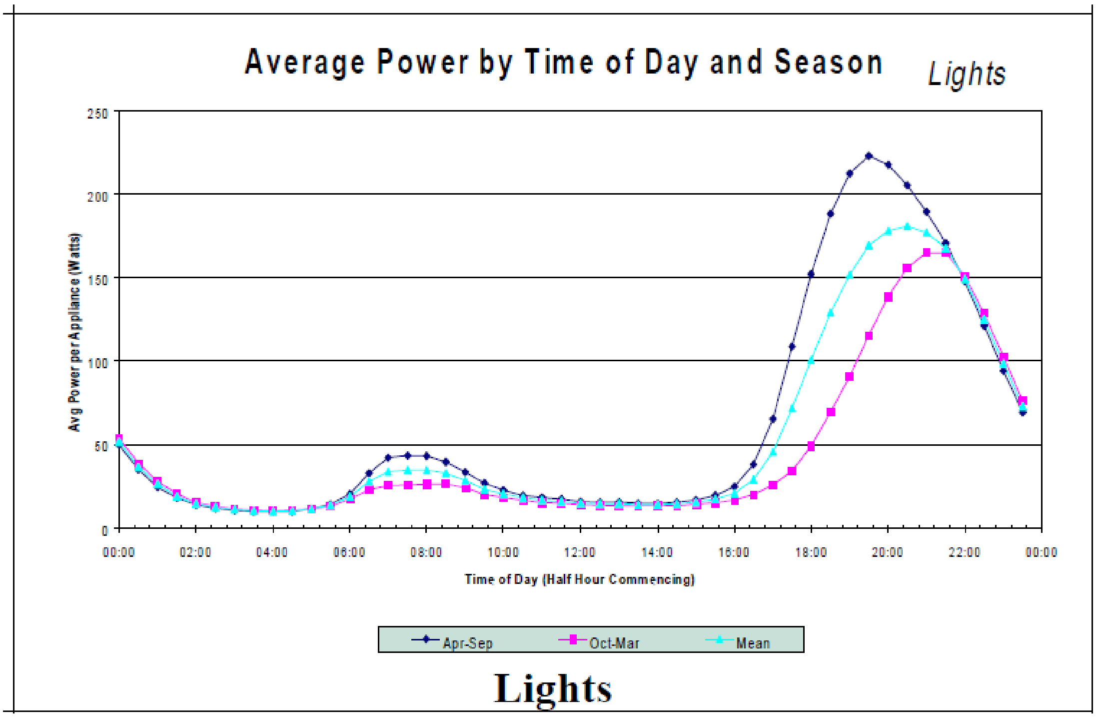
Incumbent			**Replacement**		
Type	Proportion	Efficacy (Lm/W)	Type	Proportion	Efficacy (Lm/W)
Ferromagnetic	15%	0.8	Ferromagnetic	0%	0.8
Electronic	85%	0.93	Electronic	100%	0.93
Other	0%		Other	0%	
Weighted		0.9105	Weighted		0.93

Usage Profiling

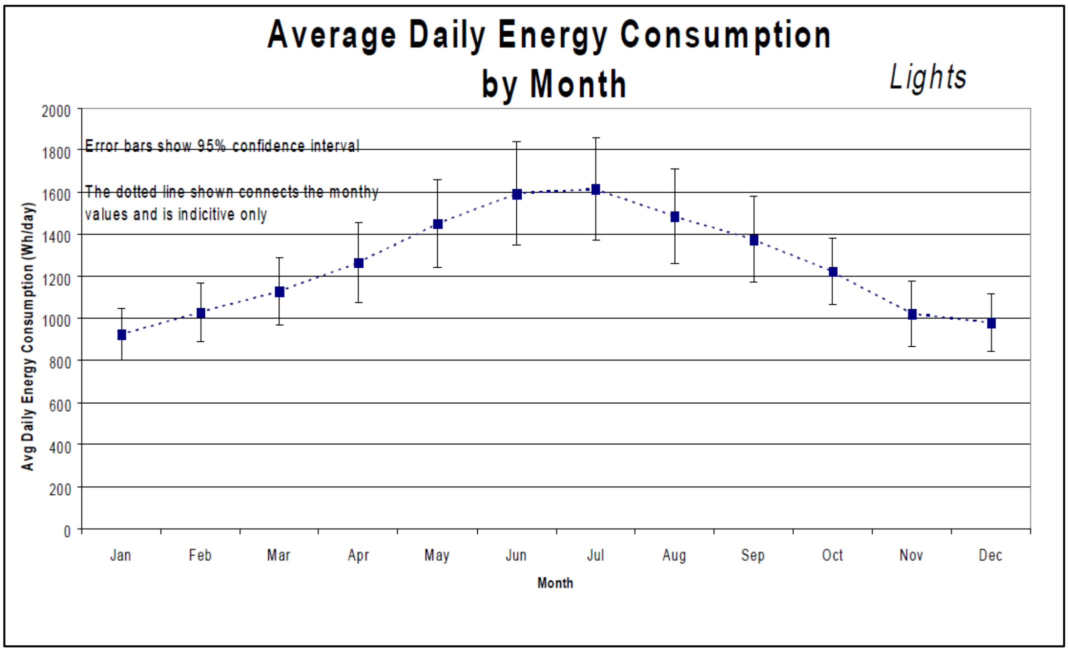
Residential Profile

For residential applications (L1, L2 and L3) the usage profiles were based on data compiled by Pacific Power. Graphically these profiles are reproduced below. The daily and monthly profiles were combined to generate an annual profile covering hour of day and month of year (i.e. 24 * 12 data points).

RESIDENTIAL LIGHTING USAGE PROFILE (PACIFIC POWER) – AVERAGE HOURLY



RESIDENTIAL LIGHTING USAGE PROFILE (PACIFIC POWER) – AVERAGE MONTHLY



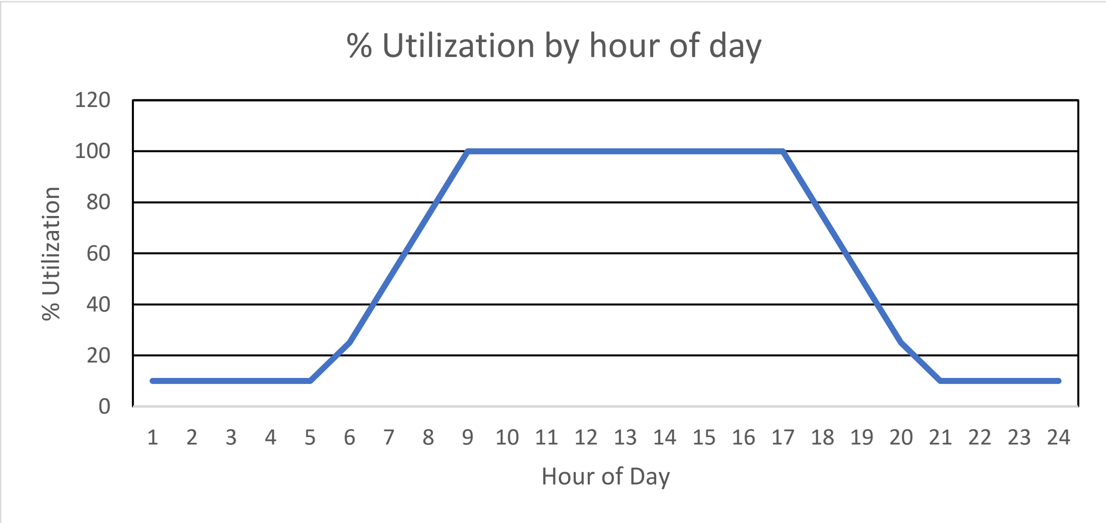
Commercial Lighting Profile

For commercial applications (CL1) there were no readily available Australian surveys upon which profiles could be based. Consequently it was assumed based on experience and professional judgement that the typical hourly profile for a commercial operation would be as per the figure below. In this profile it is assumed that about 10% of commercial lighting is left on all night. Between the hours of 9am and 5pm there is virtually 100% utilization and for four hours either side of this period the utilization tapers back down to the overnight 10% assumption.

