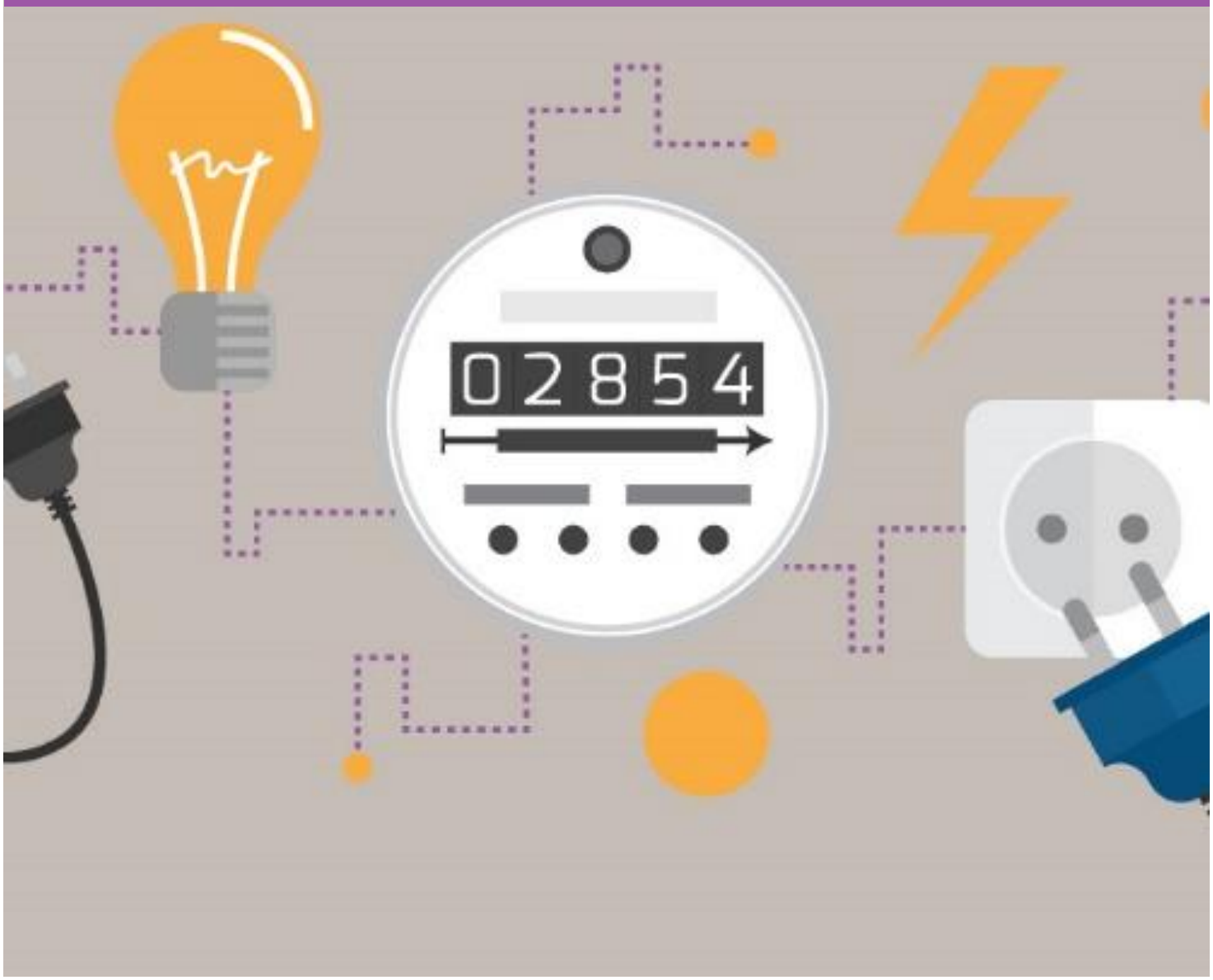
ACIL ALLEN CONSULTING

REPORT TO
AUSTRALIAN ENERGY REGULATOR

13 OCTOBER 2017

ENERGY CONSUMPTION BENCHMARKS

ELECTRICITY AND GAS
FOR RESIDENTIAL CUSTOMERS



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EXECUTIVE SUMMARY

As a means to measure energy efficiency, Part 11 of the National Energy Retail Rules (NERR) requires the Australian Energy Regulator (AER) to produce electricity consumption benchmarks. These are estimates of electricity consumption of typical Australian (excluding Western Australia) households. Their purpose is to provide residential customers with the means to compare their consumption with that of similar households in their area.

According to rule 169 of the NERR, the benchmarks must be based on:

1. electricity consumption data provided to the AER by electricity distributors
2. localised zones as determined by Energy Ministers
3. the number of persons living in a dwelling (household size).

In jurisdictions that have adopted the National Energy Retail Law (NERL), electricity retailers are required to include benchmark information on customers' bills to facilitate this comparison.

Under the NERR, the AER must update the electricity benchmarks every three years. ACIL Allen developed the first set of benchmarks in 2011, updated them in 2014 and was engaged to update them again in 2017.

There are a number of key differences between the benchmarks presented in 2011 and 2014, and those contained in this report.

Gas consumption benchmarks estimated for the first time.

One difference is that, **for the first time, this report provides *gas* consumption benchmarks.**

The AER's intention is that adding gas benchmarks to the Energy Made Easy website (EME) will provide a corresponding tool for gas customers to compare gas consumption with similar households in their state and to estimate gas bills.

A second difference is the methodology taken to increase sample size.

Table ES 1 (overleaf) summarises the total sample size for this occasion, compared with 2011 and 2014.

On this occasion the sample consists of

- for the electricity benchmarks, 8,174 households – more than 1.8 times as many as in 2014
- for the gas benchmarks, 2,518 households.

The substantial increase in the electricity sample size, compared to previous occasions, means that the benchmarks presented here are a more robust and reliable estimate of typical electricity consumption of households to whom they apply.

TABLE ES 1 SAMPLE SIZE COMPARISONS BY BENCHMARKS REPORT

Sample	2011	2014	2017
Electricity	4,488	3,302	8,174
Gas	-	-	2,518

SOURCE: ACIL ALLEN CONSULTING

The benchmarks are based on data provided by Australian households through an online survey. The answers to the survey allow for an analytical method to identify the 'best' factors relating to a household depending on their individual, geographical circumstances.

On this occasion survey respondents could participate in the survey through a variety of channels. The first channel was through online panels, which include people who had previously indicated a willingness to participate in surveys. This is the same approach used previously.

Using social media and gaining assistance from energy retailers and DNSPs means that the sample size is substantially larger than previous exercises.

In addition, invitations for households to participate in the survey were also sent by:

- three Victorian electricity distribution network service providers, who invited customers who had joined their energy portals
- two large energy retailers, who enabled a more targeted approach to customers with time of use meters in jurisdictions other than Victoria
- social media, including tweets by the Australian Competition and Consumer Commission which were retweeted by numerous other stakeholders.

A third difference is in the way these benchmarks vary across locations.

Under the NERR, the benchmarks must be based on *localised zones* chosen by Energy Ministers. On this occasion, Energy Ministers in jurisdictions other than South Australia chose to adopt the climate zones developed by the Australian Building Codes Board. This was on the basis that climate has a substantial impact on the way energy is used and, therefore, on the benchmark level of usage.

South Australia preferred to remain with its own, tailored zones. These zones account for climate and other factors, such as the availability of reticulated gas, and geography.

Most Energy Ministers nominated Climate zones as localised zones. The larger dataset allows for benchmarks with higher geographic 'granularity'.

The benchmarks are broadly based on data within a given zone / State pair, where possible. Some zones cover large parts of Australia but are sparsely populated, meaning there were insufficient observations (even with the larger overall household sample). In cases where samples were too small to generate reliable estimates the data were 'pooled' within or across zones.

A fourth difference is in the way additional 'factors' were chosen for the benchmarks.

Electricity benchmarks

The NERR require that benchmarks on electricity bills are distinguished by household size and localised zones. As with previous years, ACIL Allen has also considered additional 'variables', which retailers can use to 'tailor' benchmarks more closely to individual households. Further, the AER could use these variables on the EME website to provide tailored benchmarks based on information website users provide about their household.

In this project, ACIL Allen used the larger household sample to identify the variables that 'explain' the greatest variation in electricity consumption within each climate zone. Six separate models were estimated to identify the variables relevant to these zones. This approach differs from analysis in previous years, which selected the most important explanatory variables using a national model, and then generated benchmarks by applying the same variables to each state.

The approach was put into effect using a proprietary algorithm that tests the available variables (which come from the survey) to identify those that explain the most variation. The algorithm stops testing for additional variables when the incremental amount of variation explained falls below a pre determined threshold.

The analysis takes an empirical approach to determining the most 'important' variables in explaining differences in electricity consumption between households in a given localised zone. That is, the

conclusions are based on analysis of actual consumption data. It allows for the possibility that the 'variables' that are most 'important' vary from place to place and are driven by the data, rather than by prior expectations.

Figure ES 1 summarises the results of this analysis, showing the variables that were identified as most important in explaining variation in electricity consumption in each climate zone.

The height of the coloured column segments in Figure ES 1 represents the contribution each variable makes to explaining differences in the amount of electricity used by customers in the sample. A taller column segment represents that the variable explains more of the difference.

The figure also shows the extent to which these models are able to explain overall variability in the sample (the height of the stacked bars excluding 'Other factors'). The overall amount of variation explained is broadly similar to the results achieved on previous occasions, if not somewhat stronger.

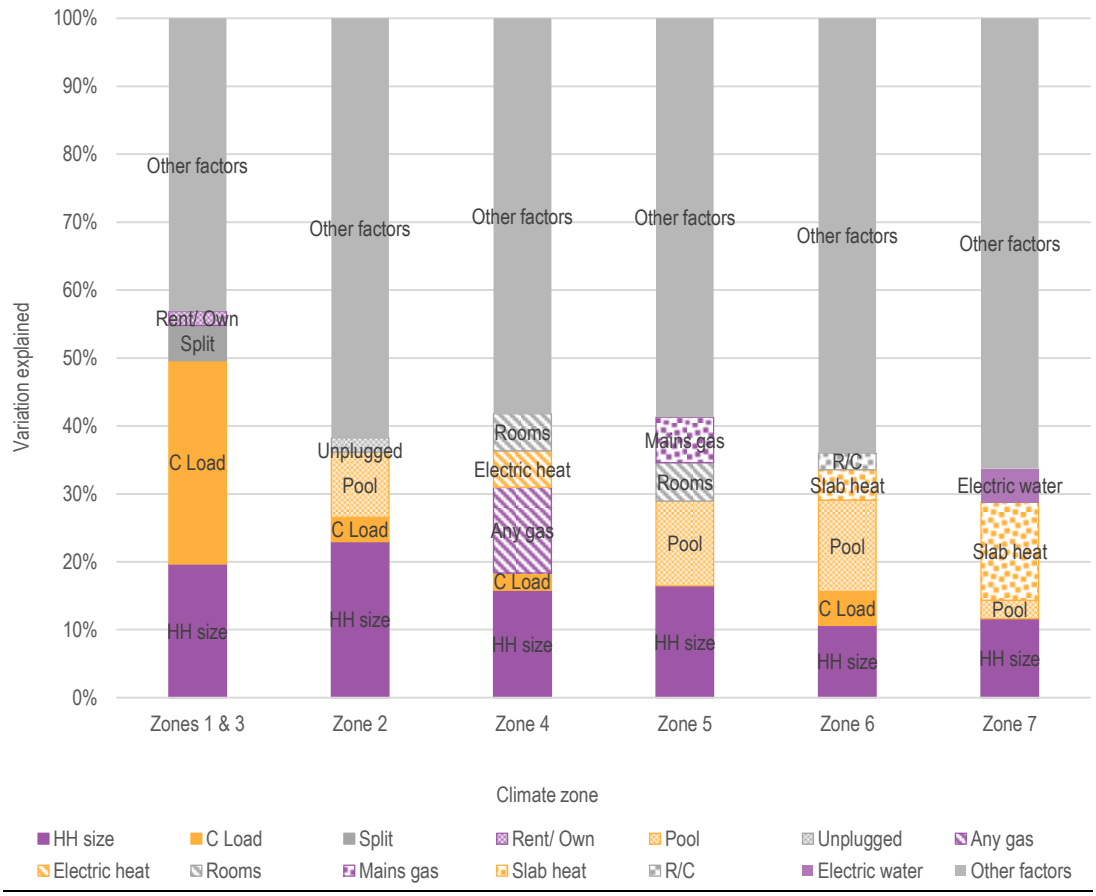
The key variables that explain differences in electricity consumption vary by location.

Figure ES 1 suggests that the sample would support benchmarks based on several variables *in addition to* household size, and that the most important variables vary between zones. In total, 12 variables were identified as potentially relevant across the six Benchmark equations.

Note that the definitions of some variables overlap. For example the model in:

- zone 4 includes 'any gas' - referring to reticulated and/ or bulk bottled gas supply
- zone 5 includes 'mains gas' - referring only to reticulated supply.

FIGURE ES 1 ELECTRICITY BENCHMARKS BY CLIMATE ZONE 'BEST' VARIABLES



SOURCE: ACIL ALLEN CONSULTING

The analysis that underpins Figure ES 1 identifies the explanatory *variables* that are 'best' in explaining variability in electricity consumption from an empirical perspective.

The NERR do not require that retailers distinguish benchmarks by other factors than household size. However, our analysis shows that the veracity of benchmarks can be improved by doing so. That is, if

additional variables are taken into account, the resulting benchmarks will explain more of the variability in consumption and, thereby, be more informative to consumers.

Therefore, we provide recommendations as to the 'second factor' retailers might use in placing benchmarks on their customers' bills. The factors we recommend are:

— household size and pools in climate zone two, five and six
— household size and gas in climate zone four
— household size and slab heating in climate zone seven and eight.

Despite controlled load being important in climate zones one and three, there were few people who answered the survey in these zones, meaning that the benchmarks would not be robust if controlled load was to be considered. We therefore recommend that benchmarks in these zones only be presented according to household size.

There are several approaches that retailers might use to display tailored benchmarks to their customers.

In developing these recommendations we took account of differences between empirically selected *variables* and practically useful benchmark *factors*. The key difference between these two concepts is that for a *variable* to be a useful *factor* it must be capable of being communicated to consumers appropriately, as well as being important in explaining differences in electricity consumption between customers. In other words, if retailers are to use benchmarks distinguished by a particular factor, they would ideally display one set of benchmarks on the bills of customers to whom that factor applies and another set on the bills of other customers.

This is the approach we recommend in zone four. That is, if a second factor is to be used we recommend that the:

— 'with gas' benchmarks are shown on the bills of households who receive both electricity and gas from their retailer
— 'without gas' benchmarks are shown to other households.

We note that there will be some customers who receive gas from a retailer other than their electricity retailer. If retailers are aware of this they would ideally display the 'with gas' benchmarks. They would also ideally add a note directing customers to EME for more tailored benchmarks

In other zones the most important *variables* are whether the households in question has either a swimming pool or electric underfloor (slab) heating. Neither of these is likely to be known to retailers, so retailers cannot reasonably be expected to show different benchmarks to, for example, customers with or without swimming pools.

To overcome this we recommend that if a second factor is to be used the benchmarks displayed on the bill in these zones should be the 'without' benchmarks. That is:

— 'without swimming pool' in zones two, five and six
— 'without slab heaters' in zones seven and eight.

This would ideally be accompanied by a note explaining this and directing customers with swimming pools or slab heaters to EME for the appropriate benchmarks and for more tailored benchmarks.

We note that this will mean that the bills of customers with swimming pools in some places and with slab heaters in other places will not display suitable benchmarks. However, this is a small proportion of customers and the alternative is to provide a single benchmark which averages across customers with and without these 'appliances'. The averaging approach would produce benchmarks that are substantially less accurate for all customers, which we would consider to be less informative to most consumers.

The sample that underpins gas consumption benchmarks is smaller and less geographically spread than the electricity sample, reflecting the availability of reticulated gas.

Another option would be to present both benchmarks on the bill in some way.

Gas benchmarks

The gas benchmarks are distinguished by household size. Selecting additional benchmark factors followed the same process as in that for electricity.

The key factor in explaining gas consumption is usually whether the household uses gas for space heating.

The 'best' factor to inform benchmarks for gas bills is the presence of a gas heater. Table ES 2 summarises the jurisdictions for which the presence of a gas heater explains sufficient variation in gas consumption to specify separate benchmarks for households with or without gas heaters.