Utilization was also adjusted according to day of the week with 100% utilization assumed on weekdays, 50% on Saturdays and 25% on Sundays or public holidays. Again, these are estimates only based on experience and professional judgement and are intended to represent a stock average profile rather than representing the profile of any one particular business type.

The resultant profile as used in the calculations included an assumed utilization factor for each and every hour of the year.

COMMERCIAL LIGHTING USAGE PROFILE – AVERAGE HOURLY UTILIZATION



SPC1 and SPC2 Standby Power Controllers

Overview

The method for calculating credits for these two standby power controller activities is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.).

It should be noted however that the 2014 values as calculated by EES were not used in the REES specifications. Instead DEM made their own credit estimates significantly based on earlier work undertaken for the VEET program. As explained in the 2014 study the VEET estimates are considered to be flawed and significantly over estimate savings (particularly now in 2020 in the context of lower equipment standby power). Consequently, for this 2020 update the original more conservative 2014 estimates were used with the added overlay of TOU based normalisation factors.

The use of more conservative credit estimates combined with TOU productivity normalization factors based on TV usage (0.88) gives a significant reduction in credits for these two activities (reduced by approximately 60% compared to the credits available under the current REES arrangements.

Amendments to Scope, Settings, Assumptions and Baselines

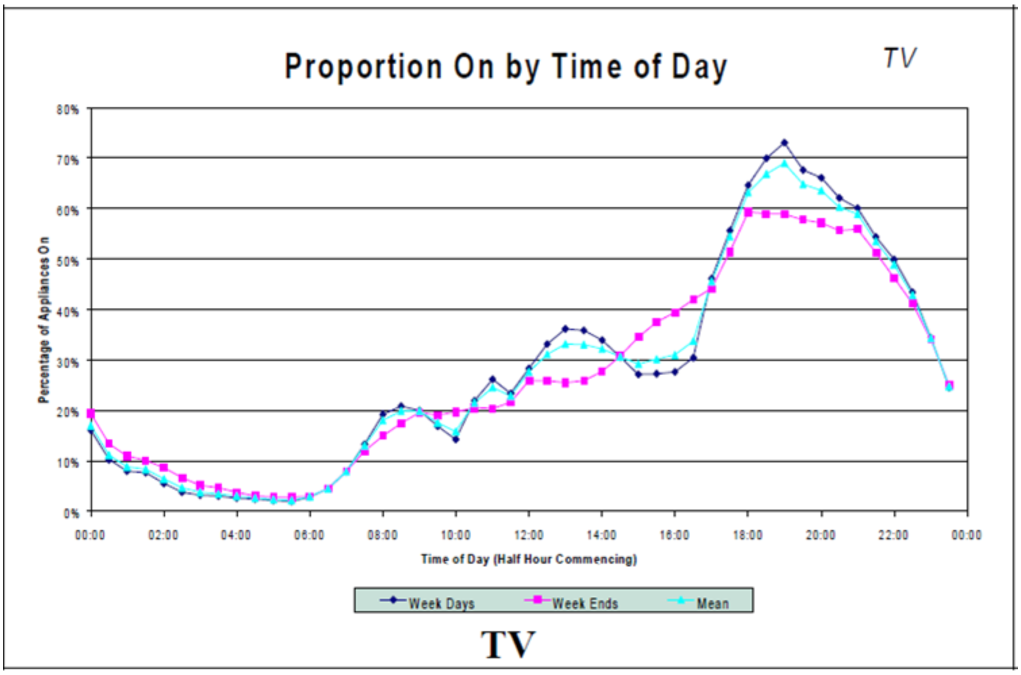
Scope, settings assumptions and baselines were largely unchanged from those developed by EES in the 2014 study - Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.).

All discount factors remained the same.

Usage Profiling

For both SPC activities the usage profiles were based on data compiled by Pacific Power for TV usage (mean values). Graphically these profiles are reproduced in the figure below.

RESIDENTIAL TV USAGE PROFILE (PACIFIC POWER) – AVERAGE HOURLY



APP 1A and 1B (New Refrigerators and Freezers)

Overview

The method for calculating credits for both these activities is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.) with updates to assumptions in 2017.

In 2017 the refrigerator activity was updated to include a table of savings factors rather than a formula based approach, this was considered by DEM to be more user friendly. The freezer activity was not similarly updated in 2017 and remained as a formula based approach. For this update the freezer activity has now also been updated to include a table of deemed savings factors (now called productivity factors).

Baseline assumptions were updated (increased) for this update and TOU based normalisation factors were applied.

Amendments to Scope, Settings and Assumptions

Scope, settings and assumptions were largely unchanged from those adopted in the last review just three years ago, all discount factors remained the same.

Amendments to Baseline

Baseline assumptions were updated as per the two tables below. The updates were based on the analysis of model weighted performance data obtained from the GEMS register which is then correlated with expected sales weighted trends based on similar correlation analysis conducted by EES over the past 20 years.

REFRIGERATOR BASELINE ASSUMPTIONS REES 2017 V REPS 2020 (STAR RATINGS)

Refrigerators	REES 2017		REPS 2020	
Type	Baseline	Minimum permitted	Baseline	Minimum permitted
Group 1	1.35	2.0	2.4	3.5
Group 4 or 5	2.39	2.7	3.2	3.5

FREEZER BASELINE ASSUMPTIONS REES 2017 V REPS 2020 (STAR RATINGS)

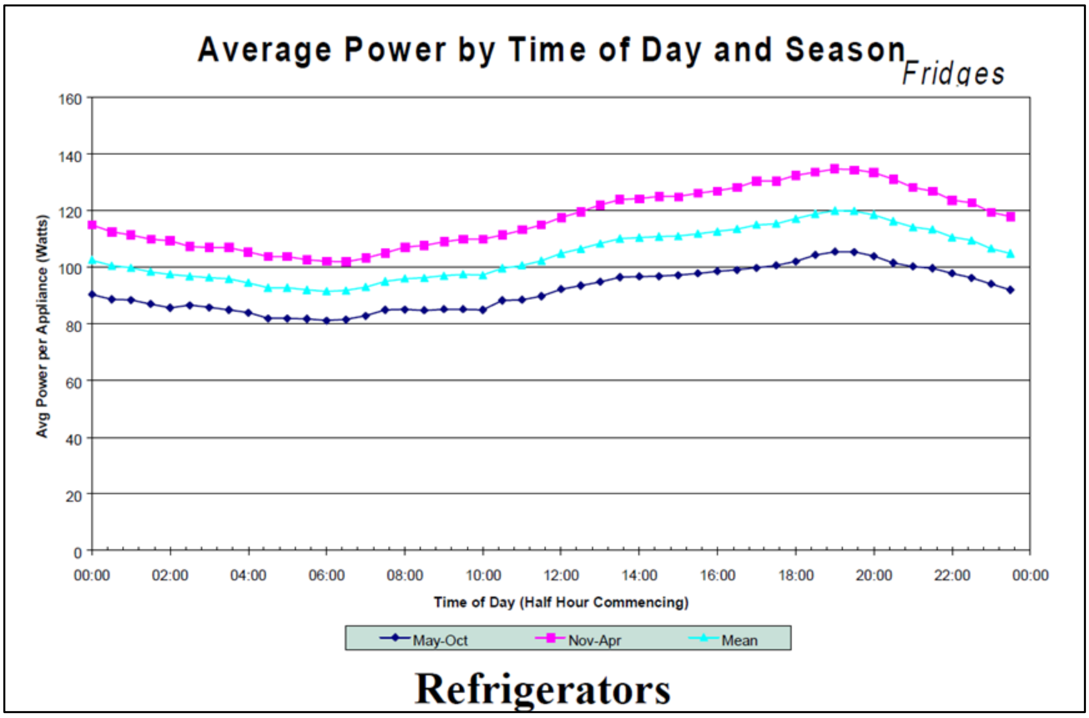
Freezers	REES 2017		REPS 2020	
Type	Baseline	Minimum permitted	Baseline	Minimum permitted
Group 6c	2.75	3.3	3.1	3.5
Group 6u	2.0	2.5	2.8	3.1