TABLE ES 2 INCLUSION OF GAS HEATER BY JURISDICTION

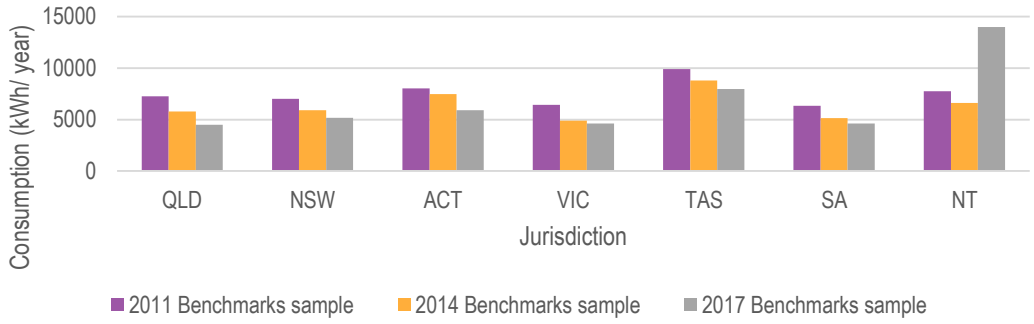
State	Benchmarks estimated for gas heaters / no gas heater
QLD	No
NSW	Yes
ACT	No
VIC	Yes
TAS	No
SA	Yes

NOTE: The Northern Territory is omitted as there are no gas benchmarks for the Northern Territory.
SOURCE: ACIL ALLEN CONSULTING

A fifth difference is in the amount of electricity used by households in the sample.

Annual consumption appears to have fallen since 2011 when we first produced bill benchmarks. There has been a decreasing trend across almost all jurisdictions. This potentially reflects households becoming more energy efficient, though this was not the purpose of this exercise, so the results can only be considered indicative. The exception is the Northern Territory, though this appears to be attributable to small sample size as discussed in section 4.4 of the main report.

FIGURE ES 2 COMPARISON OF ANNUAL CONSUMPTION WITH PREVIOUS BENCHMARKS



SOURCE: ACIL ALLEN ANALYSIS

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1 INTRODUCTION

It is widely accepted that some Australian households use more electricity than is necessary to achieve a desired standard of living. In other words, they are not as energy efficient as they could be.

Energy prices have risen in recent years, and they are expected to keep rising in the near future. Further, Australia's greenhouse gas emissions, and therefore its contribution to climate change, are more closely linked to energy use than most other countries because the electricity generation sector in Australia is substantially based on coal. For these reasons, and others, it is important for Australian households to improve their energy efficiency. Doing so will assist them to manage rising energy bills and reduce Australia's carbon footprint.

A significant amount of attention has been given over the years to the so called 'energy efficiency gap' or the difference between actual energy efficiency and the level thought to be achievable and affordable.[1] As time passes, the level of energy efficiency that could technically be achieved increases, but the gap remains.

A number of reasons have been identified as to why energy efficiency persists below the level which could be achieved. One is that customers usually have less than perfect information on what is an efficient level of consumption. If customers do not know what is possible, they will find it more difficult to improve their energy efficiency.

Australian Governments have taken various steps to improve energy efficiency in Australia. One such step was taken in December 2011 when the Australian Energy Regulator (AER) provided the first electricity bill benchmarks to retailers. The benchmarks are a useful resource for electricity customers, assisting them to manage their consumption and, by extension, their energy bills.

The benchmarks are typical annual and seasonal consumption figures of domestic properties. Their purpose is to provide residential customers with the means to compare their consumption with that of similar households in their area.

In jurisdictions that have adopted the National Energy Retail Law (NERL), electricity retailers are required to include benchmark information on customers' bills to facilitate this comparison.

The electricity bill benchmarks are a requirement of part 11 of the National Energy Retail Rules (NERR). According to rule 169 of the NERR, the benchmarks must be based on:

1. electricity consumption data provided to the AER by electricity distributors
2. localised zones as determined by Energy Ministers
3. the number of persons living in a dwelling (household size).

[1] See, for example, Productivity Commission, "Productivity Commission Inquiry Report no 36, The Cost Effectiveness of Improving Energy Efficiency", 2005, p. XXIV

Under the NERR, the AER must update the electricity benchmarks every three years. ACIL Allen developed the first set of benchmarks in 2011, updated them in 2014 and has now been engaged to update them again in 2017.

The AER also hopes that making EME more useful to consumers will support the AER's goal of facilitating customer engagement and confidence in the retail energy market.

This report summarises the process ACIL Allen undertook to produce the updated benchmarks and presents the benchmarks that were produced. Geographically, this report provides benchmarks for all Australian jurisdictions apart from Western Australia. The Western Australian Government chose to opt out of this process.

The methodology used here is similar to the methodology ACIL Allen used when developing the existing benchmarks in 2014 and the previous 'set' in 2011. However, a number of significant modifications were made with the objective of increasing the robustness of the benchmarks.

Further, this report incorporates benchmarks for gas consumption for the first time. The AER's intention is that adding gas benchmarks to EME will provide a more useful and convenient tool for gas customers in NERL jurisdictions.

This report is structured as follows:

- chapter 2 describes the data collection process
- chapter 3 describes the sample that was collected
- chapter 4 describes the analytical methodologies used to:
  - identify relevant *variables* that explain the difference in electricity consumption between similar customers and *factors* for the benchmarks
  - develop the benchmarks themselves
- chapter 5 summarises the electricity bill benchmarks
- chapter 6 summarises the gas bill benchmarks.

2 DATA COLLECTION

This chapter describes the methodology used to collect the data upon which the benchmarks are based. The data collection process consisted of three steps:

1. surveying customers to collect information relating how they use electricity and gas – discussed in section 2.1
2. obtaining energy consumption data from electricity and gas distribution network service providers (DNSPs) for those customers – discussed in section 2.2
3. 'matching' the datasets from above – discussed in section 2.3.

2.1 Collecting household data

The household data underpinning the electricity and gas bill benchmarks were collected using an online survey of residential customers in each jurisdiction. The online survey instrument was administered by I-View.[2]

The survey was distributed through three separate channels:

1. via online panels
2. by invitation from distribution network service providers (DNSPs)
3. by invitation from energy retailers and through social media.

Table 2.1 shows the number of people who completed the survey through each 'channel'. It shows that, in total, we collected 9,863 responses to the survey, although not all responses could be used in the analysis.

The survey is quite extensive. Broadly, it includes questions relating to:

- the number of people living in each household
- demographics of the household
- the appliances in the household
- the way appliances are used.

The 'core' of the survey was the same regardless of the channel by which it was distributed, but there were some differences in the details. These differences related mostly to the way the respondent would consent to the release (by their DNSP) of their energy data.

An initial question in the survey sought the respondent's consent to the release of their consumption data by their DNSP to ACIL Allen and the AER. Customers who did not consent to the release of their

[2] I-View is a member of the Australian Market and Social Research Society and, as such, administered the survey in accordance with the requirements of that organisation. I-View is also accredited to the International Market and Social Research Standard ISO 20252, which incorporates the principles of the Australian Standard AS4752

data were not able to proceed further with the survey and are not reflected in Table 2.1 or elsewhere in this report.

TABLE 2.1 HOUSEHOLD DATASET SAMPLE SIZES

Channel	Complete Responses
Online panel	5,836
Invitation by DNSP	
AusNet	1,229
CitiPower/ Powercor	1,243
Open link	1,555
TOTAL	**9,863**

The survey has been developed over a number of years through estimating energy bill benchmarks and other similar projects. There are many more questions in the survey than are ultimately used in the benchmarks or presented in this report. The survey answers were inputs to the process of selecting the 'best' factors for use in the benchmarks, which is described in chapter 4.

Channel 1: online panel survey

The survey was administered to online panels of people who had previously indicated their willingness to participate in surveys. Panel members were invited to participate by email. If they chose to complete the survey, they clicked on a link and were connected to the online survey instrument. They were compensated for doing so in accordance with arrangements they had previously made with the panel operator.[3] People who responded to the survey through online panels did so in April and May 2017.

Channel 2: invitations sent by DNSPs

To increase the potential sample size we approached all NERL DNSPs and Power & Water Corporation[4] and asked them to send invitations to complete the survey to some of their customers.

The first exception to this was with some of the Victorian electricity DNSPs. The Victorian electricity DNSPs each operate energy portals, which were established following the smart meter rollout. Those portals are available to customers, but not all customers are registered with them.

Some of the customers who have registered with their DNSP's portal also indicated a willingness to be contacted by (or on behalf of) their DNSP for projects such as this. Therefore, following an extensive process of outreach and liaison with the DNSPs it was established that CitiPower, Powercor and AusNet Services have the necessary contact details and arrangements (in terms of customer permission) to assist with the project. Those three DNSPs assisted by emailing[5] invitations to customers who had provided the relevant contact details and had given permission to be contacted in this way.

The other exception was Power and Water Corporation that is able to contact its customers because it is both the DNSP and retailer.

Between them these four businesses sent survey invitations to approximately 25,000 residential customers in Victoria and the Northern Territory. Customers who responded to the survey in response to these invitations did so in June 2017.

People who participated through this channel clicked on the link sent to them and were then connected to the online survey instrument.

[3] Neither ACIL Allen nor the AER is privy to those arrangements.
[4] We note that Power & Water Corporation is both retailer and DNSP. For simplicity, we refer to it as a DNSP here.
[5] In one case the DNSP sent the emails itself. In the other two cases the emails were sent by I-View, our research partner, at the direction of the relevant DNSPs.

ACIL Allen is very grateful for the assistance provided by the businesses that assisted the survey in this way.

Channel 3: Open link – retailers, DNSPs and other stakeholders

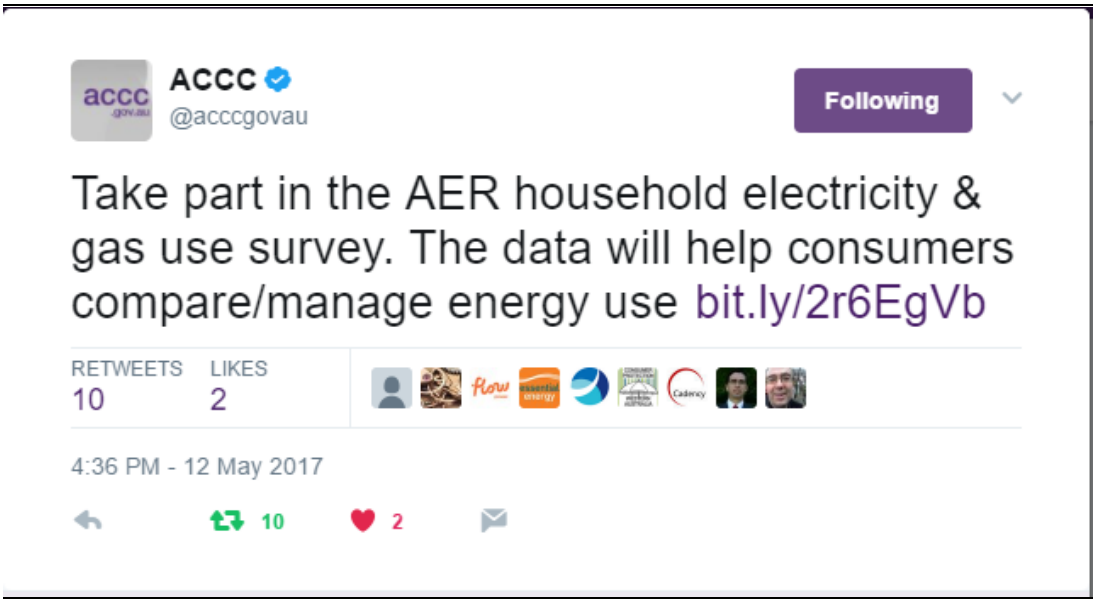
The third channel by which household data were collected was an 'open link'. This link was circulated by two large energy retailers. In total, they circulated the open link to approximately 50,000 residential energy customers, mostly in New South Wales, South Australia and Queensland.[6]

The survey was also distributed by the AER and stakeholders through Twitter. A tweet was sent through the ACCC/AER account containing an invitation to complete the survey and a link (Figure 2.1). The ACCC's tweet was retweeted by a number of DNSPs and retailers to expand the reach of the survey. The link was also made available to various other industry bodies and stakeholders who may also have chosen to distribute it.

Anyone who received this link was able to click it and, by doing so, be taken to the survey instrument. Given that the same link was sent to all participants in this channel we cannot distinguish between the responses provided by people who were invited by their energy retailer or who received the invitation through social media etc.

Data were collected via the open link in May and June 2017.

FIGURE 2.1 ACCC TWEET INVITING PARTICIPATION IN THE SURVEY



SOURCE: HTTPS://TWITTER.COM/ACCCGOVAU/STATUS/862919271747383297, RETRIEVED 8 JUNE 2017

[6] The retailers selected the customers to whom the invitations were sent in line with their own policies and practices for communicating with their customers. ACIL Allen has no information regarding the customers who were invited to complete the survey other than the approximate total number. ACIL Allen only obtained information from, and about, customers who chose to respond to the invitation and to provide that information.

2.2 Collecting consumption data

The 9,863 survey responses summarised in Table 2.1 represent the maximum possible sample size for calculating consumption benchmarks. However, before they could be used, those responses needed to be matched to energy data.

To facilitate this, most survey respondents were asked to provide their National Metering Identifier (NMI), which is a unique reference number allocated to a customer's electricity meter. The NMI is used in the electricity market to 'match' customers to their data.

To enable gas consumption data to be collected, customers with gas were also asked to provide their Market Identification Reference Number (MIRN). This corresponds to the NMI, but relates to gas consumption.

The exceptions to the above were customers invited by their DNSP. Those customers were matched to their electricity data in different ways though they were still asked for their MIRN.

Further, energy retailers included their customer's NMIs and MIRNs (where applicable – see below) in the invitation to assist their customers to complete the survey.

Given that the primary focus of this project was to estimate electricity benchmarks and the fact that access to mains electricity is near universal, the NMI was a *mandatory* question. Customers who were unable to enter a valid NMI were excluded from the survey. In contrast, the MIRN was an *optional* question for customers with access to mains gas.[7] In other words, every customer who said that they have mains gas was asked to supply their MIRN. However, unlike the NMI, they were able to proceed without supplying a valid MIRN.

The NMIs and MIRNs of customers who consented to the release of their data were sent to the relevant DNSPs with a request to populate a set of spreadsheets providing:

1. consumption data for up to three years (separated between general imports, controlled load imports[8] and solar exports as applicable for electricity customers)
2. the customer's distribution tariff
3. details of the customer's solar panel system if applicable.

Data were collected in two 'tranches' from each DNSP. ACIL Allen acknowledges that the process of extracting the necessary data for this project was time consuming. We appreciate the efforts of all DNSPs that assisted with this project.

Breakdown of consumption data

DNSPs provided data in various formats. For example:

- billing information was presented differently by each DNSP
- billing periods were of different lengths
- there were differences in consumption reads related to consumption, controlled load and PV/export data.

In addition, several DNSPs are currently in the process of transitioning customers to smart meters, meaning that many customers had accumulation meter data for some of the period and interval meter data for the remainder. We applied numerous processes to standardize the information provided by DNSPs into a format suitable for analysis by season.

The length of bills (in days) was an important consideration in the cleaning process. Data from interval meters were provided mainly on a half-hourly basis, while accumulation meter ranged from reads spanning one to three months (in most cases), but with additional reads for many customers in intervening periods.

[7] Customers who said that they do not have mains gas were not asked for a MIRN because they do not have one.
[8] Controlled load, or dedicated circuit in some networks, refers to a situation where certain appliances are connected to a dedicated (separate) electrical circuit in the home. The electricity used by these appliances only is usually charged at a lower rate. This is sometimes known as 'off peak' hot water, but should not be confused with more modern off peak tariffs which apply to all appliances in the home.

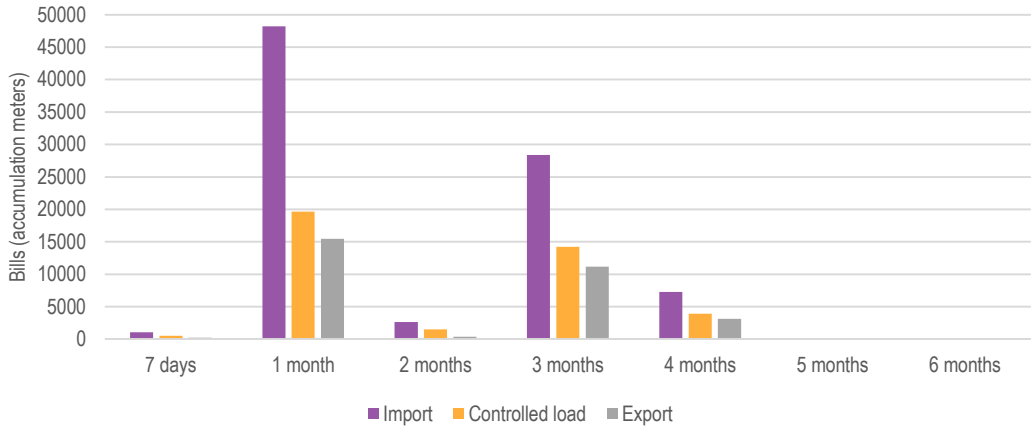
As an example consider Figure 2.2, which shows the frequency (or duration) of each of the individual 'bills'. These are based on a subset of the energy data received from DNSPs. In this context there is more than one bill per customer/ survey respondent reflecting the time period for which their data are available.

The figure shows that most, almost 50,000, of the individual data points for general electricity consumption relate to a one month period. However, a substantial number, nearly 30,000, relate to three months. A few relate to other periods.

This pattern is broadly similar for controlled load and solar export data.

This does not necessarily mean that the people in our dataset receive bills on these frequencies. This is a matter between them and their energy retailers. For us, this variation and the presence of a substantial quantity of interval data means that the approach we have used in the past of assigning each consumption reading to one season or another is no longer the best approach.

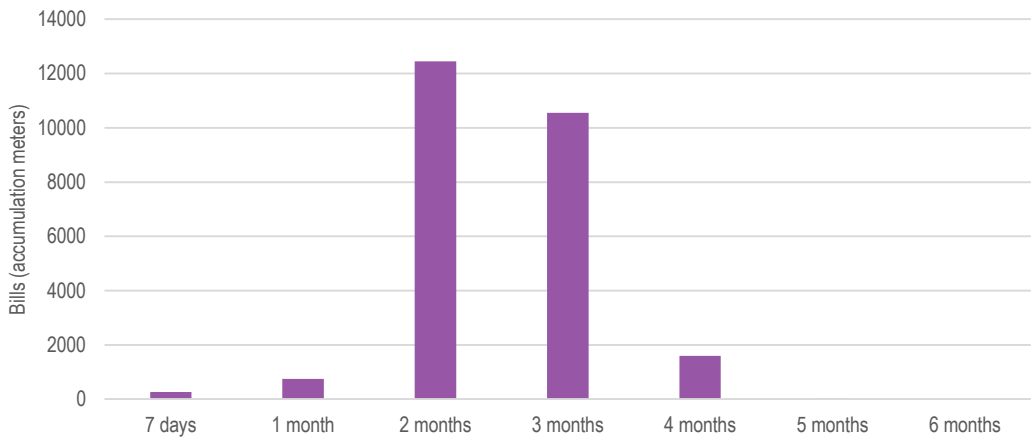
FIGURE 2.2 DATA FREQUENCY BY REGISTER TYPE — ELECTRICITY ACCUMULATION METERS



SOURCE: ACIL ALLEN CONSULTING

There are no interval meters for gas consumption so all of the gas data are on a meter reading basis, which is typically either two or three months as shown in Figure 2.3.

FIGURE 2.3 BILL FREQUENCY — GAS ACCUMULATION METERS



SOURCE: ACIL ALLEN CONSULTING

Converting energy data to seasonal consumption

The complexity of the energy data received from DNSPs means that we needed to take a more sophisticated approach to estimating seasonal consumption than on previous occasions. This has implications for the way the benchmarks should be interpreted.

In 2011 and 2014 the energy data were dominated by three monthly meter reads. On those occasions we assigned each read to a season and analysed data from that point. As a result, benchmarks on previous occasions were based on the consumption as recorded on the *bills received* by customers within each season.

The energy data collected from accumulation meters on this occasion consists of higher frequency data as shown in Figure 2.2. We also collected a significant amount of interval data on this occasion. We standardised these into an appropriate format for estimating benchmarks by converting each respondent's energy consumption data to a series of average daily consumption values for each month of the year. Those values were then 'grossed up' to provide estimates of monthly and seasonal consumption.

In some instances, we did not obtain sufficient consumption data to construct a seasonal consumption value. In cases where we had less than 15 days of consumption within a season, we did not calculate a seasonal consumption figure.

This means that the final 'cleaned' energy data contained:

— seasonal consumption values of only those customers with more than 15 days of consumption data for that season

— annual consumption of only those customers with all four seasons of energy data.

There are two implications from 'cleaning' process. Firstly, the sample size when estimating consumption benchmarks, as described in chapter 4, varies by season. This is a direct result of our decision to exclude customers from a particular season with less than 15 days of consumption data for that season.

Secondly, on this occasion, benchmarks are not based on the consumption recorded in the *bills received* by customers. Instead, they are based on an estimate of *energy consumed* within each season. This should be noted when comparing seasonal benchmarks in this report with previous benchmark reports.

2.3 Creating the final dataset

The final step of our data collection methodology involved 'matching':

- the household data, comprising all responses to survey questions
- the energy data, comprising annual and seasonal consumption.

The final dataset comprises all respondents who completed the survey and were successfully matched to consumption data.

A small proportion of non-matching households is expected as a result of invalid NMI entry (e.g. consistently entering a customer number instead of a NMI), and/ or challenges in extracting energy data from DNSP systems.

In combining the household survey and energy data, we arrived at:

- a total sample size of 8,174 for estimating electricity benchmarks (hereafter 'the electricity sample')
- a total sample size of 2,518 for estimating gas benchmarks (hereafter 'the gas sample').

TABLE 2.2 HOUSEHOLD DATA MATCHED TO ENERGY DATA

Jurisdiction	Electricity total	Matched to energy data	Proportion matched	Gas total	Matched to energy data	Proportion matched
	Number	Number	%	Number	Number	%
Queensland	1,637	1,479	90%	166	152	92%
New South Wales	2,780	2,402	86%	991	845	85%
Australian Capital Territory	131	127	97%	64	58	91%
Victoria	4,105	3,079	75%	2,334	1,076	46%
Tasmania	298	295	99%	14	14	100%
Northern Territory	112	95	85%	-	-	-
South Australia	800	697	87%	409	373	91%
TOTAL	**9,863**	**8,174**	**76%**	**3,978**	**2,518**	**63%**

SOURCE: ACIL ALLEN CONSULTING

Table 2.2 breaks down the sample size by jurisdiction and indicates the difference between the number of survey responses we collected and the number that were matched to energy data (electricity and gas separately).

For the electricity sample, the match rate is over 85 per cent in most cases. For the gas sample it is similarly high.

In both cases the match rate is notably lower in Victoria. There are two reasons:

- not all of the data sought were able to be extracted by AusNet Services
- due to the timing of the survey and our preference to make no more than two data requests from any DNSP, we chose not to seek gas consumption data for some respondents.

If we set aside respondents from Victoria, the match rates are 91 per cent and 84 per cent for electricity and gas respectively.

3 DESCRIPTION OF SAMPLES

This chapter provides a description of the electricity and gas samples. The summary consists of:

— basic demographics in section 3.1

— benchmark 'factors' in section 3.2

— energy consumption in section 3.3.

3.1 Basic demographics

It is important to consider the demographic summary in light of both the analytical method, described in chapter 4, and the objective of this project. Importantly, the objective of this project is *not* to estimate the typical energy consumption of the average Australian. Rather, it is to:

1. identify variables (factors) that are associated with differences in typical energy consumption
2. estimate the typical energy consumption of Australian energy consumers *distinguished by those factors.*

With these objectives it is less important that the sample we use is representative of the broader Australian population. Rather, it is more important to have enough people in the relevant factors to allow the models to be estimated reliably.

TABLE 3.1 BASIC DEMOGRAPHICS

Characteristic	Electricity Sample	Gas Sample	Population
Number of Households	8,174	2,518	N/A
Gender of survey respondent			
Male	56%	54%	50%
Female	44%	46%	50%
Other	0%	1%	-
Age Distribution			
Age of survey respondent^			
18-29	4%	4%	N/A
30-50	31%	35%	N/A
51-65	36%	35%	N/A
Over 65	29%	26%	N/A
Age of all household members			
0 to 4 years	8%	8%	7%
5 to 12 years	13%	12%	12%
13 to 17 years	8%	8%	6%
18 to 29 years	14%	15%	14%
30 to 50 years	21%	23%	28%
51+ years	36%	34%	33%

^ There is no ABS series to compare directly with 'survey respondent' so no comparison is given here.

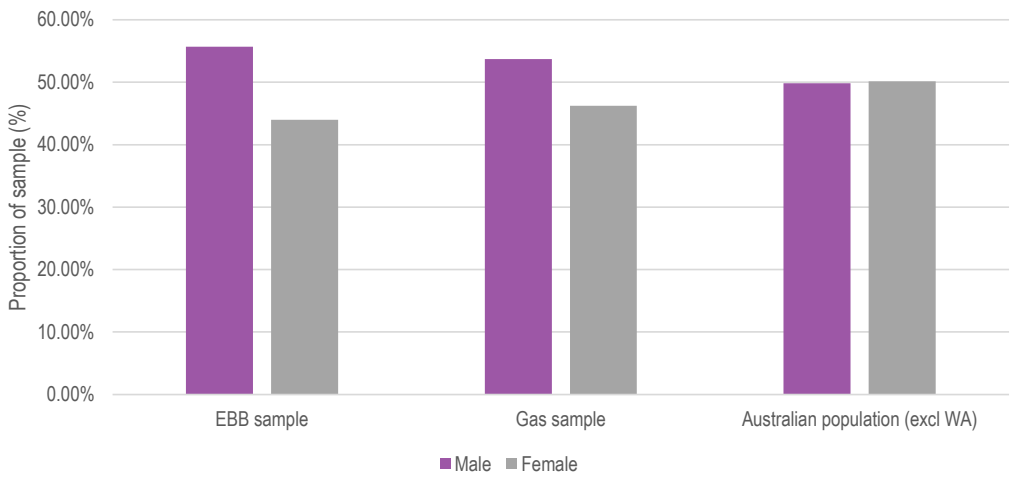
Note: column totals may not add to 100 per cent due to rounding

SOURCE: ACIL ALLEN ANALYSIS

Gender spread

Figure 3.1 and the topmost pane of Table 3.1 show the gender spread of the sample. The key message is that both samples are slightly overrepresented by men when compared to the Australian population. In our view this is not a concern for the current analysis. The key reason is that the questions in the survey, and the factors upon which benchmarks are distinguished, are matters of objective fact such as whether a particular household has solar panels, or whether electricity or gas is used to heat water. We see no reason to expect that men or women would give different answers to these questions. It is important from a broader perspective that the survey was accessible to men and women alike and this result shows that it was.

FIGURE 3.1 GENDER SPREAD OF SURVEY RESPONDENTS



SOURCE: ACIL ALLEN CONSULTING

Age demographics

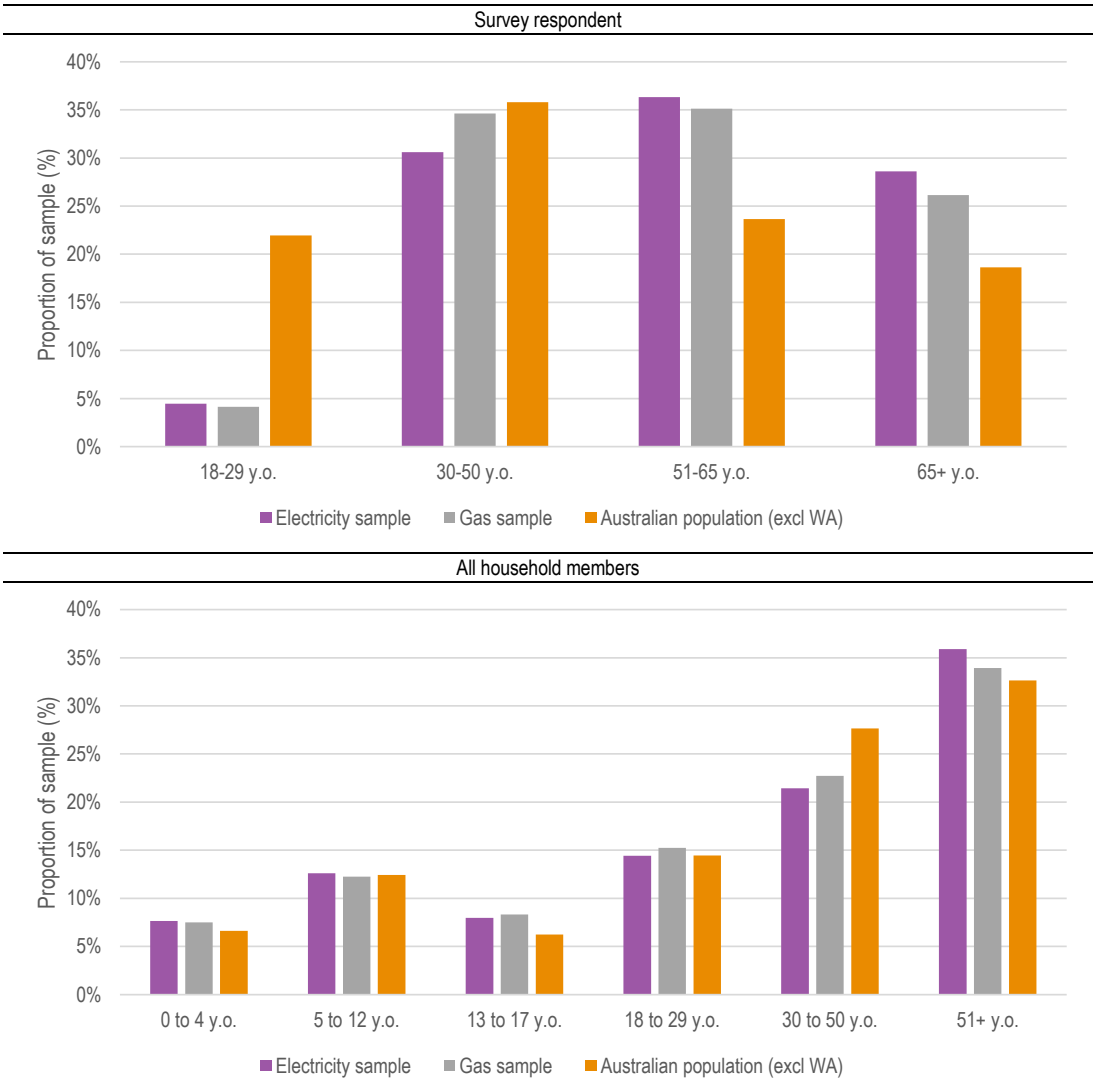
The top pane of Figure 3.2 shows the age distribution of survey respondents. The lower pane goes beyond the respondents to include others living in their households (hence showing a number of children aged under 12 years old who were obviously not survey respondents).

It is plausible that the age of people living in a household is relevant to the way energy is used. The causal link is not likely to be with age directly, but with other things associated with age. For example, people who are retired may be in their homes more of the time. They also tend to be aged over 65, but this does not necessarily mean that *all* people aged over 65 use more energy than others.

Similarly, people with young children may be in their homes more of the time than others and thus use more energy (all else equal). However, it is the time they spend at home, not their age, that 'drives' differences in energy usage.

The key message from these figures is that the survey provides a reasonable approximation of the Australian population insofar as the age of people 'covered' by the samples are concerned. In our view it is more important that the survey is representative at this level than in terms of the people who answered the questions.