Usage Profiling

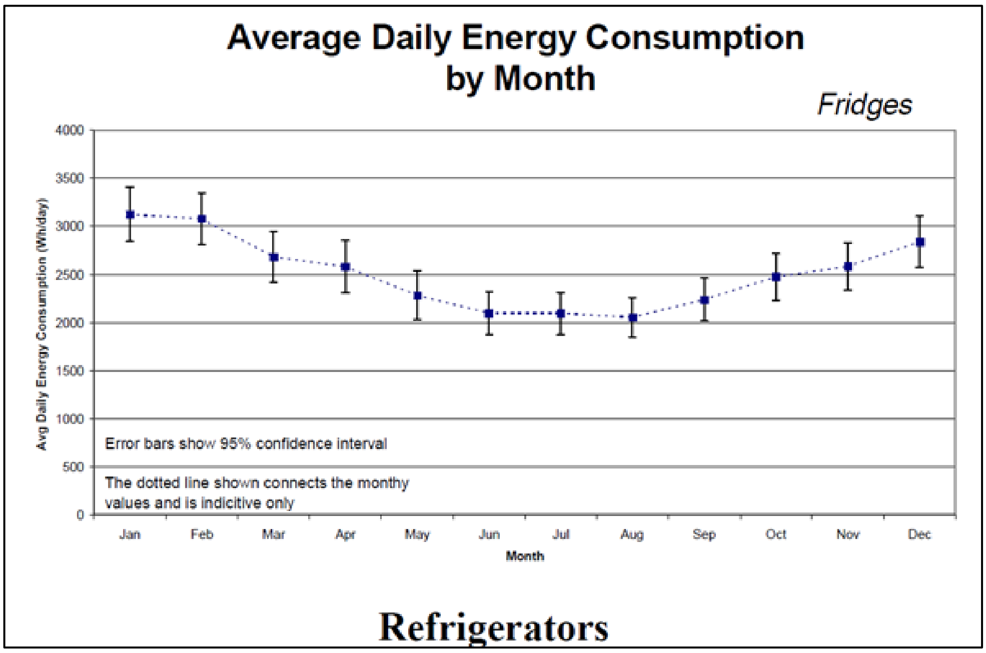
For both these activities the usage profiles were based on data compiled by Pacific Power for refrigerator usage (freezer profiles were found to be almost identical to refrigerator profiles). Graphically these profiles are reproduced below.

The daily and monthly profiles were combined to generate an annual profile covering hour of day and month of year (i.e. 24 * 12 data points).

RESIDENTIAL REFRIGERATOR USAGE PROFILE (PACIFIC POWER) – AVERAGE HOURLY



RESIDENTIAL REFRIGERATOR USAGE PROFILE (PACIFIC POWER) – AVERAGE MONTHLY



APP 1D Clothes Dryer

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.) with updates to assumptions in 2017.

Baseline assumptions were updated for this update and TOU based normalisation factors were applied.

Amendments to Scope, Settings and Assumptions

Scope, settings and assumptions were largely unchanged from those adopted in the last review just three years ago, all discount factors remained the same.

Amendments to Baseline

Baseline assumptions were updated as per the table below. The updates were based on the analysis of model weighted performance data obtained from the GEMS register which is then correlated with expected sales weighted trends based on similar correlation analysis conducted by EES over the past 20 years.

CLOTHES DRYER BASELINE ASSUMPTIONS REES 2017 V REPS 2020 (STAR RATINGS)

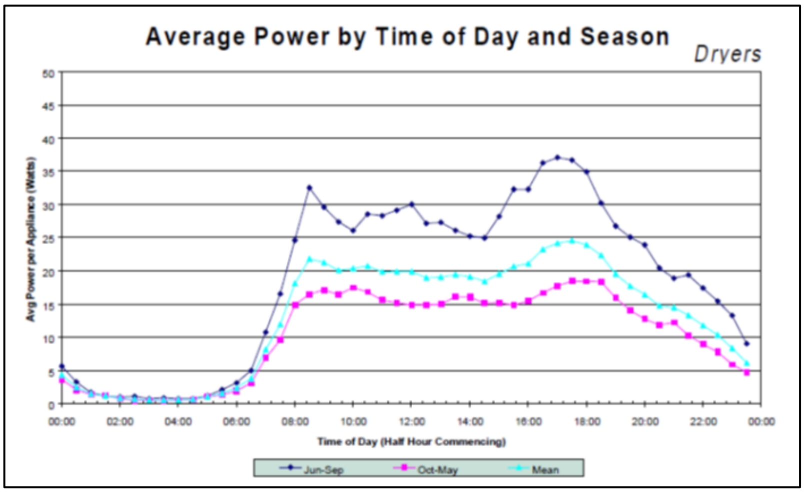
Clothes Dryers	REES 2017		REPS 2020	
Type	Baseline	Minimum permitted	Baseline	Minimum permitted
All	1.6	5.0	2.9	5.5

Usage Profiling

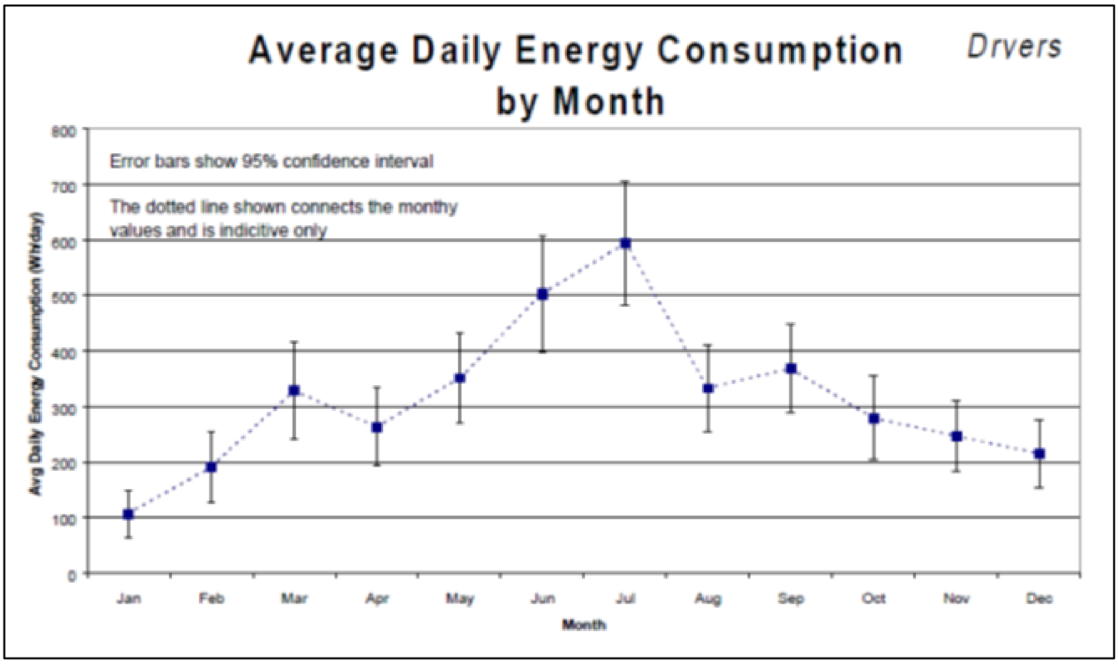
For this activity the usage profiles were based on data compiled by Pacific Power for clothes dryer usage. Graphically these profiles are reproduced below.

The daily and monthly profiles were combined to generate an annual profile covering hour of day and month of year (i.e. 24 * 12 data points).

CLOTHES DRYER USAGE PROFILE (PACIFIC POWER) – AVERAGE HOURLY



CLOTHES DRYER USAGE PROFILE (PACIFIC POWER) – AVERAGE MONTHLY



APP2 - Remove and Dispose of an Unwanted Refrigerator or Freezer (Residential or commercial)

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.) with updates to assumptions incorporated in 2017.

Because the fundamental nature of the activity is unchanged (removal of older equipment) the only modifications undertaken was that TOU based normalisation factors were applied. This increased credits very marginally (by about 3%) because the normalization factor for a refrigerator which effectively runs continuously is very close to 1.0.

Amendments to Scope, Settings Assumptions and Baselines

Scope, settings, assumptions and baselines were largely unchanged from those adopted in the last review just three years ago, all discount factors remained the same.

Usage Profiling

Usage profiling for this product type is the same as for new refrigerator installations.

APP3 - Installation of a High Efficiency Pool Pump (Residential only)

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2014 update of REES – *'Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014'* with updates to assumptions in 2017.