FIGURE 3.2 AGE OF SAMPLE – RESPONDENT AND ALL MEMBERS OF HOUSEHOLD



SOURCE: ACIL ALLEN CONSULTING

3.2 Benchmark factors

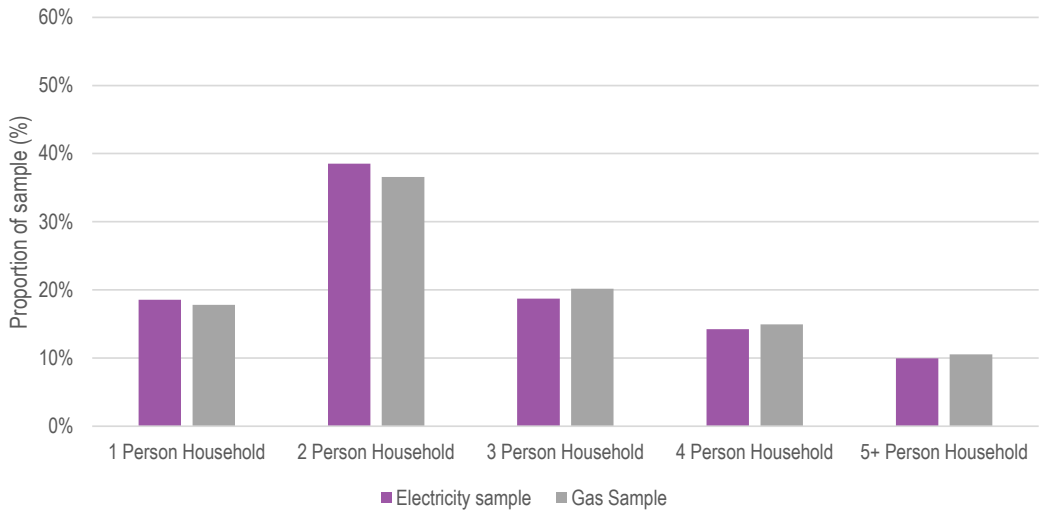
This section summarises the two samples by reference to the 'factors' that were chosen to distinguish between benchmarks. The process by which this selection was made is described in chapter 4.

3.2.1 Household size

Pursuant to the NERR the benchmarks must be based on household size, which is interpreted to mean the number of people normally living in the household, not the physical size of the house (or another measure of size such as the number of rooms).

Figure 3.3 breaks the two samples down by household size. Generally, our samples have a good representation of each type of household.

FIGURE 3.3 BREAKDOWN OF SAMPLES BY HOUSEHOLD SIZE



SOURCE: ACIL ALLEN ANALYSIS

3.2.2 Location

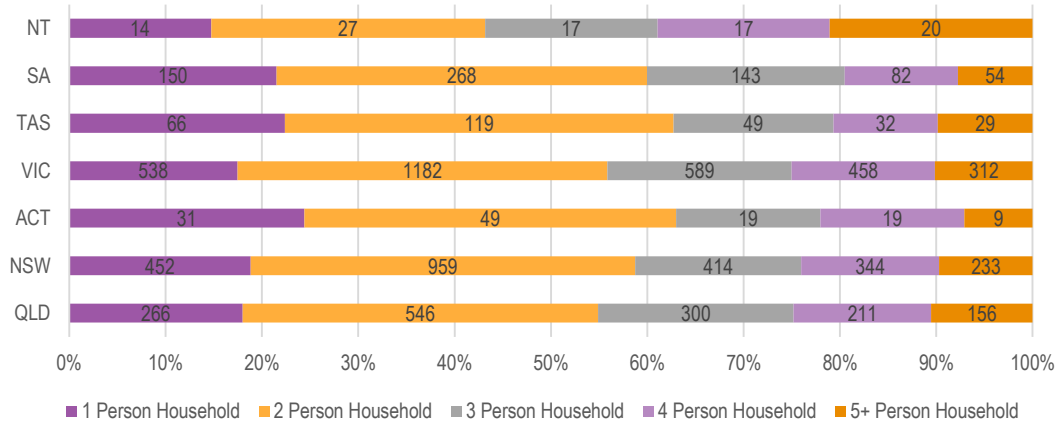
By jurisdiction

Figure 3.4 shows the distribution of the two samples between jurisdictions broken down by household size. The sample size itself is shown as data labels in the chart and in Table 3.2. There is a good representation of each type of household size across jurisdictions with the exception of the Northern Territory where the sample is small.

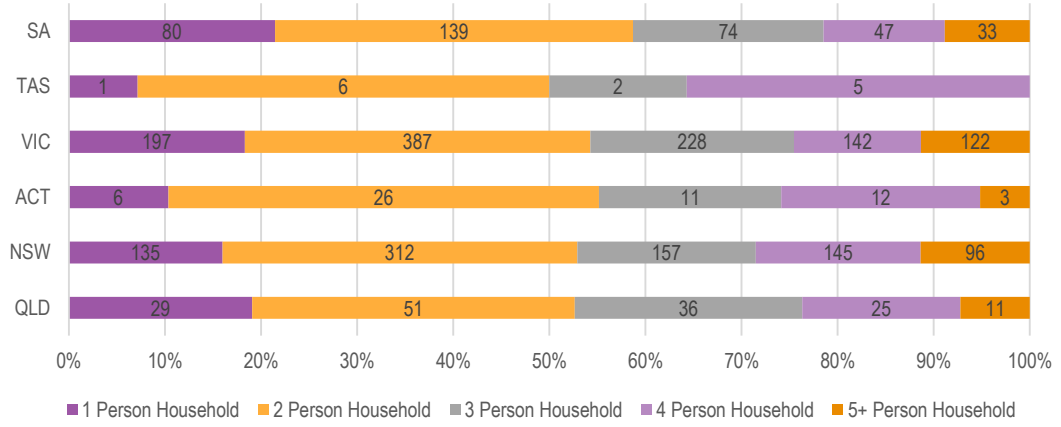
The lower panes of Figure 3.4 and Table 3.2 correspond to the upper panes, but relate to the gas sample. The broad pattern is similar, but there are small samples in the ACT and Tasmania.

FIGURE 3.4 BREAKDOWN OF SAMPLE BY JURISDICTION AND HOUSEHOLD SIZE

Electricity sample



Gas sample



SOURCE: ACIL ALLEN CONSULTING

TABLE 3.2 BREAKDOWN OF SAMPLE BY JURISDICTION AND HOUSEHOLD SIZE

HH Size	QLD	NSW	ACT	VIC	TAS	SA	NT	Total
Electricity sample								
Number of respondents								
1	266	452	31	538	66	150	14	1517
2	546	959	49	1182	119	268	27	3150
3	300	414	19	589	49	143	17	1531
4	211	344	19	458	32	82	17	1163
5+	156	233	9	312	29	54	20	813
Total	1479	2402	127	3079	295	697	95	8174
Gas sample								
Number of respondents								
1	29	135	6	197	1	80	N/A	448
2	51	312	26	387	6	139	N/A	921
3	36	157	11	228	2	74	N/A	508
4	25	145	12	142	5	47	N/A	376
5+	11	96	3	122	0	33	N/A	265
Total	152	845	58	1076	14	373	N/A	2518

SOURCE: ACIL ALLEN CONSULTING

Localised zones

According to the NERR, the electricity bill benchmarks must be calculated for *localised zones* as determined by state and territory Energy Ministers.

Climate zones

On this occasion, Energy Ministers in jurisdictions other than South Australia chose to adopt the climate zones developed by the Australian Building Codes Board (ABCB).

The ABCB is a Council of Australian Governments standards writing body responsible for developing the National Construction Code of Australia (NCC). Energy Efficiency is a core focus of the ABCB. [9]

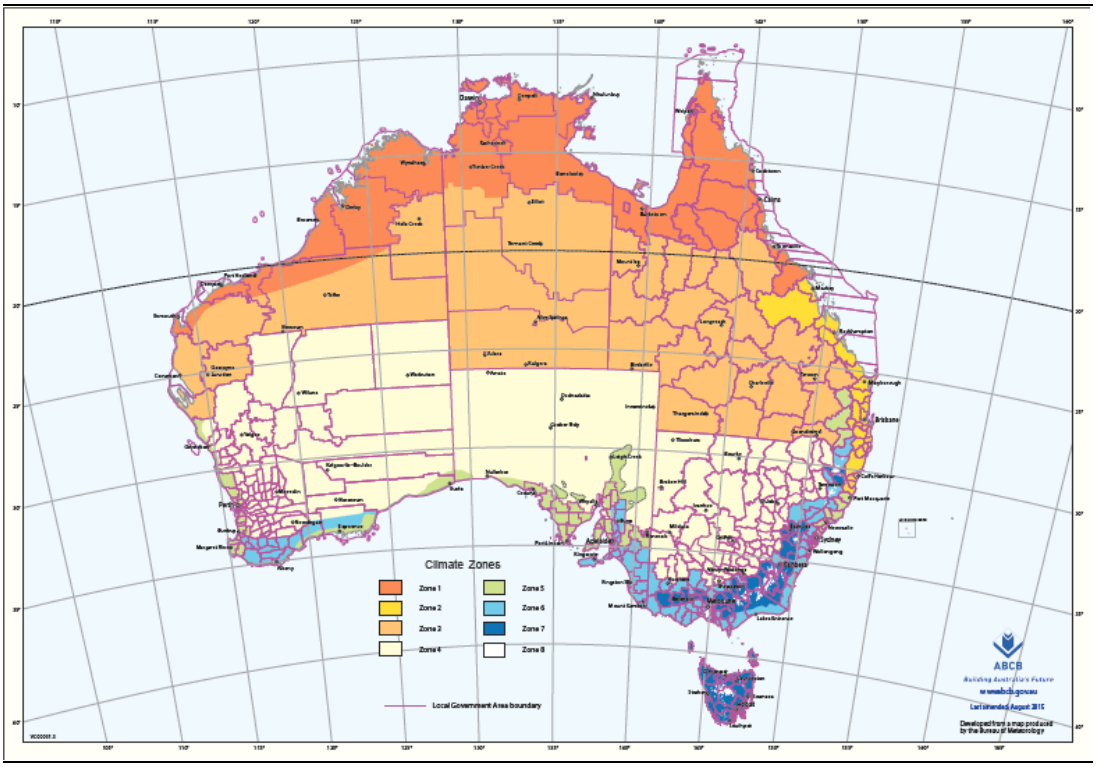
One of many ways that energy efficiency is reflected in the NCC is through the climate zones. Broadly, these are zones which have been identified as having similar climates and, therefore, similar heating and cooling requirements. The zones themselves were chosen (by the ABCB) by reference to climatic data collected by the Bureau of Meteorology. The data analysis supported establishing six different climate zones, but adjustments were made to add an additional temperate zone and an alpine zone. Administratively, the climate zone boundaries are defined by reference to Local Government Areas so they are subject to change from time to time.

There are eight climate zones, which are shown in Figure 3.5. As the figure shows, there is little relationship between the climate zones and the jurisdictional boundaries of Australia's states and territories.

For example, all jurisdictions other than Tasmania and the Northern Territory include at least some 'mild temperate' zone, shown in light blue in the figure. Similarly, most of Tasmania is in zone seven (cool temperate – dark blue), but this also appears in Victoria and some parts of New South Wales.

[9] www.abcb.gov.au

FIGURE 3.5 AUSTRALIAN CLIMATE ZONES



SOURCE: HTTP://WWW.ABCB.GOV.AU/RESOURCES/TOOLS-CALCULATORS/CLIMATE-ZONE-MAP-AUSTRALIA-WIDE

Figure 3.6 shows the distribution of the two samples between climate zones broken down by household size. The data shown here exclude South Australia because it elected to use different zones as discussed in the next section. Note that the charts are shown as percentages of the sample in each climate zone. The sample size itself is shown as data labels in the chart and in Table 3.3.

The lower panes of Figure 3.6 and Table 3.3 correspond to the upper panes, but relate to the gas sample. The broad pattern is similar, but there is the added issue that some parts of Australia do not have access to reticulated gas. For example there is almost nobody in the gas sample in climate zones 1 or 3. Accordingly we have not estimated gas benchmarks for these zones.

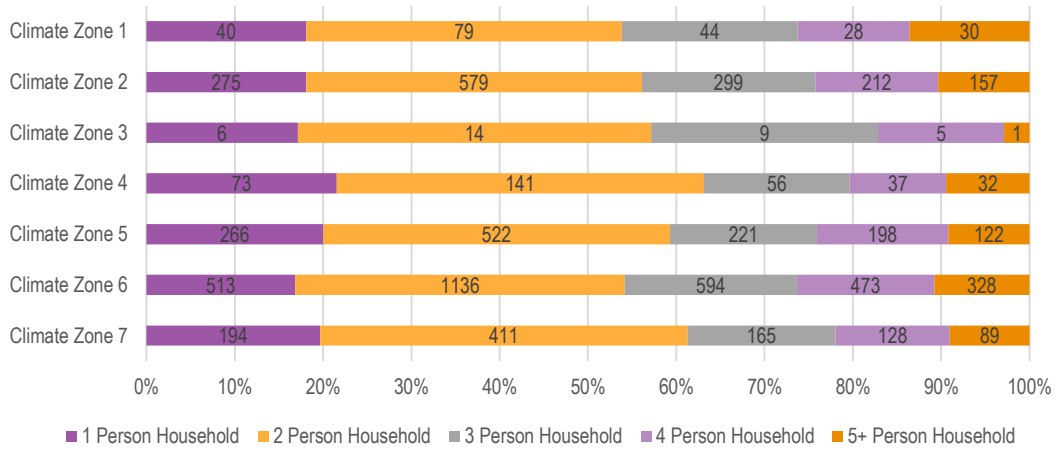
In principle we sought to estimate benchmarks using the smallest (geographic) area that could be supported by the data that were available. The way this was applied is discussed in section 4.1 below.

The climate zones are defined by reference to Local Government Areas (LGA). However, in the survey we asked respondents to provide their postcode rather than their LGA to avoid mismatch errors between the formal names of LGAs and the common names of suburbs in which people live. In other words, the risk that a respondent would enter a suburb name, or an approximation of their LGA's name was considered too high.

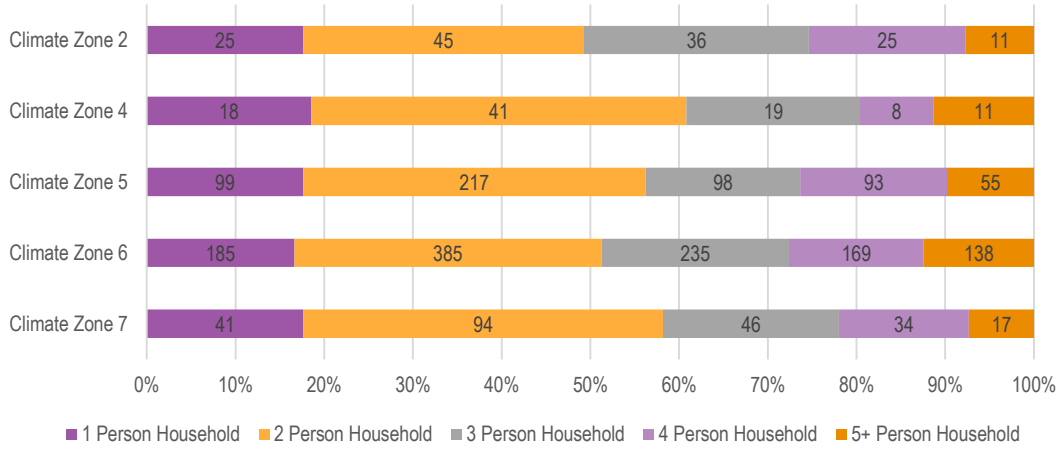
The implication of this approach is that there are a number of postcodes that overlap climate zones. In section 4.1, we outline how postcodes are allocated to climate zones for use in electricity benchmarks. An important point to note here is that by construction there is no climate zone eight. The Australian Bureau of Statistics (ABS) allocates regions belonging to climate zone eight to the neighbouring climate zone. In all cases, this is climate zone seven. As a result, our benchmarks for climate zone eight are pooled with climate zone seven.

FIGURE 3.6 BREAKDOWN OF SAMPLE BY CLIMATE ZONE AND HOUSEHOLD SIZE

Electricity sample (excl SA)



Gas sample (excl SA)



SOURCE: ACIL ALLEN CONSULTING

TABLE 3.3 BREAKDOWN OF SAMPLE BY CLIMATE ZONE AND HOUSEHOLD SIZE

Household size	Climate zone one	Climate zone two	Climate zone three	Climate zone four	Climate zone five	Climate zone six	Climate zone seven and eight	Total
Electricity sample (excl SA)								
Number of respondents								
1 Person Household	40	275	6	73	266	513	194	**1367**
2 Person Household	79	579	14	141	522	1136	411	**2882**
3 Person Household	44	299	9	56	221	594	165	**1388**
4 Person Household	28	212	5	37	198	473	128	**1081**
5+ Person Household	30	157	1	32	122	328	89	**759**
Total (excl. SA)	**221**	**1522**	**35**	**339**	**1329**	**3044**	**987**	**7477**
Gas sample (excl SA)								
Number of respondents								
1 Person Household	0	25	0	18	99	185	41	**368**
2 Person Household	0	45	0	41	217	385	94	**782**
3 Person Household	0	36	0	19	98	235	46	**434**
4 Person Household	0	25	0	8	93	169	34	**329**
5+ Person Household	0	11	0	11	55	138	17	**232**
Total (excl. SA)	**0**	**142**	**0**	**97**	**562**	**1112**	**232**	**2145**

Note: These numbers exclude South Australian respondents.