Baseline assumptions were updated for this update and TOU based normalisation factors were applied.

Because pool pumps usage is significantly higher during the summer months the TOU normalization factor for this product type is approximately 23% higher than under the REES arrangements. However, because the baseline assumption has also been increased from 2 stars to 3 stars (in consideration of the impending MEPS) and the assumed number of free riders has been increased from 10% to 25% (see following sections for details) the net result is that credits for this activity are now lower than under the current REES specifications.

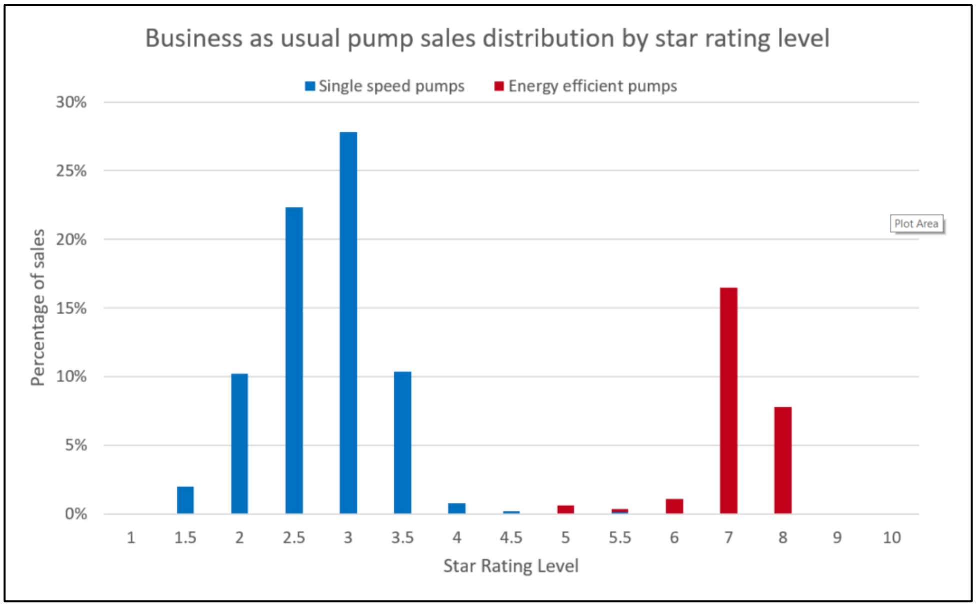
Amendments to Scope, Settings and Assumptions

With a few notable exceptions (see below) settings and assumptions were largely unchanged from those developed for the 2014 update of REES - see: Review of Residential Energy Efficiency Activities under the SA REES Scheme 2014 (EES et. al.).

The assumed lifetime for pool pumps was maintained at 10 years. This is somewhat lower than that applied in the NSW EEIS scheme (12 years) but higher than suggested in the 2018 pool pumps decision RIS (7.25 years). The figure of 10 years is considered to be a reasonable compromise between available data sources.

The only change undertaken to the assumptions was to the free rider assumption in the discount factors. Under REES it was assumed that sales of high efficiency pumps was approximately 10% of all sales (i.e. a free rider discount of 90%). Data from the 2018 Decision RIS suggests that by 2021 the free rider discount should be in the order of 75% of savings.

POOL PUMPS DECISION RIS 2018: SALES DISTRIBUTION (BAU 2021)

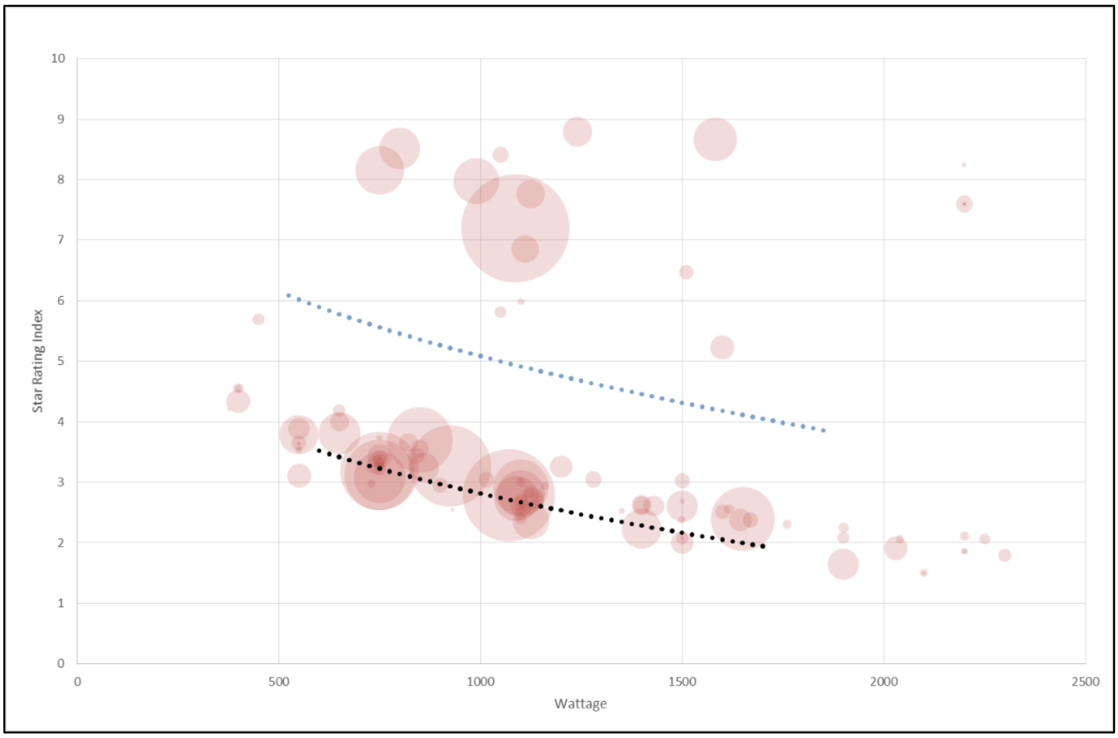


Amendments to Baseline

In December 2018, the COAG Energy Council agreed that new regulations would apply to pool pumps, requiring them to meet minimum energy performance standards (MEPS) and display an energy rating label under the *Greenhouse and Energy Minimum Standards Act 2012* (GEMS). Regulations are scheduled to commence in 2021.

The Decision RIS for pool pumps 2018 recommended MEPS levels are in the figure below. The black dotted line represents the recommended MEPS level. This varies somewhat according to capacity but averages approximately 3 Stars. As 3 stars is higher than the current average performance level for pool pumps this level can be assumed to represent the new baseline post regulation