SOURCE: ACIL ALLEN CONSULTING

South Australian localised zones

In contrast to the other jurisdictions, South Australia chose to continue using its own, tailored zones. As on previous occasions, the South Australian Minister decided that benchmarks in that State should be applied to 10 zones that are based on the National Home Energy Rating Scheme.

The zones are:

1. Adelaide and environs
2. Mount Lofty Ranges
3. Central North
4. Mid North
5. Murraylands and Riverland
6. Yorke Peninsula and Kangaroo Island
7. Port Augusta and Pastoral

8. West Coast
9. Eastern Eyre
10. South East.

As on previous occasions these zones are defined by postcodes. A correspondence of postcodes to South Australian zones can be found in Appendix 0.

The key difference between these and the climate zones, as we understand it, is that they consider:

— geographical affinity
— the availability of reticulated natural gas.

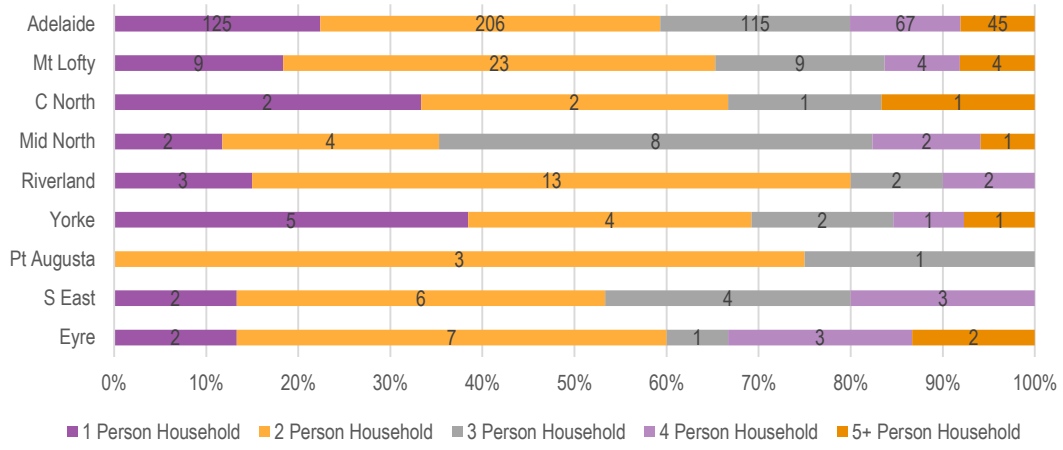
Figure 3.7 shows the distribution of the two samples between climate zones broken down by household size. The sample size itself is shown as data labels in the chart and in Table 3.4.

The lower panes of Figure 3.7 and Table 3.4 correspond to the upper panes, but relate to the gas sample. The broad pattern is similar, but there is the added issue that some parts of South Australia do not have access to reticulated gas. For example there is almost nobody in the gas sample outside the Adelaide and Environs zone even though reticulated gas is available in some of these places.

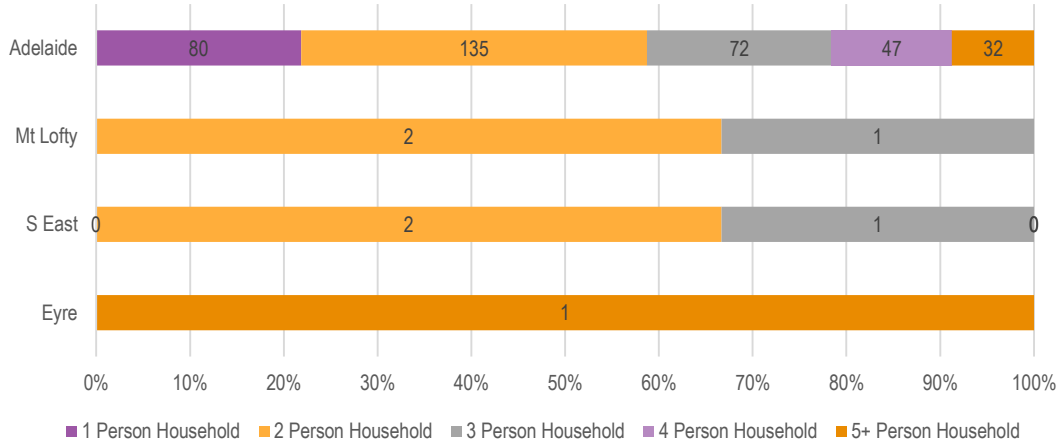
It is clear that the dataset is too small to allow benchmarks for the ten different zones to be estimated independently. The approach we took to producing benchmarks for the South Australian zones is described in chapter 4.

FIGURE 3.7 BREAKDOWN OF SAMPLE BY SA LOCALISED ZONE AND HOUSEHOLD SIZE

Electricity sample (SA only)



Gas sample



SOURCE: ACIL ALLEN CONSULTING

TABLE 3.4 BREAKDOWN OF SOUTH AUSTRALIAN SAMPLE BY LOCALISED ZONE AND HOUSEHOLD SIZE

HH size	Adelaide	Mt Lofty	Yorke & KI	R'land	South East	Mid North	C' North	Pt Augusta	Eyre	West Coast	Total SA
Electricity sample (SA only)											
Number of respondents											
1	125	9	5	3	2	2	2	0	2	0	150
2	206	23	4	13	6	4	2	3	7	0	268
3	115	9	2	2	4	8	1	1	1	0	143
4	67	4	1	2	3	2	0	0	3	0	82
5+	45	4	1	0	0	1	1	0	2	0	54
Total SA	558	49	13	20	15	17	6	4	15	0	697
Gas sample (SA only)											
Number of respondents											
1	80	0	0	0	0	0	0	0	0	0	80
2	135	2	0	0	2	0	0	0	0	0	139
3	72	1	0	0	1	0	0	0	0	0	74
4	47	0	0	0	0	0	0	0	0	0	47
5+	32	0	0	0	0	0	0	0	1	0	33
Total SA	366	3	0	0	3	0	0	0	1	0	373

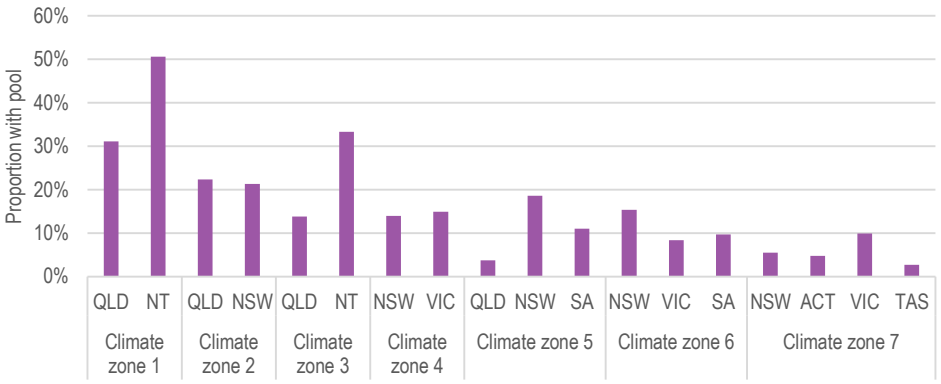
SOURCE: ACIL ALLEN CONSULTING

3.2.3 Swimming pools

As on previous occasions, the analysis found the presence of a swimming pool to be a relevant factor in determining electricity benchmarks.[10] Figure 3.8 shows that pool ownership varies by sample size, with higher shares in the warmer climates than in the cooler ones. Overall, around 14 per cent of the people in the sample have swimming pools (over 1,000 households).

[10] See chapter 4 for a description of how this was determined.

FIGURE 3.8 BREAKDOWN OF SAMPLE BY SWIMMING POOL OWNERSHIP

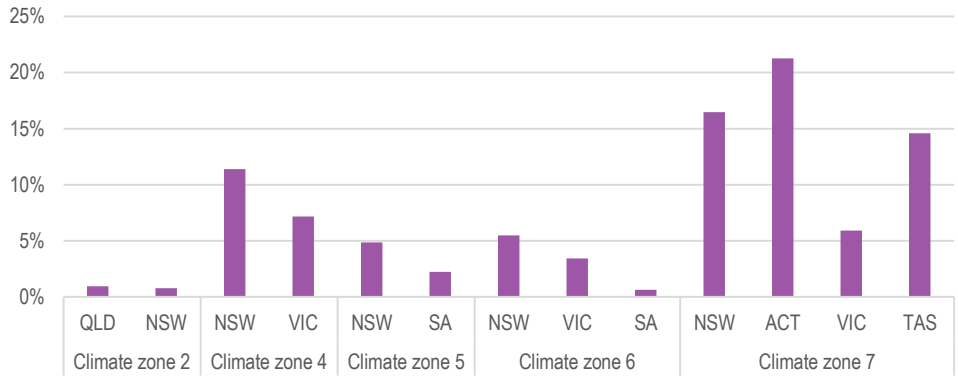


SOURCE: ACIL ALLEN CONSULTING

3.2.4 Electric underfloor heating

The analysis showed that the presence of electric underfloor (slab) heating is an important variable in explaining variability in electricity consumption in some zones. Figure 3.9 shows the breakdown of the sample by reference to whether respondents have slab heating in their homes.

FIGURE 3.9 BREAKDOWN OF SAMPLE BY PRESENCE OF SLAB HEATING



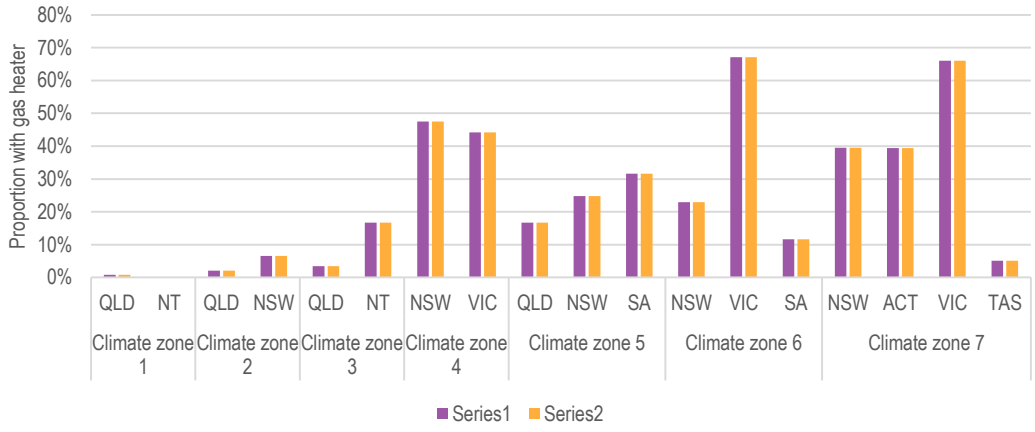
SOURCE: ACIL ALLEN CONSULTING

3.2.5 Gas heating

The presence of gas heating is a relevant factor in determining gas benchmarks. As shown in Figure 3.10, the cooler climates of climate zone six and seven have a much higher gas heater ownership than the warmer climates of climate zone one and two. Overall, around 60 per cent of the gas sample had some type of gas heater in their home.[11] Those with gas heaters use over 183 per cent more gas than those who do not have gas heaters. The presence of a gas heater is associated with differences in typical gas consumption, so is an important variable to consider when calculating gas benchmarks.

[11] For the purposes of analysis, the category of having any gas heating entails: gas ducted heating, gas individual heating, gas underfloor heating and/ or gas hydro.

FIGURE 3.10 BREAKDOWN OF SAMPLE BY GAS HEATER OWNERSHIP



SOURCE: ACIL ALLEN CONSULTING

3.3 Energy consumption

This section describes the distribution of energy consumption values across the people to whom the benchmarks will apply. Section 3.3.1 summarises the sample size by season and annually for electricity and gas consumption in each of the relevant samples. Section 3.3.2 compares the average consumption of the electricity sample on this occasion with previous occasions. Section 3.2.2 provides a summary of the electricity consumption of both the electricity and gas samples. Section 3.3.4 provides corresponding summaries of gas consumption.

3.3.1 Energy consumption sample size by season

In section 2.2, we noted that for some respondents, there was insufficient consumption data to construct a seasonal consumption value for that respondent in the relevant season. This means that the number of consumption values we have varies by season.

A breakdown of the final sample sizes for each season and annually are summarised in Table 3.5. An annual consumption value is only calculated for those respondents with four consecutive seasons of consumption data. That is, if a respondent had energy data for summer, autumn and winter but not spring, then an annual consumption figure was not created for that respondent.

TABLE 3.5 SAMPLE SIZES OF ENERGY CONSUMPTION BY SEASON AND ANNUALLY

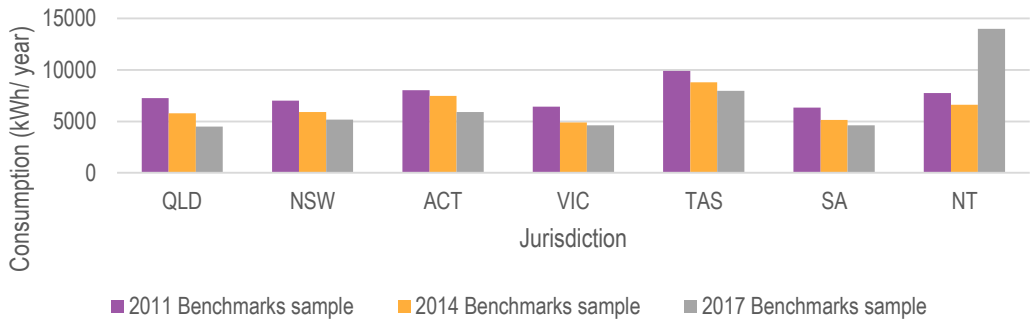
	Autumn	Spring	Summer	Winter	Annual
Electricity consumption					
Electricity sample	7,982	7,956	8,007	7,826	7,797
Gas sample	2,372	2,357	2,382	2,272	2,265
Gas consumption					
Gas sample	2,480	2,512	2,514	2,507	2,475

SOURCE: ACIL ALLEN CONSULTING

3.3.2 Comparison of energy consumption data

Figure 3.11 compares the annual electricity consumption numbers with that of previous occasions by jurisdiction. There is a decreasing trend across almost all jurisdictions, which could be reflective of households becoming more energy efficient over the past six years. However, these values relate to unweighted, simple averages, so do not take into account sample size issues that existed in this analysis, as well as on previous occasions.

FIGURE 3.11 COMPARISON OF AVERAGE ANNUAL CONSUMPTION IN BENCHMARKS SAMPLES OVER TIME



SOURCE: ACIL ALLEN ANALYSIS

3.3.3 Summary of electricity consumption data

Table 3.6 shows the average electricity consumption in the sample by Jurisdiction and DNSP. Table 3.7 breaks the data down to various subsets distinguished by the presence of controlled load, solar panels and gas.

These tables suggest that electricity consumption in the Northern Territory is substantially higher than other jurisdictions. From discussions with Power and Water Corporation, we understand that the average Northern Territory household uses about 9,000 kWh each year, about 66 per cent of the average usage in our collected sample. Power and Water Corporation indicated that our sample may have been biased by a small number of large energy users. To account for this we scaled the benchmarks in the Northern Territory as discussed in section 4.4.

TABLE 3.6 AVERAGE ANNUAL ELECTRICITY CONSUMPTION BY DNSP

DNSP	Electricity consumption (kWh/annum)
Northern Territory	**13,718***
Power & Water	13,718*
South Australia	**4,613**
SA Power Networks	4,613
Queensland	**4,502**
Ergon	4,298
Energex	4,706
New South Wales	**5,172**
Essential	4,543
Ausgrid	5,210
Endeavour	5,765
Victoria	**4,627**
Jemena	4,055
CitiPower	4,413
Powercor	5,413
AusNet	4,968
United Energy	4,275
ACT	**5,910**
ActewAGL	5,910
Tasmania	**7,975**
Tasnetworks	7,975

* Sample bias due to large amount of high energy users in our sample.