POOL PUMPS DECISION RIS 2018: RECOMMENDED MEPS LEVELS

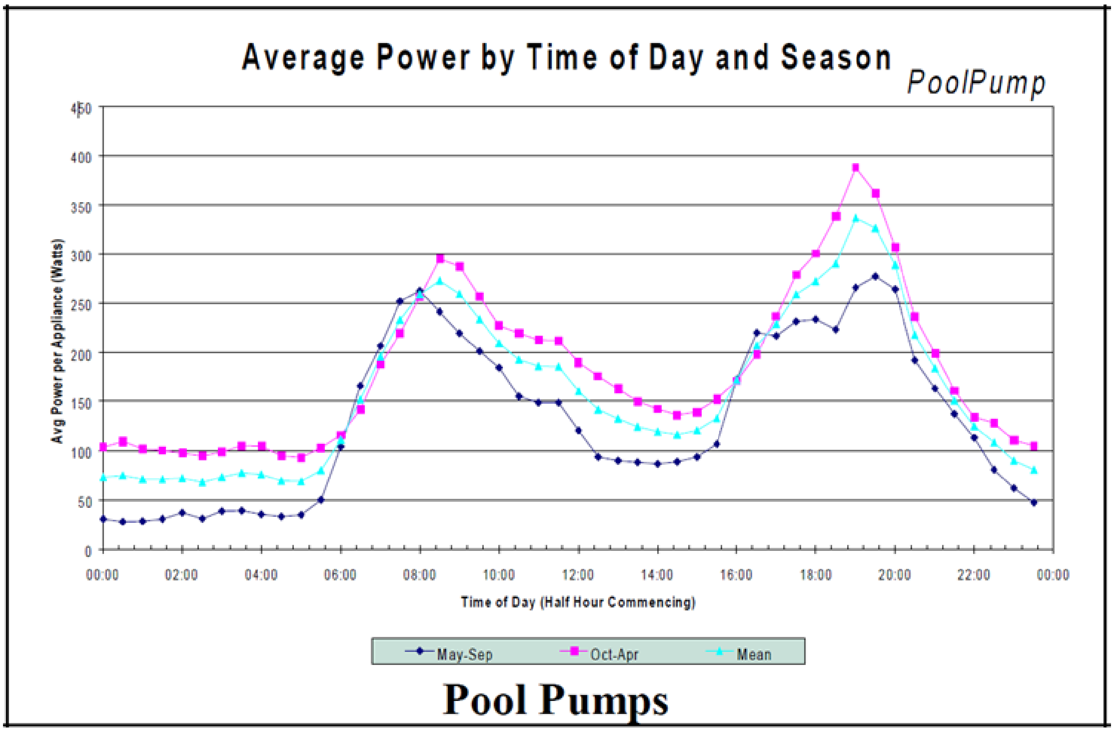


Usage Profiling

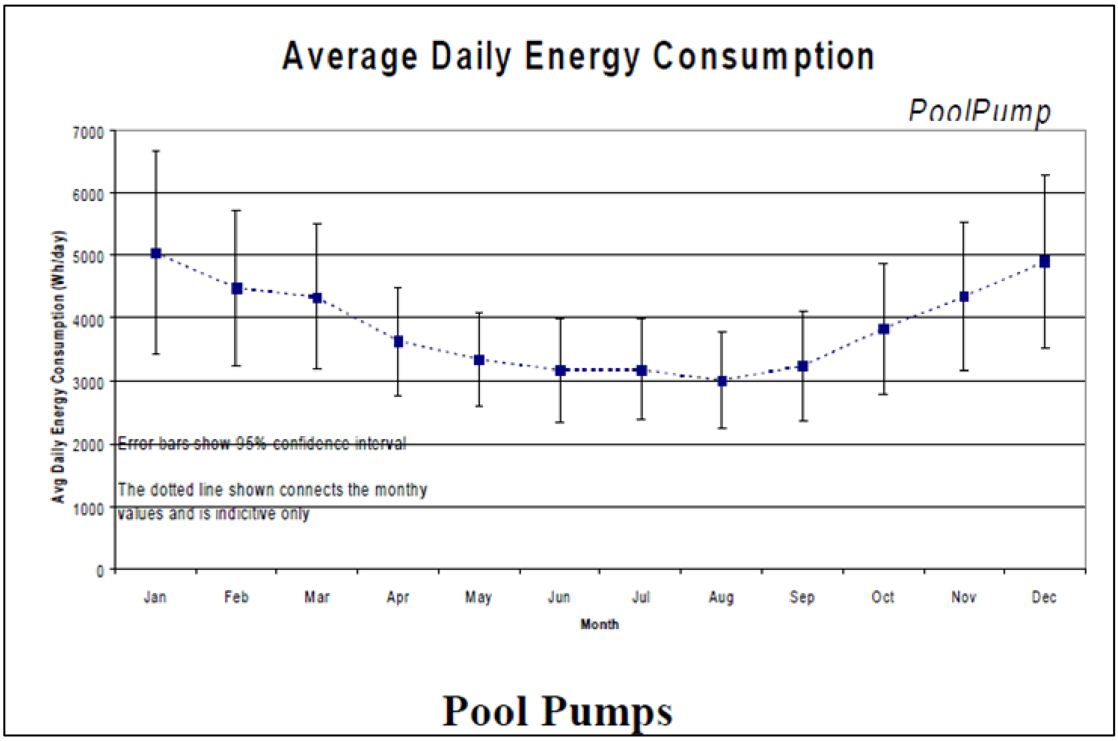
For this activity the usage profiles were based on data compiled by Pacific Power for pool usage. Graphically these profiles are reproduced below.

The daily and monthly profiles were combined to generate an annual profile covering hour of day and month of year (i.e. 24 * 12 data points).

Pool Pump Usage Profile (Pacific Power) – average hourly



Pool Pump Usage Profile (Pacific Power) – average monthly



RDC1 - Install a High Efficiency Refrigerated Display Cabinet (Commercial only)

Overview

The method for calculating credits for this activity is fundamentally unchanged from that developed for the 2017 update of REES – *'Review of Residential Energy Efficiency Activities under the SA REES Scheme 2017'*.

Two main alterations were made:

- Expansion of the scope of the activity to include both self-contained and remote (non-self-contained).
- Application of TOU based normalisation factors

Because refrigeration cooling loads are greater in summer when electricity costs are on average higher, there was a modest increase in the level of credits available for this activity.

Amendments to Scope, Settings and Assumptions

As noted in the overview above the scope of this activity was expanded to include both self-contained and remote (non-self-contained) units.

Apart from the expansion of the scope, no other amendments to settings or assumptions were made.

Amendments to Baseline

No amendments to the baseline assumptions were made for this activity. The base case is assumed to be represented by the MEPS level efficiency and the improved case by the GEMS high efficiency level. Additionality is assumed to be 80%.

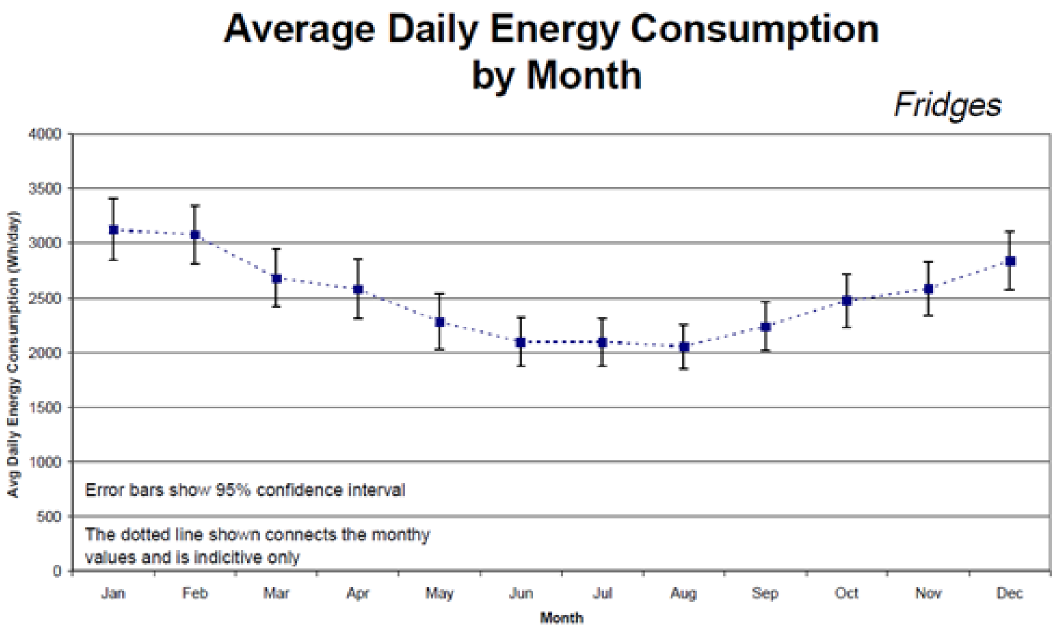
Usage Profiling

For this activity the monthly (seasonal) usage profile was based on data compiled by Pacific Power for refrigerator usage – see figure below. Whilst the Pacific Power data is based on residential demand, commercial demand by month of year can reasonably be assumed to exhibit a similar profile to residential refrigerator demand as the main driver of variation is variation in weather.

For an hourly profile, in the absence of available survey data a similar approach to that taken for activity CL1 was used. It was assumed based on experience and professional judgement that the typical hourly profile for a commercial operation would be as per the figure below. In this profile it is assumed that between the hours of 9am and 5pm maximum load is applied in the form of door openings and between 9pm and 6am a minimum load is applied (assumed to be 80% of the maximum load) and for four hours either side of these maximum and minimum demand time periods the utilization tapers between 80% and 100%.