SOURCE: ACIL ALLEN CONSULTING

TABLE 3.7 AVERAGE ANNUAL ELECTRICITY CONSUMPTION BY JURISDICTION – VARIOUS SUBSETS OF SAMPLE

	All	No CL	CL	No gas	Gas	No solar	Solar	CL, no gas	CL and gas	No CL no gas	No CL with gas	CL, no solar	CL and solar	No gas with solar	Mains gas with solar
	kWh/ annum														
QLD	4597	4648	4564	4615	4468	4818	4212	4531	5539	4787	4272	4531	5539	4874	4193
NSW	5137	5142	5131	5140	5131	4971	5343	5096	5356	5247	5081	5096	5356	5120	5159
ACT	5910	5973	5690	6435	5515	5874	6045	5580	5784	6705	5444	5580	5784	6074	7464
VIC	4984	4618	6537	6871	4432	5241	4671	7411	5542	6431	4288	7411	5542	7145	6600
TAS	7975	7992	7874	8026	7204	8440	6750	7877	7806	8050	7129	7877	7806	8511	6644
SA	4613	4742	4197	5107	4246	5095	4036	4070	5048	6093	4201	4070	5048	6008	4222
NT	13718	13718	N/A	13746	N/A	13718	N/A	N/A	N/A	13746	N/A	N/A	N/A	13746	N/A

SOURCE: ACIL ALLEN CONSULTING

Figure 3.12 shows the distribution of electricity consumption in the electricity sample.

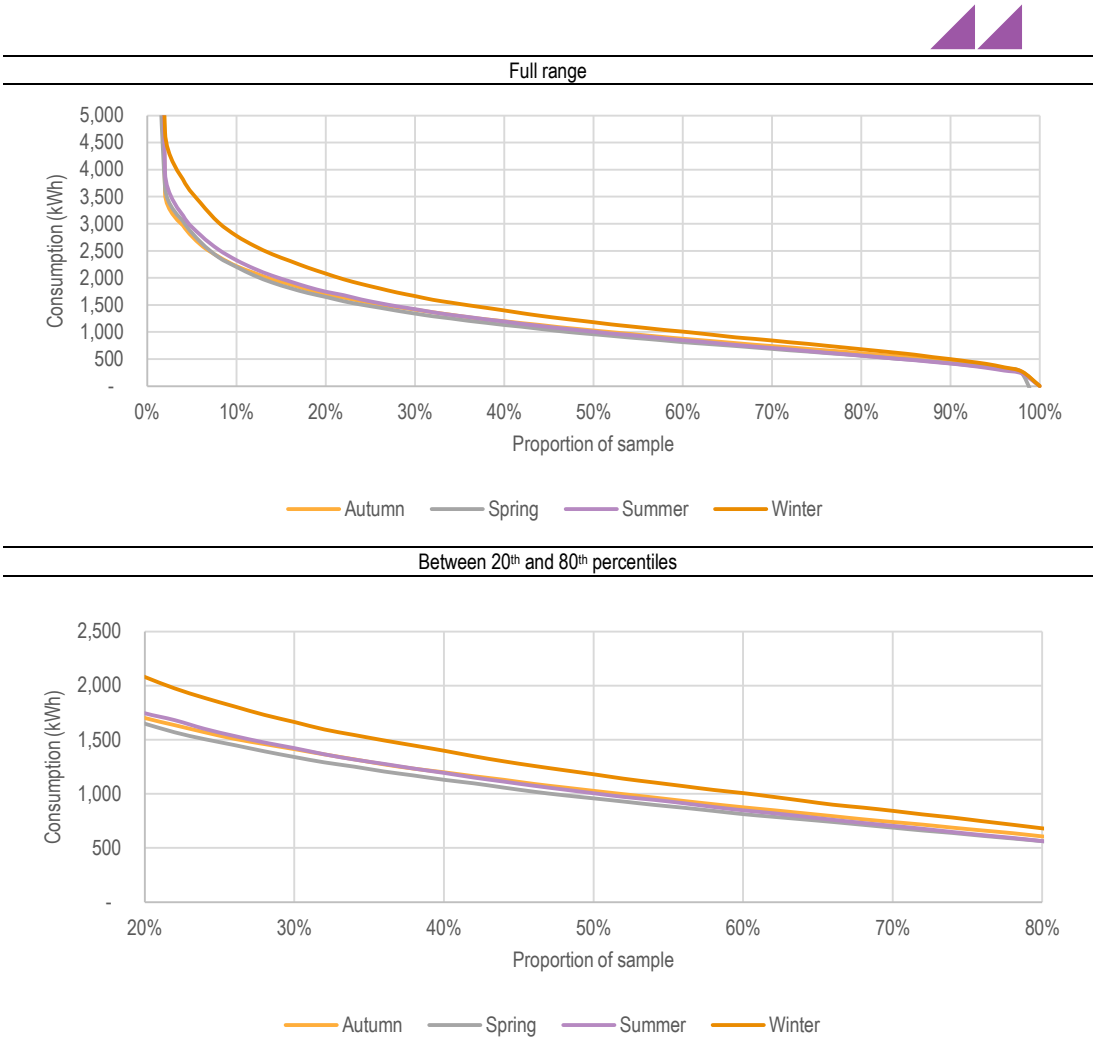
Each of the four curves corresponds to a season. The horizontal axis shows the proportion of the sample with consumption at a given level, read from the vertical axis. For example, it shows that in Spring (grey curve), the 50th percentile electricity consumption is 959 kWh for the season.

The lower pane of Figure 3.12 shows the same curves, but 'zooms in' on the portion between the 20th and 80th percentiles (note the different scale on the vertical axis).

Key features of the sample include:

- at any given percentile level, consumption is highest in winter
- consumption levels in all seasons other than winter are quite similar, with each curve 'crossing over' the others several times
- at the high levels, consumption grows reasonably steadily to around the 90th percentile and then increases sharply at the very high end of the sample
- similarly, at the low levels, consumption falls steadily to around the tenth percentile before falling sharply.

FIGURE 3.12 ELECTRICITY SAMPLE – SUMMARY OF ELECTRICITY CONSUMPTION



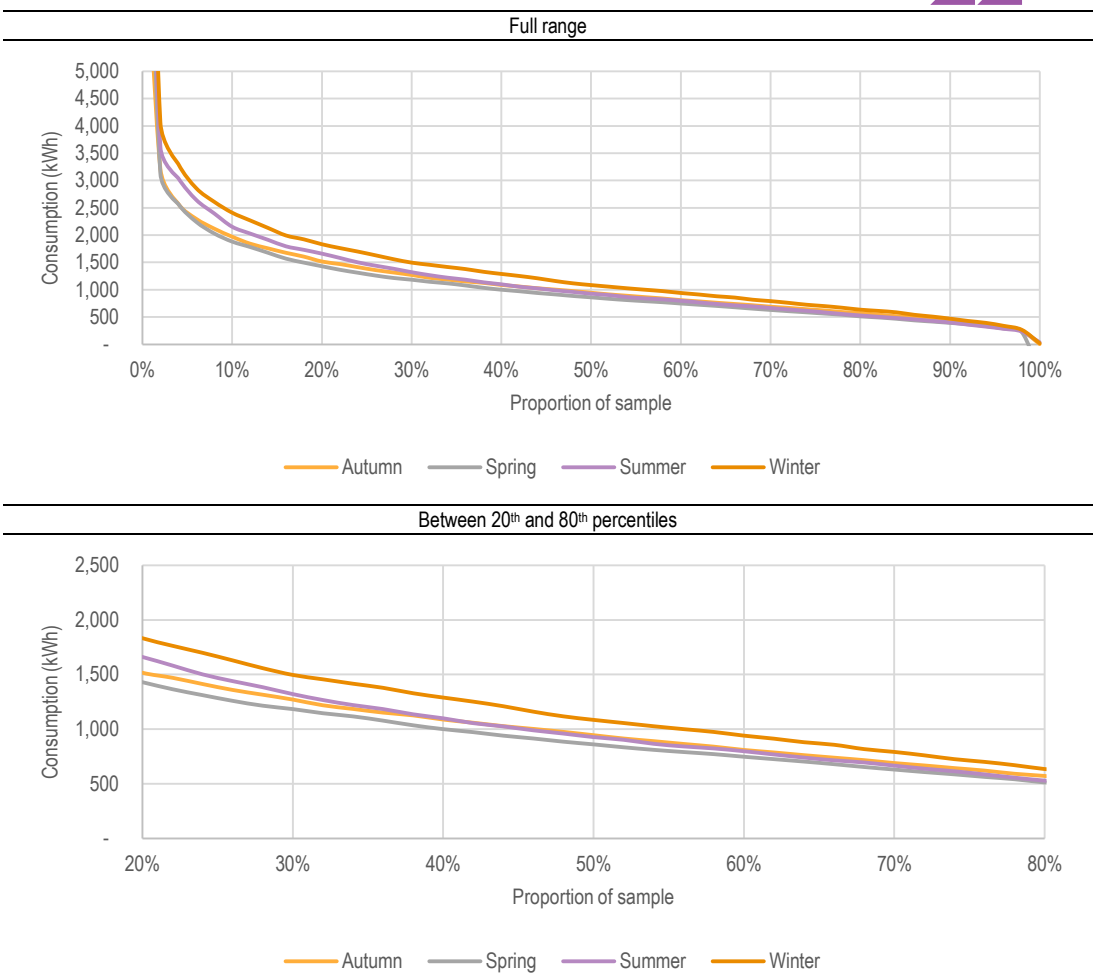
SOURCE: ACIL ALLEN CONSULTING

Figure 3.13 shows the corresponding analysis of the *electricity* consumption of the *gas* sample. That is, the amount of electricity used by households in the sample with mains gas as well.

The broad message conveyed is the same as for the electricity sample. For example:

- even in the gas sample, electricity consumption is highest in winter at all percentile levels
- electricity consumption in spring is lower than other seasons at most, but not all, percentiles in the gas sample
- consumption is relatively flat between the 10th and 90th percentiles and increases/ decreases sharply beyond these limits.

FIGURE 3.13 GAS SAMPLE – SUMMARY OF ELECTRICITY CONSUMPTION

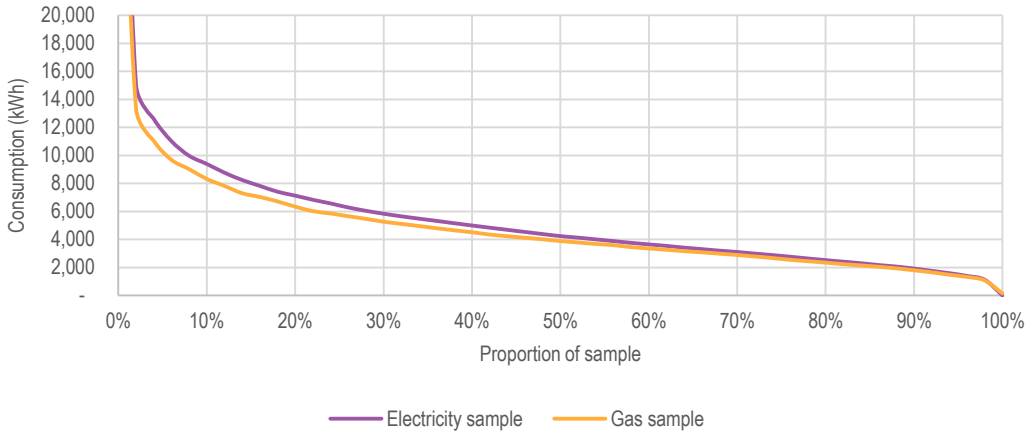


SOURCE: ACIL ALLEN CONSULTING

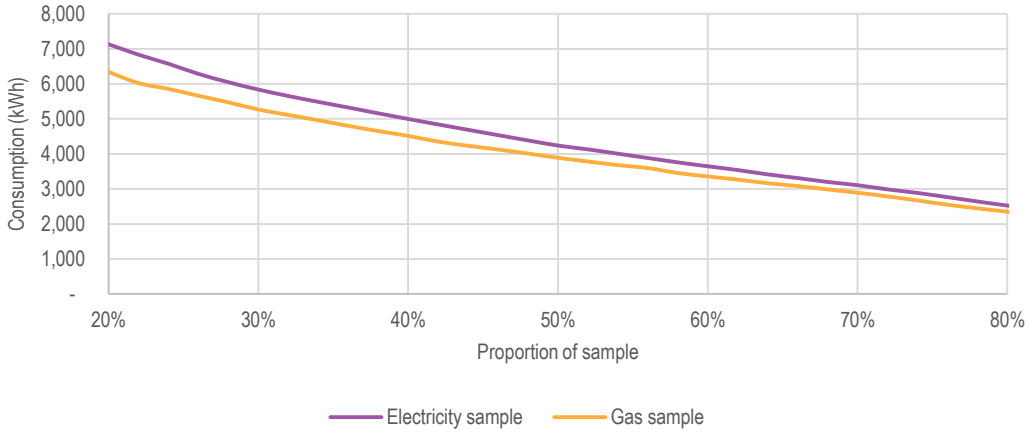
The discussion around the previous two charts shows that, at the 10th and 90th percentiles, people in the sample with gas use less electricity than those without. This is true at all percentiles, as shown in Figure 3.14. At most percentiles customers with gas use between 5 and 15 percent less electricity than those without gas.

FIGURE 3.14 ANNUAL ELECTRICITY CONSUMPTION – ELECTRICITY AND GAS SAMPLES

Full range



Between 20th and 80th percentile



Note: These annual consumption figures are based on four consecutive season's worth of consumption data. For the purposes of this figure, the electricity sample size is 7,797 and the gas sample size is 2,475.

SOURCE: ACIL ALLEN CONSULTING

3.3.4 Gas consumption patterns

Table 3.8 shows average annual gas consumption by jurisdiction and DNSP.

TABLE 3.8 AVERAGE ANNUAL GAS CONSUMPTION BY DNSP

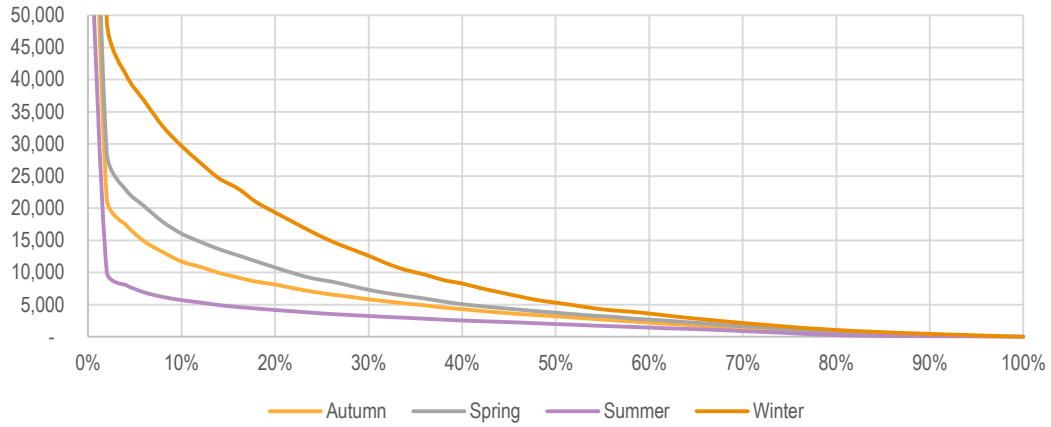
DNSP	Average consumption (MJ/annum)
South Australia	**17,501**
Australian Gas Networks	17,501
Queensland	**7,873**
Australian Gas Networks	7,799
AllGas	7,948
New South Wales	**22,855**
Australian Gas Networks	40,682
Jemena	20,435
Tamworth	7,448
Victoria	**57,064**
Australian Gas Networks	47,847
AusNet	72,125
Multinet	51,222
ACT	**42,078**
ActewAGL	42,078
Tasmania	**26,477**
TasGas	26,477

SOURCE: ACIL ALLEN CONSULTING

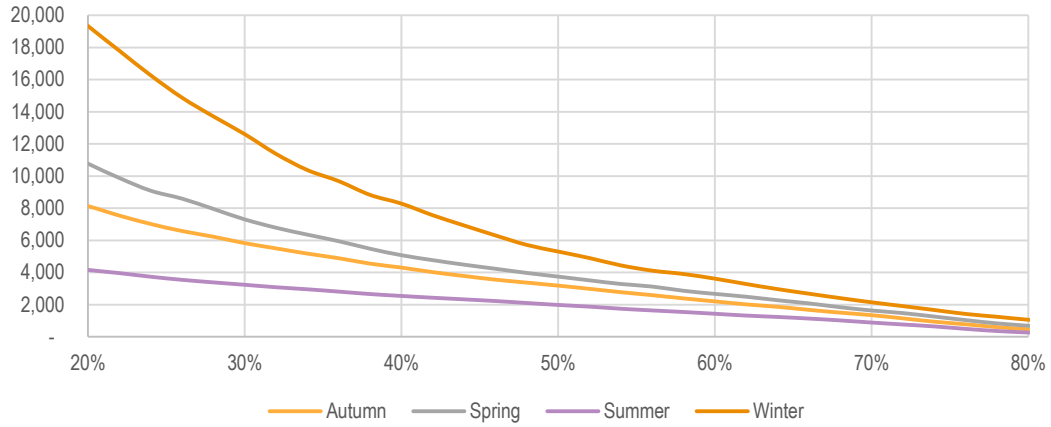
Figure 3.15 shows the distribution of gas consumption among the gas sample. This shows very clearly that gas consumption is substantially higher in winter than in all other seasons, which is consistent with space heating being a major driver of gas usage.

FIGURE 3.15 GAS SAMPLE – SUMMARY OF GAS CONSUMPTION

Full range



Between 20th and 80th percentile



SOURCE: ACIL ALLEN CONSULTING

4 ANALYTICAL METHODOLOGY

This chapter describes the analytical methodology used to prepare the benchmarks. This applies equally to the electricity and gas benchmarks because both were estimated using the same methodology, though the results themselves differ.

The benchmarks are, technically, *conditional mean* values. That is, they are the average consumption of households in the dataset who meet certain conditions.

The *conditions* are described in this report as benchmark factors. These are used to identify which benchmark applies to a particular household. For example, the NERR require that one of the conditions (factors) is *household size*. They are also required to reflect the *localised* zones described in section 4.1. In very simple terms the benchmarks could be the average consumption of households of different sizes in each zone.

In addition to this we used the available data to identify other factors that are useful in 'describing' energy consumption. These are presented as additional benchmark factors that could be used to provide more refined benchmarks. The approach we took to doing this is described in section 4.3.

As described in that section the benchmark models were estimated using weighted least squares regression. The weights that were used are described in section 4.2.

The methodology is similar to that used to develop the current benchmarks in 2014 and the originals in 2011. However, a number of significant modifications were made to the analytical methodology to improve the robustness of the benchmarks and to allow for increased flexibility in benchmark categories in different places.

4.1 Selecting geographic samples

As discussed in section 3.2.2, the NERR require that electricity benchmarks be 'based on localised zones'. This reflects the expectation that the efficient amount of energy usage will vary from place to place. For the most part this is likely to be due to climate and the different heating and cooling requirement in different places. It will also differ depending on whether people have access to gas as well as electricity, though in our approach this is taken into account separately.

On this occasion, Energy Ministers other than South Australia's chose to adopt the climate zones used by the ABS as their localised zones. South Australia chose to continue using a tailored set of zones developed in that State.

4.1.1 Assigning the sample to localised zones

Electricity benchmarks

Allocating responses to climate zones

In jurisdictions where climate zones are used as localised zones the sample was matched to climate zone using the respondent's postcode.

We used the following two sources from the Australian Bureau of Statistics (ABS) to create a correspondence of postcodes to climate zones:

1. 1270.0.55.006 – Australian Statistical Geography Standard (ASGS): Correspondences, July 2011: provides a mapping of postcodes to statistical area 2 (SA2)
2. 4671.0 – Household Energy Consumption Survey, User Guide, Australia, 2012: provides a mapping of climate zones to statistical area 2 (SA2).

This correspondence list is attached in Appendix A.1.

Therefore, our final correspondence of postcodes to climate zones is mapped at the SA2 level. However, as mentioned in section 3.2.2, the ABCB defines climate zones by reference to Local Government Areas, not SA2. Some local government areas span multiple SA2 areas, so some postcodes cross over more than one climate zone.

This affects fewer than 10% of all postcodes in Australia. In the small number of overlapping postcodes we allocated postcodes with multiple climate zones to the lower climate zone. For example, if postcode 4321 spans climate zones three and four (or three, four and five), we allocated it to climate zone three.

Another caveat in the Household Energy Consumption Survey mapping of climate zones to SA2 is that the ABS does not identify climate zone eight regions because these are very small and doing so would jeopardise the privacy of people living there. Instead, the ABS states that climate zone eight regions have been allocated to the surrounding climate zones.

As displayed in Figure 3.5, climate zone seven borders climate zone eight. As a result, our electricity benchmarks for climate zone eight are the same as those for climate zone seven.

Allocating responses to South Australian localised zones

It was also necessary to develop benchmarks for the ten South Australian zones.

Some of the South Australian localised zones cover very large areas but have very sparse populations. This makes it difficult to collect a large enough sample to estimate benchmarks for these regions independently. For this type of reason we sought to increase the available sample on this occasion, including by seeking assistance from SA Power Networks (SAPN).

However, as described in section 2.1, SAPN was unable to assist in this way as it does not have contact email addresses for (enough of) its customers. Therefore, the South Australian sample is 800 responses, of which 697 were matched to electricity data. This is larger than samples used previously, but still too small to support independent estimation of five household sizes in ten zones and an alternative approach is required to produce benchmarks for the South Australian zones.

In the absence of sufficient data to estimate benchmarks independently, we drew on data collected in corresponding climate zones in other Jurisdictions. Those benchmarks are then expressed separately for each localised zone.

An alternative approach would have been to work entirely with the South Australian data to produce South Australian benchmarks and 'scale' the different zones as we have done in the past. In our view it is more robust to allow data from the same climate zone in other parts of Australia to inform benchmarks in South Australia's zones. Very simply put, this appears to provide more robust benchmarks than would be available using only the very small number of responses in some of the South Australian zones.

Gas benchmarks

We examined the question of localized zones/ geographic areas for gas benchmarks independently of the electricity benchmarks.

The first approach was to estimate these benchmarks by climate zone / state combination, as per the electricity benchmarks. This analysis appeared to provide good model 'fit' but the benchmarks that were produced were problematic, with many unintuitive changes in consumption by household size such as decreases in consumption as household size increases.

We do not necessarily reject the possibility that average gas consumption *decreases* as household size *increases* in some cases. For instance larger household sizes may be correlated with lower disposable incomes and, a correspondingly decreased propensity to use energy for heating.

However, we are aware that the 'backward steps' in the current (2014) electricity benchmarks caused difficulties for retailers and their customers because they are not intuitive. Despite the fact that a backward step is *plausible*, our analysis stops short of confirming that it is actually observed, which would be beyond the scope of the project we have done.

Therefore, we tended to reject model specifications on theoretical grounds if they yielded 'backward steps'.[12] A small number remain as discussed in section 4.2.3.

Small sample sizes were identified as one source of these issues, and several alternative geographic structures were considered as a way to estimate consumption models based on more data. The jurisdiction level was found to provide the best balance of good model fit and results consistent with theoretical expectations. Therefore, the gas benchmarks presented here were estimated at the jurisdiction level. A summary of the gas sample size is reproduced here in Table 4.1.

TABLE 4.1 GAS SAMPLE SIZE BY STATE

Jurisdiction	Sample Size
QLD	152
NSW	845
ACT	58
VIC	1,076
TAS	14
SA	373
Total	**2,518**

SOURCE: ACIL ALLEN CONSULTING

4.2 Weighting and pooling the sample

Analytically, there is a need to ensure that the sample that underpins the benchmarks is large enough to support the analysis, and that it is not unduly biased towards one 'type' of respondent.

For example, if a set of benchmarks is to be estimated in a particular zone and is to be 'based on household size' as required by the NERR, the sample would ideally include a reasonable number of households of each relevant size in that zone. If other variables are taken into account the sample would ideally accommodate this – for example the sample might need to include enough households of each relevant size with swimming pools as well as enough without. As more variables are taken into account the necessary sample size increases substantially.

Similarly, it is important that the sample is not overly represented by households from one particular place, or (as discussed above) by households with solar panels.

[12] The same is true in the electricity benchmarks

In some cases the current sample includes enough observations to allow benchmarks to be based only on data collected in a given zone/ jurisdiction pairing, i.e. to be estimated independently within a zone/ jurisdiction pair. For example there is sufficient data that the benchmarks for 'Victoria zone 6' are based only on data collected from Victorian householder in climate zone 6.

However, the available sample was not always large enough to allow independent estimation by localised zone and jurisdiction in all cases. This may be due to localised zones being sparsely populated and/or the low response rates among householders.

In these places an alternative methodology is needed to estimate benchmarks at the localised zone level. The next two sections describe the approach we took to:

— weight the sample to deal with overrepresentation in Victoria and of people with solar panels — in section 4.2.1

— 'pool' the sample to address limited numbers of responses of certain household sizes and in sparsely populated parts of Australia — in section 4.2.2.

4.2.1 Weighting the sample

In chapter 3, we raised some aspects in which the collected sample of households differs significantly to the population. These aspects include:

— an overrepresentation of households with solar panels

— an overrepresentation of Victorian households in climate zones 6 and 7.

We corrected for this 'mismatch' by weighting our sample at the jurisdiction and localised zone level and estimating the equations above using weighted least squares.

To conduct the weighting process, population data were collected at the postcode level on:

— the number of households - from the 2016 Census

— solar PV installations - from the Clean Energy Regulator.

These were aggregated at the jurisdiction and localised zone level to calculate the proportion of households with and without solar panels in the population. The proportions were then also calculated for the sample and the sample adjusted to conform to the population. This produced a set of weights that were used in a weighted least squares approach to estimate the benchmark parameters described above.

For the gas sample, weights were developed by gas DNSP and State. This is because there was not a readily available source of information on the number of households with gas in each climate zone / jurisdiction at the time of the analysis.

4.2.2 Pooling the sample

Table 4.2 shows the breakdown of the electricity sample by climate zone and jurisdiction.

TABLE 4.2 SAMPLE SIZE BY CLIMATE ZONE, JURISDICTION AND HOUSEHOLD SIZE

Household size (# people)	1	2	3	4	5+
Climate zone one					
NT	14	23	16	16	20
QLD	26	56	28	12	10
Climate zone two					
NSW	60	115	43	23	17
QLD	215	464	256	189	140
Climate zone three					
NT	0	4	1	1	0
QLD	6	10	8	4	1
Climate zone four					
NSW	41	62	24	16	15
SA	1	3	1	0	0
VIC	32	79	32	21	17
Climate zone five					
NSW	247	506	213	192	117
QLD	19	16	8	6	5
SA	124	198	106	65	44
Climate zone six					
NSW	83	236	120	101	80
SA	25	67	36	17	10
VIC	430	900	474	372	248
Climate zone seven and eight					
ACT	31	49	19	19	9
NSW	21	40	14	12	4
TAS	66	119	49	32	29
VIC	76	203	83	65	47

SOURCE: ACIL ALLEN CONSULTING

As a rule of thumb there would ideally be at least 30 responses in each 'cell' of this table or, in other words, the benchmark level of consumption for, say, a five person household in a given zone would be based on data from at least 30 five person households in that zone.

However, the table shows that while the sample is large overall, comprising more than 8,000 Australian households, some 'cells' contain only a fairly small number of responses. It shows that in some of the localised zones the number of responses is too small to allow independent estimation.

Rather than provide benchmarks based on these very small 'cell sizes' we *pooled* the data in some cases. That is, instead of running one regression for each climate zone and state combination, we ran six regressions — one for climate zones one and three, one for climate zones seven and eight, and one for each of the other climate zones. Within these equations we specified the parameters to account for differences across states, to the extent that was possible while maintaining sensible and robust estimates.

We also grouped (pooled) some household sizes together in cases where there were too few households of a particular size within a particular zone (or pair of zones)[13].

The *advantage* of pooling is that it allows each benchmark to be based on more data. As mentioned above, the benchmarks are conditional averages. Each benchmark is an estimate of the average consumption across the population of households within the relevant cohort (for example, out of all one person households in climate zone six in Victoria). The average consumption of a sample of households will necessarily vary from the average across the population, but by a lessor amount the greater the size of the sample. That is, benchmarks based on larger samples are likely to more closely reflect the average consumption across all households.

The *disadvantage* to pooling is that it may limit the ability to observe legitimate variation between groups of households. This disadvantage can be moderated by careful specification of the econometric models estimated. For example, where a climate zone exists in more than one jurisdiction and there are few responses in one of the jurisdiction, it may be appropriate to:

— use data from the same climate zone in other jurisdictions to estimate the 'shape' of the benchmarks across different household sizes

— use individual state data to adjust the 'level' of consumption across all household sizes.[14]

We exercised our professional judgement about when to pool data, and when to fully allow the data in a particular zone / household size to inform the benchmark. We chose to pool data in circumstances where there were only a small number of observations available and the benchmarks yielded by the un-pooled data were not consistent with theoretical expectations, usually because they either decreased or moved erratically as household size increased.

The following sections provide examples of pooling data across zones, and across household sizes.

Pooling across zones

To illustrate the use of pooling across zones, consider climate zone one, which covers the far north of Australia.

The sample includes responses from 218 people in this zone, of whom 89 live in the Northern Territory and 129 in Queensland.

There are even fewer people in the sample in climate zone three, which is a very sparsely populated part of the country

The small samples within these areas meant that the estimated benchmarks were not considered to be robust, and were not consistent with theoretical expectations. Therefore we pooled the data from climate zones one and three, which border one another, and are both wholly within Queensland and the Northern Territory.[15]

Within that pool of data we estimated benchmarks using a model which allows for variation in typical energy consumption across household size and between the two jurisdictions (Queensland and the Northern Territory) but which ensures that benchmarks throughout this region are informed by *all* of the climate zone one *and* climate zone three data.

Despite pooling the data, the most flexible functional form that produced sensible benchmarks in these zones required an assumption that the difference in benchmarks between zones one and three in Queensland is constant across all household sizes. That is, regardless of the household size, the difference in benchmark consumption in zones one and three in Queensland is estimated to be a fixed number of kWh (which varies by season – see Table 5.1 and Table 5.2 for example). Although this could be viewed as a limitation of the benchmarks for climate zone three, in our judgement this is preferable to the alternative of not being able to generate benchmarks for that climate zone.

[13] As above, zones one and three and, separately seven and eight, were treated as pairs of zones.
[14] An example is provided below.
[15] And Western Australia, although the survey did not cover this jurisdiction

Pooling across household sizes

Table 4.2 also shows that the number of responses in some 'cells' is small. Our initial analysis showed that this led to results that were not consistent with theoretical expectations. Therefore, in some cases we pooled across household sizes.

Details of which household sizes were pooled are provided in Chapter 5. To illustrate the methodology and its implications, consider climate zone one in Queensland in which our sample consists of

- 26 one person households
- 56 two person households
- 28 three person households
- 12 four person households.
- 10 households with five or more people.

There are not enough households with five people or more in this zone to estimate reliable benchmarks, which was confirmed by our initial analysis. Therefore in this zone we pooled all households with four people or more in Queensland. The result is that the benchmarks are more reliable, but that they are the same for four person and larger households in zone one in Queensland.

In more technical terms, we estimated the benchmarks using variants of equation (1), which are shown in Appendix B.

$$Cons_i = XXhh_{ij}\beta_j + \epsilon_i \quad (1)$$

Where:

- $Cons_i$ is a column vector of electricity consumption with row *i* representing household *i*
- $XXhh_{ij}$ is a matrix of indicator variables where the rows represent household i and column j represents household size bins interacted with state XX
- β_j is a column vector of parameters to be estimated using weighted least squares regression.

As noted above, a broad summary of the pooling approach applied to each climate zone is included in the discussion of results for each of these zones, in chapter 5.

Table 4.3 reproduces Table 4.2 but shows how the pooling across household sizes was applied within each climate zone. Each alternate 'bin' is shaded in purple or white. For example, the first row (climate zone one, NT) contains five separate 'bins'. In line two (climate zone one, QLD) households with four people, and five or more people, were grouped into one 'bin' as discussed above. Essentially, household size categories that are low in sample sizes are grouped with a corresponding category and benchmarks are calculated for that combined category.