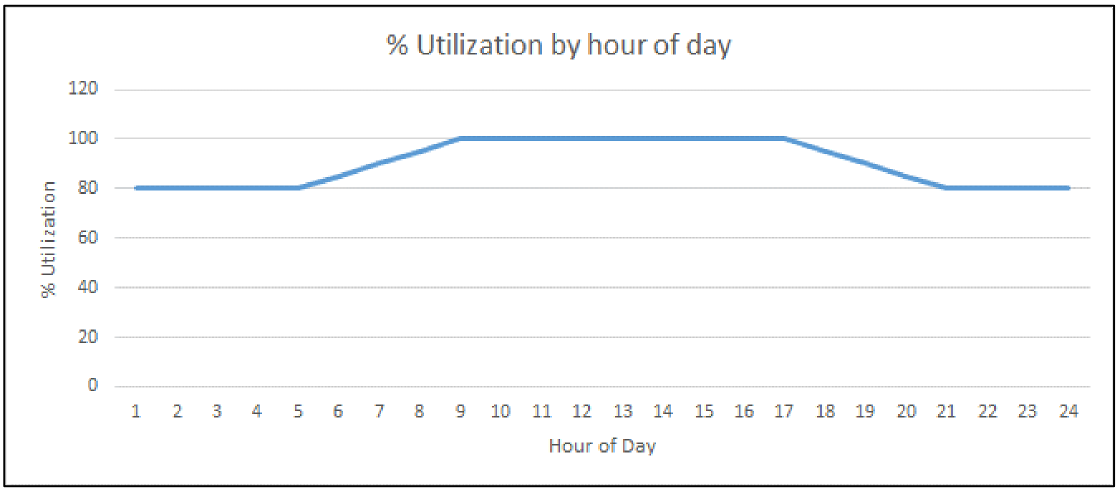
These daily and monthly profiles were combined to generate an annual profile covering hour of day and month of year (i.e. 24 * 12 data points).

Refrigerator Usage Profile (Pacific Power) – average monthly



Refrigerators

Estimated Commercial Refrigerator Usage Profile – average hourly



Activity WH3 – Switching water heater to SAPN controlled load

Overview

Water heaters comprise of a significant percentage of electricity usage in South Australia. Optimising the load would provide realisable benefits without significant costs to consumers since the storage of the resulting hot water allows for unique flexibility. Shifting the electricity demand to OPCL would relieve the peak stress on the grid and increasing demand during the Solar Sponge period would allow the grid to fully utilise the potentially destabilising amount photovoltaic power generated throughout the state.

Underlying Assumptions

This activity is eligible only for electric resistance and electric heat pump water heaters that are on continuous tariffs. However, only a small number of these water heaters are thought to not already be on controlled load tariffs. Peak demand reductions are calculated on the basis of the difference between the usage profiles for continuous and controlled load (solar sponge) tariffs described below.

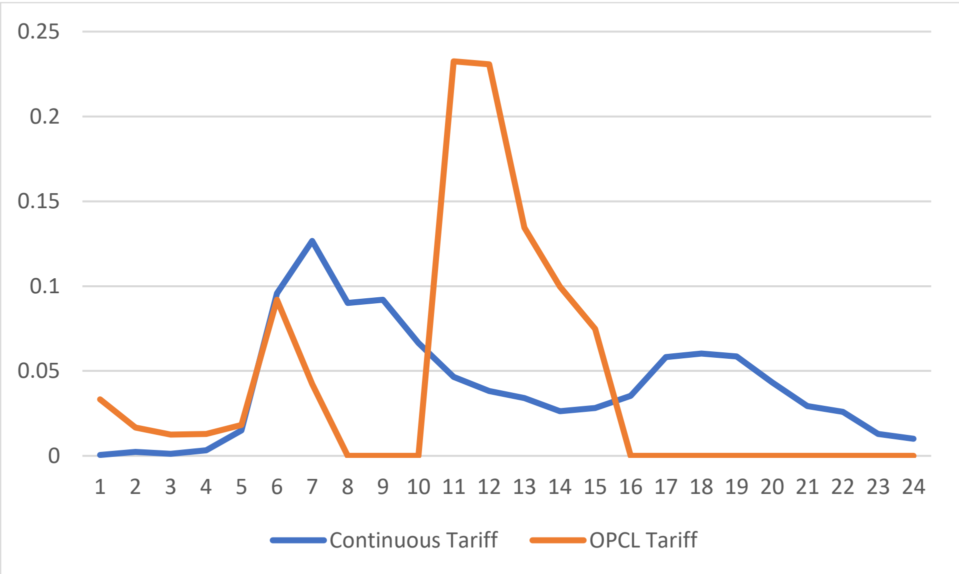
Only electric resistance and electric heat pump are covered by this activity since this program is aimed at the electricity market and the inclusion of solar aided water heaters shows insignificant benefits. Additionally, only water heaters with a storage capacity of at least 125 litres are included in the specification as they would need to be of sufficient size to meet household demand.

For this activity, a deemed period of 10 years is assumed.

Usage Profiling

The baseline profile of hot water usage is assumed to remain consistent with previous activities. However, the improved alternative is shown in the graph below. It assumes that the water heater would be optimised to consume the majority of its daily electricity demand during the solar sponge period as it would result in the lowest daily cost. To be conservative it is assumed additional off-peak heating will be required outside the solar sponge period. Additionally, the amount of hot water used by each property is assumed in order to aid the functionality of the program and reduce compliance costs.

ADJUSTED DAILY WATER HEATER ELECTRICITY DEMAND PROFILES WITH SAPN CONTROLLED LOAD



Activity TOU1 – Switch a household from uncontrolled tariff to Time of Use (ToU) pricing.

Overview

Dynamic ToU pricing more accurately represents the marginal cost of producing electricity and leads to increasing efficiencies by discouraging power consumption during periods of peak demand and encouraging greater use during off-peak of solar sponge times. It would ideally increase demand for DR-enabled appliances and batteries as consumers react to transparent actualised pricing.

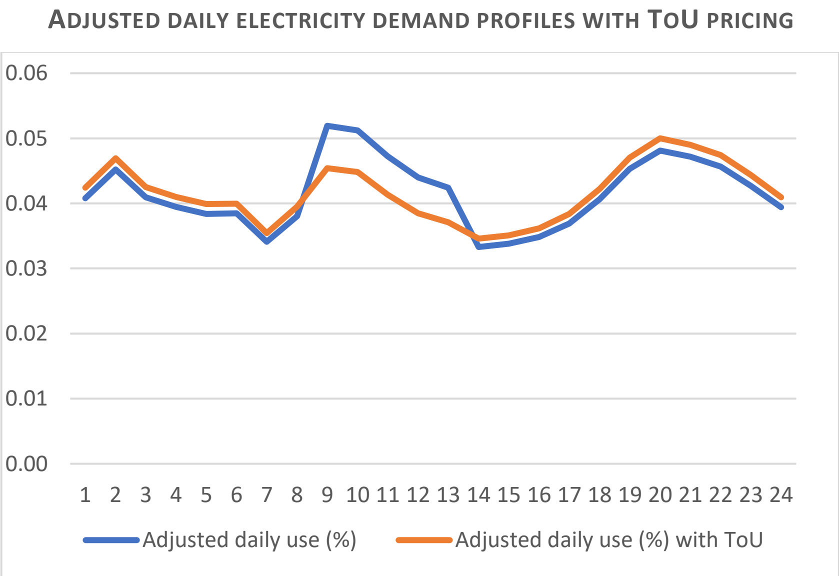
Underlying Assumptions

This REPS credits assume an average annual electricity use for each household. This again reduces what would otherwise be burdensome compliance and regulatory costs and uses its simplicity to further incentivise potential consumers.

Usage Profiling

The model's implementation assumes a level of cross price elasticity of demand which would result in a reduction in consumption during peak times and an increase during off-peak and solar sponge. This elasticity, which is predicted to be around -0.25% for residential customers, is essential in predicting the benefits to the grid, in aggregate, from changes in behaviour. The figure below, shows the changes in demand profiles following the implementation of ToU pricing for a typical residential consumer. This shows that there would be significant increases during off-peak periods with corresponding decreases during peak periods.

This activity calculates adjusted electricity use without considering solar sponge which is previously covered by activity WH3. When considering the further discount from solar sponge the shift in electricity demand is even more pronounced.



Activity VPP1 – Connect battery to VPP

Overview

Virtual Power Plants (VPP) broadly refers to an aggregation of resources such as decentralised generation, storage and controllable loads which is coordinated to deliver services for power system operations and electricity markets. VPPs are of increasing importance as they can shift energy demand from peak to off-peak and are able to intelligently store the otherwise instantaneous electricity production.

Incentivising residential and commercial batteries to participate in a VPP would increase the flexibility and ability of a collection of batteries to alleviate stresses on the electricity grid. This activity rewards residential and commercial battery owners to participate in a VPP and compensates them for the loss of control that entails.

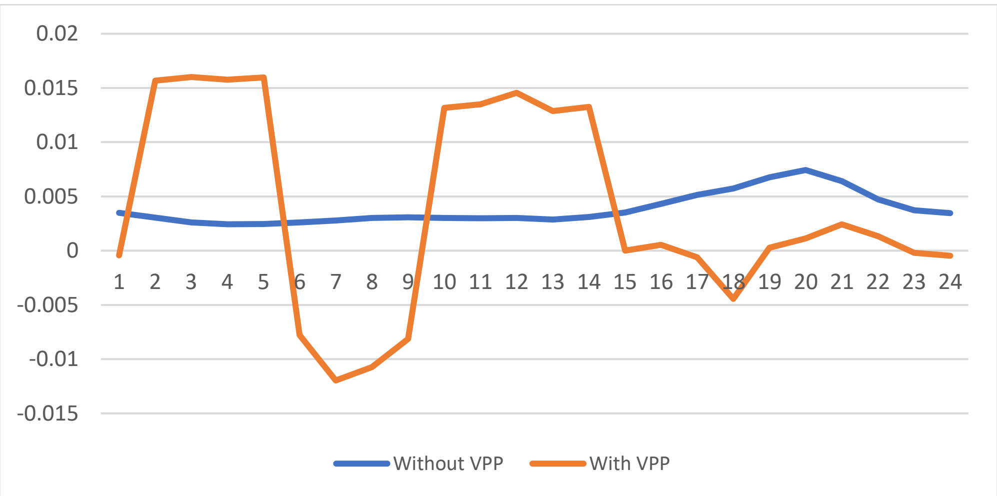
Underlying Assumptions

This analysis assumes that a connecting to a VPP would be deemed for 10 years and assumes daily energy consumption of 16.6 kWh per household, a value consistent with average use for South Australian households. Our analysis has shown that there is little change on the productivity values depending on the consumption of the individual household. This is because the analysis considers the productivity of the battery on an aggregate level looking at the entire grid, meaning that the productivity value is solely dependent on the size of the battery. The round-trip efficiency (RTE) of the battery is assumed to be 90%.

Usage Profiling

It is assumed that the VPP completely charges and discharges the battery twice daily to maximise its effectiveness and assumed profitability for the operator. This would involve fully charging the battery overnight during off-peak as well as fully charging the battery during solar sponge times. Additionally, it will be discharged at a continuous rate during peak times until the supply is exhausted. The figure below shows the daily demand profile for a household with daily consumption of 16.6kWh and a 10kWh battery for a typical household in January.

DAILY ELECTRICITY DEMAND PROFILE (JANUARY) FOR HOUSEHOLD WITH 10KWH BATTERY (VPP)



Activities APP4, HC2C, WH4, EV1 – Connect pool pump/HVAC/water heater/EV charger to demand response aggregator

Overview

These activities are all quite similar is covering the connection of household appliances to demand response aggregators. Pool pumps, HVAC systems, water heater and EV chargers are either the main drivers of household electricity use or are expected to be in the future. Connecting these appliances to DR aggregators would allow for the operation of a negative power plant reducing the strain on the grid during peak demand periods. Incentivising consumers to reduce their power consumption may prove to be more economical than increasing electricity production at high marginal costs and could counterbalance the intermittency of renewable energy sources.

As previously discussed, there are four different modes which would allow DR aggregators to more specifically adapt demand to suit the particular market conditions. DRM1, DRM2 and DRM3 allow for the remote reduction of power consumption, each by a different proportion of demand. DRM4 would allow the aggregator to instruct the appliances to increase power consumption to consume or store energy.

Underlying Assumptions

It is challenging to predict the typical changes to demand from DR aggregation services, due to the emerging nature of this market. A balance needs to be struck between not over rewarding activities with more credits than the demand benefit they will deliver, while also not constraining innovation by prescribing precisely how DR aggregators deliver their services. The assumptions for each activity aim to cover the amount of demand response that could realistically be required to be delivered while allowing for flexibility over the timing of that DR. But these assumptions need to be tested through consultation.

In this analysis it is assumed that the consumption of each of the appliances will remain constant, other than on days during which demand response has been activated. However, when looking at the demand on an annual timescale the reduction in actual demand because of demand response is mostly insignificant. We have assumed a deeming period of 10 years with 20% churn, resulting in 8 years deemed in advance.

The different activation conditions for each activity are as follows:

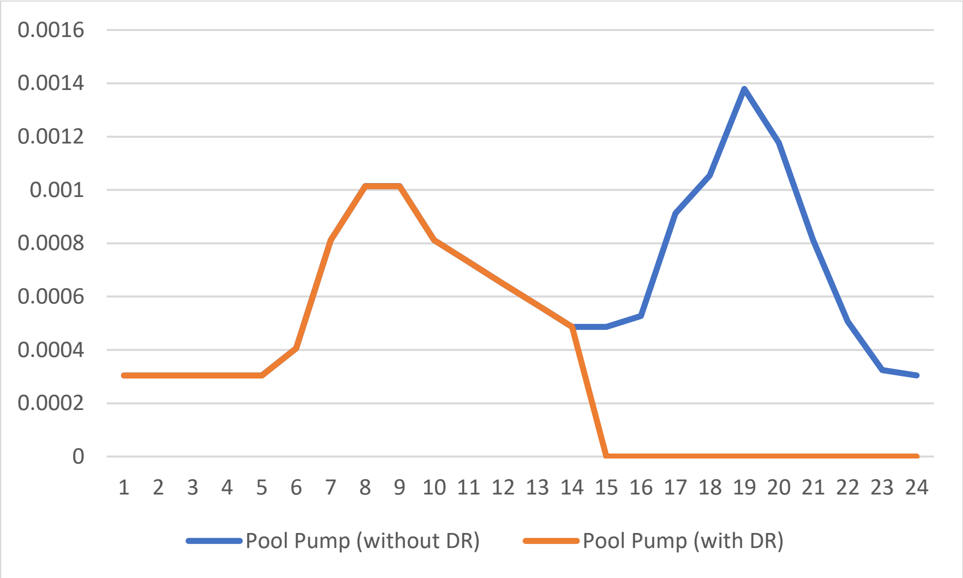
- APP 4 (Pool Pumps): 100% of demand (DRM1) is shifted between 3 PM – 1 AM on at least the 5 highest demand days of the year.
- HC2C (HVAC): 50% of demand (DRM2) is shifted between 3 PM – 1 AM on the 15 highest demand days of the year, including the 5 highest demand days of the year.
- WH4 (Water Heaters): 100% of demand (DRM1) is shifted between 3 PM – 1 AM on at least the 5 highest demand days of the year.
- EV1 (EV Chargers): 100% of demand (DRM1) is shifted between 3 PM – 1 AM on at least the 5 highest demand days of the year.

Additionally, the activities are not assumed to be mutually exclusive i.e. if consumers can claim credits for each eligible DR enabled device at the same premises they sign up to a DR aggregator.

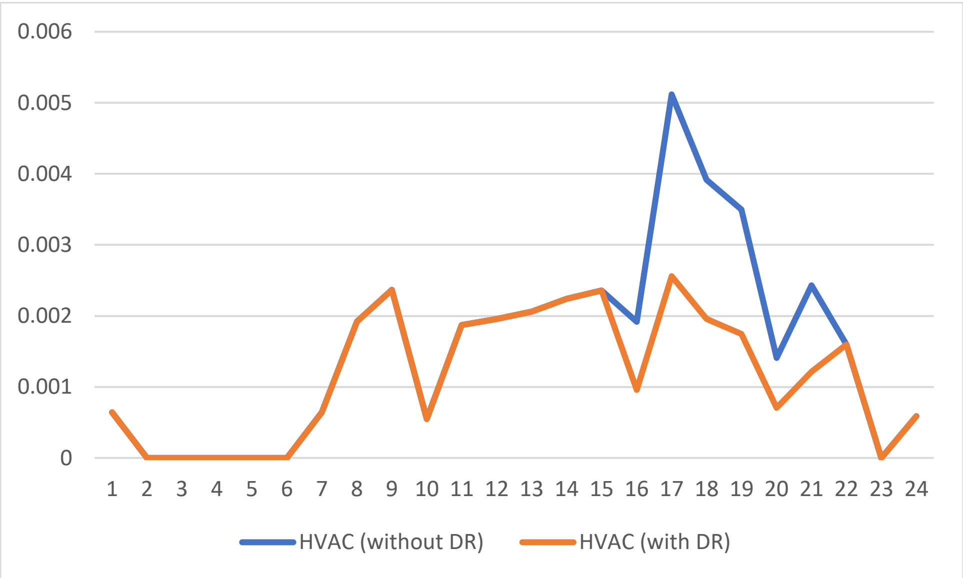
Usage Profiling

The usage profiles assume that demand response will be called upon primarily during peak days when there is maximum demand in the electricity market. Usage profiles were compiled either from previous existing activities or from further research. Element Energy research provided electric vehicle demand profiles for the United Kingdom which was then normalised to consider differences between Australian and British driving habits as well as seasonal differences. Demand changes were calculated on the basis of a range of daily usage profiles for each technology throughout the years. Examples of are as follow.

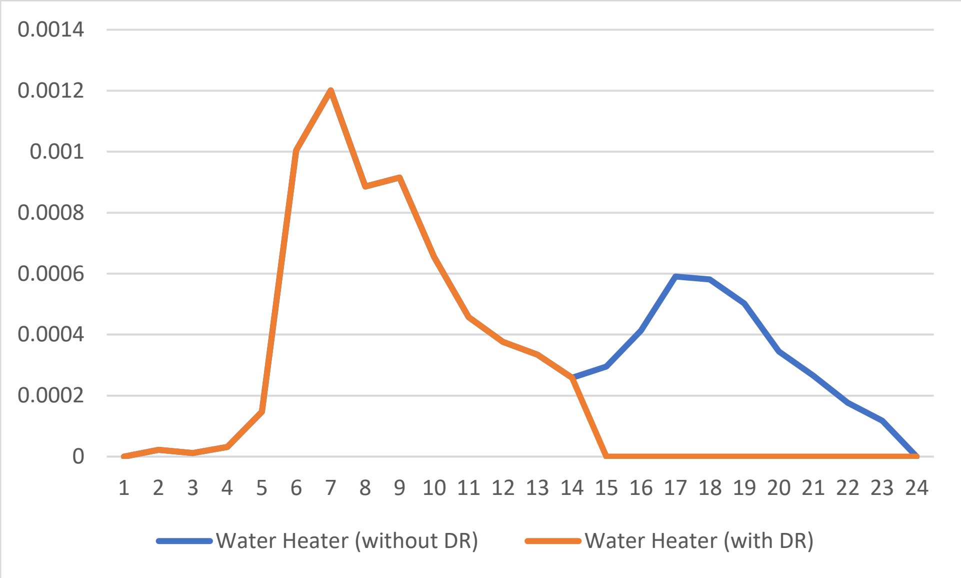
Pool Pump DR typical day adjusted demand profiles (DRM1)



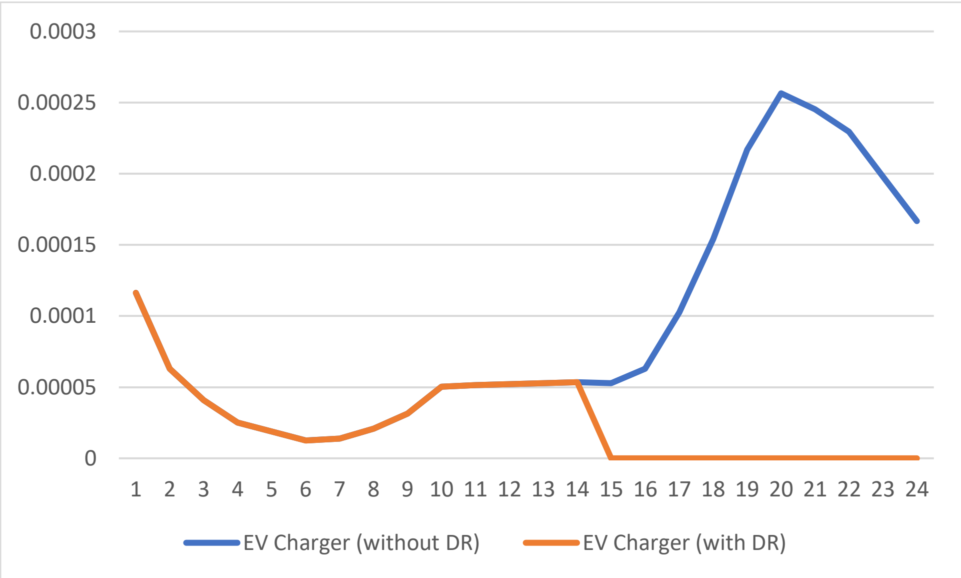
HVAC DR typical day adjusted demand profiles (DRM2)



Water heater DR typical day adjusted demand profiles (DRM1)



EV charger DR typical day adjusted demand profiles (DRM1)



NABERS – Commercial Demand Savings (NABERS)

Overview

General electricity demand savings by commercial entities should be encouraged as a way to decrease costs and increase energy productivity throughout the state. It would be impossible to quantify every possible upgrade possible which could in some way have a beneficial impact on the electricity demand. Therefore, this activity relies on the NABERS method in order to quantify the building's improvements and to adequately compensate the business for its expenditures. Using the NABERS method one is able to easily calculate improvements.

Underlying Assumptions

Different demand profiles depending on the end-use of the buildings requires calculation of normalisation values which compensate for the daily energy pattern. Using the normalisation profile, the method can further incentivise energy savings targeted during peak times. Due to increasing complexities it must be assumed that any increase in efficiency is evenly distributed over the entire demand profile. Otherwise, the required compliance and regulatory cost would be prohibitively expensive and burdensome as the NABERS framework does not capture the nature of the upgrades that result in rating increases.

Energy savings are calculated using the NSW NABERS methodology. A building is required to have a baseline NABERS rating prior to commencement of any upgrade. After completion of works the same building's electricity usage is measured for a year, following which an updated NABERS rating is calculated. The difference between the ratings multiplied by the normalisation profiles depending on the building's end-use results in the corresponding deemed productivity value.

Usage Profiling

Usage profiles have been collected depicting normalised general electricity demand profiles for buildings of the following end-uses:

- Apartment buildings.
- Office buildings.
- Shopping centres.
- Data centres.
- Hotels.

Due to the different demand profiles for each activity it is possible to quantify the actual network wide benefits for any upgrade for each end use. For example, data centres exhibit a very stable demand profile when compared to office buildings. Therefore, the normalization profiles are required in order to accurately prioritize projects reaping benefits during peak times.

Activity PIAM&V – Commercial & Industrial Demand Savings

Overview

PIAM&V stands for Project Impact Assessment with Measurement & Verification, it is a method for calculating and verifying energy efficiency savings resulting from upgrades and improvements. In this case it would most likely be used in cases where a commercial building is not covered by an existing NABERS method or the case of industrial upgrades.

Underlying Assumptions

This method works by measuring and verifying the energy use of and upgraded system, which could range from an individual piece of equipment to a whole site depending on system boundary. Once the demand has been accurately measured for a year, the data is fed into a "baseline energy model" which establishes how independent variables influence energy consumption in the absence of the activity. Following the activity, the same measurement process is repeated. Two alternative calculation approaches are available to calculate savings, based either on direct measurements (Measured Energy Savings" calculations), or on "Normal Year Energy Savings".

Usage Profiling

For savings in the PIAM&V method the method does not consider the upgrades' influence on the system's demand profile. Instead, the savings are assumed to have reduced demand proportionally to existing demand. This is due to the significant increases in complexity of administration and compliance cost if the demand profiles were more closely considered.