TABLE 4.3 POOLING ACROSS HOUSEHOLD SIZE

Household size (# people)	1	2	3	4	5+
Climate zone one					
NT	14	23	16	16	20
QLD	26	56	28	12	10
Climate zone two					
NSW	60	115	43	23	17
QLD	215	464	256	189	140
Climate zone three					
NT	0	4	1	1	0
QLD	6	10	8	4	1
Climate zone four					
NSW	41	62	24	16	15
VIC	32	79	32	21	17
Climate zone five					
NSW	247	506	213	192	117
QLD	19	16	8	6	5
Climate zone six					
NSW	83	236	120	101	80
VIC	430	900	474	372	248
Climate zone seven and eight					
ACT	31	49	19	19	9
NSW	21	40	14	12	4
TAS	66	119	49	32	29
VIC	76	203	83	65	47

Note: This table excludes South Australia, although South Australian households were included in the analysis by climate zone. Section 5.3 describes the analysis by South Australian localised zone.

SOURCE: ACIL ALLEN CONSULTING

4.2.3 'Backward steps' in benchmarks

There are a small number of cases in which the benchmarks reported in chapters 5 and 6 take 'backward steps'. That is, situations in which there is a slight *decrease* in benchmark consumption corresponding with an *increase* in household size. Backward steps are infrequent and, in all cases, small in the context of the seasonal, or annual, energy consumption. In our initial analysis there were more backward steps, which was due to the small sample sizes in certain 'cells' in the sample as discussed above. For the most part the backward steps were removed by pooling the data across household sizes. However, in the few cases where backward steps remain the case for doing so was not as strong.

A 'backward step' of this type might be the result of a small sample size. However, it might also indicate that there are other factors relevant to energy consumption that are not captured by these benchmarks.

For example, it is conceivable that, on average, smaller households have larger disposable incomes than larger households and that this causes them to use more energy. There are other possibilities, such as that smaller households might be more likely to be retired couples, or single parent families,

and might thus be occupied more hours of the day and therefore use more energy than smaller households.[16] In these cases, a 'backward step' would not be an inappropriate result.

4.3 Selecting benchmark factors

The household survey provided a very large amount of information about the people who responded and the way they use electricity in their household. This provides a broad range of variables that could explain variation in electricity consumption and, therefore, a broad range of potential benchmark factors.

The range of potential factors was described briefly in chapter 2.

The NERR do not require that retailers distinguish benchmarks by other factors than household size. However, our analysis shows that the veracity of benchmarks can be improved by doing so. That is, if additional variables are taken into account, the resulting benchmarks will explain more of the variability in consumption and, thereby, be more informative to consumers.

At the same time, there are far more potential factors in the survey than could possibly be included in the benchmarks and even if they could all be included, not all of them will *actually* be useful in explaining energy consumption in a statistical sense.

Therefore, we require a way of narrowing the long list of potential factors to a manageable set of factors. This is useful in two ways. First, retailers may choose to go beyond the requirements of the NERL and provide more tailored benchmarks on their customers' retail bills. Second, the AER can implement the additional analysis in EME to allow users to obtain benchmarks that are more tailored than those provided on their retail bill.

Therefore, there are two steps to this process:

First, we identified a set of *variables* to explain as much of the variation in electricity consumption as possible within the localised zones (and where applicable, the pools of data described above). Broadly, this step provides models that could be used on EME. It is discussed in section 4.3.1

Second, we considered those variables and reached recommendations as to which of them would be suitable for use to 'tailor' benchmarks on retail bills. This step will potentially enable retailers to go beyond the minimum requirements of the NERL. It is discussed in section 4.3.2.

4.3.1 Selecting variables

As on previous occasions, our approach to selecting *variables* was based on the extent to which each *variable* explained variation in the electricity consumption of households in the sample. In more technical terms, the 'best' variable was that which yielded the largest R-squared value when used in a linear regression to 'explain' energy consumption, as shown in equation (2).

$$consumption_i = HH_i'\beta + V_i'\alpha + \epsilon_i \quad (2)$$

Where,

- $consumption_i$ energy consumption of household *i*
- HH_i set of household size and location indicators of household *i*
- V_i variable(s) being tested, value for household *i*
- β, α parameters to be estimated using weighted least squares regression

[16] There are other possible explanations as well.

The starting point for each specification was a set of climate zone, state, and household size explanatory variables, as described in appendix B.

The next 'best' variable is that which yields the largest *increase* in the R-squared value when used in a linear regression of the same form including all variables already selected as shown in equation (3).

$$consumption_i = HH_i'\beta + X_i'\gamma + V_i'\alpha + \epsilon_i \quad (3)$$

Where:

- $consumption_i$ energy consumption of household *i*
- HH_i set of household size indicators of household *i*
- X_i previously included factors that explain consumption, value for household *i*
- V_i variable(s) being tested, value for household *i*
- β, α, γ parameters to be estimated using weighted least squares regression

All equations were estimated using data from the pools described above for all four seasons separately, so all benchmarks allow for seasonal variation in consumption. The variable selected for inclusion was the one that explained the most variation across all four seasonal equations.

To apply our approach we implemented our proprietary specification search algorithm, which tests each variable to identify the one that explains the most variation. The algorithm is similar to a step-wise regression, but with significantly more flexibility in the way that the variables are considered for inclusion, and in the way that the R-squared (or any other objective function considered as the basis for variable inclusion) is calculated. In this case the variable selected for inclusion was the one that explained the most variation across all four seasonal equations simultaneously.

The approach also enabled testing for multiple variables within each iteration. This decision was taken for cases we could identify a theoretical rationale for doing so. For instance, many variables were 'allowed' to vary in their importance with the number of people in the house, and with household income. This tests questions such as whether large households use *even more* energy under certain conditions. In more technical terms, the new approach allows consideration of interactions with household size.

The algorithm stopped including variables in each equation when the incremental amount of variation explained fell below a pre-determined threshold, or a sufficient number of variables were added.

The analysis therefore takes an empirical approach to determining the most 'important' variables in explaining differences in electricity consumption between households in a given localised zone. That is, the conclusions are based on analysis of actual consumption data. It allows for the possibility that the 'variables' that are most 'important' vary from place to place and that they are not necessarily the variables that might be expected.

The results of this analysis are shown in Figure 5.1 below.

4.3.2 From variables to benchmark factors

The first step of the analysis, described in section 4.3.1, provides a set of *variables* that explain as much of the variation in electricity consumption as possible in this context.

However, while these *variables* may be useful for EME, they are not necessarily suitable as benchmark *factors* for use by retailers.

The key difference between *variables* and *factors* is that for a *variable* to be a useful *factor* it must be important in explaining differences in electricity consumption between customers and also be capable of being communicated to householders by retailers.

In other words, retailers would ideally display one set of benchmarks on the bills of customers to whom that factor applies and another set on the bills of other customers. For example they might display one set of benchmarks on the bills of customers with gas and anther set on the bills of customers without gas.

However, in most cases the variables identified as 'best' will not usually be known by energy retailers. In many zones the 'best' variable is the presence or absence of a swimming pool. In some others it is presence or absence of electric underfloor (slab) heating. Energy retailers cannot be expected to know whether their customers have swimming pools or slab heaters. Therefore, if these were chosen as benchmark factors, retailers would have no way to know which 'set' of benchmarks to place on any given bill.[17]

Therefore, even if these are the 'best' *variables*, they can only be used as benchmark factors if another approach is taken.

The reason that the analysis identified swimming pools and slab heaters as the 'best' variables is that households that have them use substantially more electricity than other similar households. However, the sample also shows that only a small proportion of households have them (see Figure 3.8 for swimming pool ownership and Figure 3.9 for slab heater ownership). Therefore, in relevant zones (identified in chapter 5) we recommend that the 'without' benchmarks are placed on the bill and accompanied by a note directing customers with either swimming pools or slab heaters (as applicable on a zone by zone basis) to EME for appropriate benchmark information.

In zone 4 the availability of gas is identified as the 'best' variable'. In this case retailers will often know whether their customers have access to gas. More specifically, they will know whether a given customer is 'dual fuel'. In this circumstance the AER may wish to consider recommending that retailers place the 'with gas' benchmarks on the electricity bills of their 'dual fuel' customers and the 'without gas' benchmarks on the bills of other customers.

We acknowledge that this approach is not well tailored for customers who have separate retailers for their gas and electricity supply. The issue here is that the electricity retailer will know that some of its customers have gas supply from another retailer, but will not know which customers. We recommend that these customers be directed to EME for appropriate benchmarks via a note on bills showing the 'without gas' benchmarks.

Therefore, in each section in chapter 5 below we provide a recommendation as to the most suitable 'second factor' for benchmarks in each zone. Those factors are drawn from the variables identified by the process described above and from our judgement as to the most practical approach based on information likely to be available to retailers. We have not gone beyond the 'second' factor in the report, though an accompanying spreadsheet shows up to three variables for each zone. In some cases those variables may also be suitable as benchmark factors.

4.4 Scaling Northern Territory benchmarks

The sample we collected from the part of the Northern Territory in climate zone 1 consists of 89 households (see Table 4.2). When we calculated electricity benchmarks for that sample using the approach described above, the weighted average consumption of the sample was estimated to be approximately 13,500 kWh per annum.

This is substantially higher than the corresponding average consumption from the sample we obtained on the previous occasion. Upon investigation we also discovered that it is substantially more than the average annual consumption implied by the Australian Energy Council's publication, Electricity Gas Australia, which was 8,915 kWh per annum for residential customers in 2014-15.[18]

We verified the data we had been provided with Power and Water Corporation, which confirmed that its residential customers use around 9,000 kWh per annum on average and that this sample appeared to have higher than average usage.

While it is plausible that average consumption has grown since the last time we estimated benchmarks and since the 2015 data reported by the Australian Energy Council, the 50 per cent magnitude implied by this sample is not plausible. That is, our view, which was supported by Power

[18] The most recent edition of electricity gas Australia at the time of writing was the 2016 edition. The most recent data it included for this issue was 2015 data.

and Water Corporation, is that the sample consumption is likely to be an over estimate of the amount of electricity Northern Territory householders use each year.

Therefore, we elected to scale the Northern Territory zone 1 benchmarks. To do this we:

1. computed the ratio between the weighted average consumption in our sample and the corresponding average from data reported by the Australian Energy Council, which was approximately 66 per cent
2. multiplied each of the benchmarks produced by the process described above by that ratio.

In our view this provides benchmarks that are a more accurate reflection of the likely annual usage of households in the Northern Territory than those that resulted from the standard process described above.

5 RESULTS - ELECTRICITY

This chapter provides the electricity benchmarks. It is structured as follows:

— Section 5.1 provides the results of the process we used to identify the 'best' variables from the electricity dataset

— Section 5.2 addresses each of the localised zones in turn. It provides benchmarks with up to two *factors*, household size and one other, for each zone/ jurisdiction combination.

5.1 Overview

5.1.1 Variables relevant to electricity consumption

A key result of the analysis was that the 'best' variables varied between localised zones. This is encapsulated in Figure 5.1, which shows the amount of variation explained (increases in R squared) by adding variables to the benchmarks models independently within each climate zone.

Figure 5.1 shows that in most regions the sample would support benchmarks based on several variables *in addition to* household size. Across the regions considered here a total of 12 additional variables have been taken into account. The variables that would be added are listed and explained below. Note that many overlap. The point is not that these would be added to one large model, but that the variables that distinguish between benchmarks in each climate zone would differ.

The variables in question are (listed in no particular order):

1. Rooms – the number of rooms in the dwelling
2. Rent/ own - whether the household is rented or owned by its occupants
3. Pool – whether there is a pool
4. C Load – whether the household has controlled load supply (i.e. off peak supply on a separate circuit)
5. Unplugged – this was a survey question relating to how often appliances are turned off at the wall. We interpret this as a proxy for the attitude/ commitment to energy efficiency
6. Any gas – whether the household has access to gas, including in bulk bottles
7. Electric heat – whether there is any form of electric heating
8. Mains gas – whether the household has a reticulated gas supply for which they are billed directly (i.e. not through a strata account)
9. R/C – whether there is a reverse cycle air conditioner
10. Slab heat – whether there is an electric underfloor heater
11. Electric water – whether the household uses electricity for water heating
12. Split – whether the household has (any) split system air conditioning.

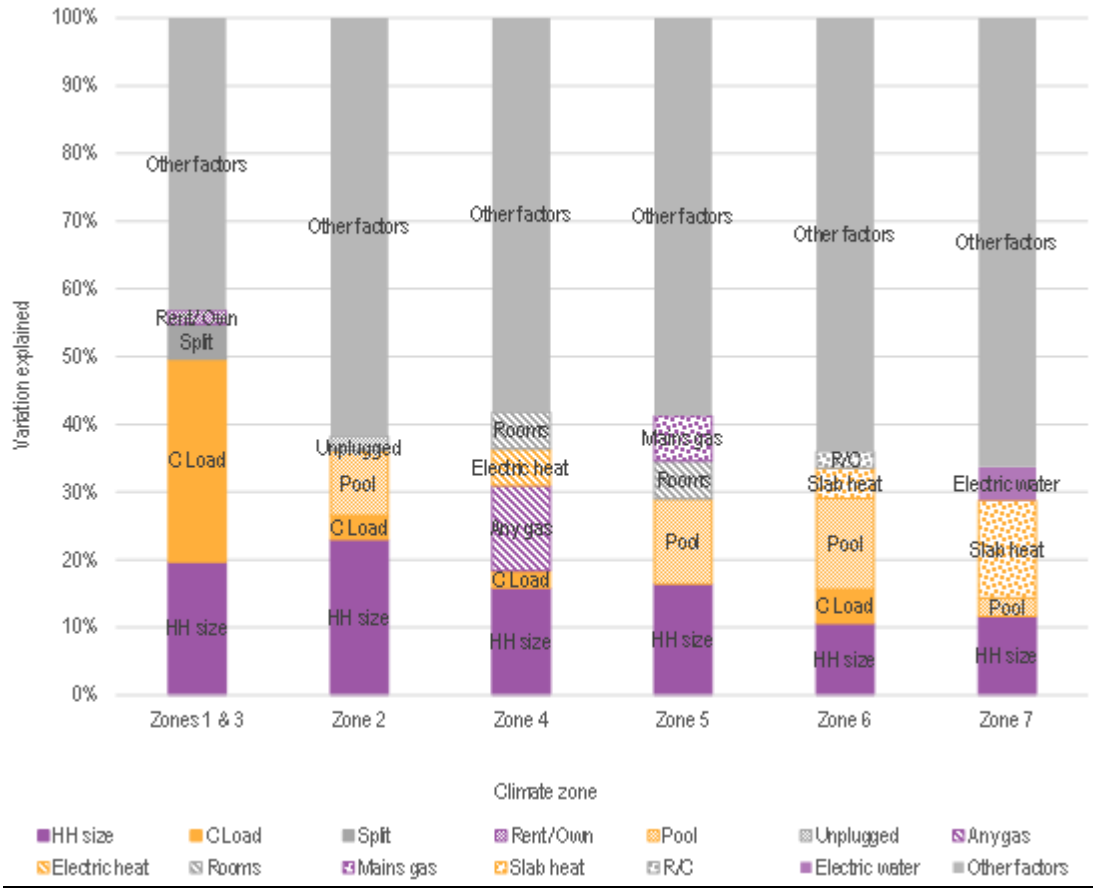
The height of the coloured column segments in Figure 5.1 represents the contribution each condition makes to explaining the variability in consumption. In terms of our decision rule a taller column segment represents a stronger condition. The figure also shows the extent to which these models are able to explain variability in the sample. These values are broadly similar to the results achieved on previous occasions, if not somewhat stronger.

More detailed discussions of the benchmark models estimated for each climate zone are in the following sections.

We emphasise that these models are not *causal*. For example, note that the variable in 'third place' in climate zones one and three (collectively) is whether the household is owned or rented by its occupants. The modelling indicates that rented households use more electricity than those that are owned outright or being paid off. The modelling does not mean that renters use more electricity *because* they rent their homes but merely identifies that, all else being equal, people in rented homes in these climate zones use more electricity.[19]

This is not a surprising result. It is widely understood that people who rent their homes have less access to energy efficiency measures than those who own. For example, tenants are unable to install draft stoppers or double glazing or exterior blinds to shade their windows. The point is that the physical characteristics of the home, not the (mere) fact that the home is rented, that is likely to cause the difference in energy consumption.

FIGURE 5.1 ELECTRICITY BENCHMARKS BY CLIMATE ZONE 'BEST' VARIABLES



SOURCE: ACIL ALLEN CONSULTING

[19] Note also that the modelling does not mean that renters in other places *do not* use more electricity, just that other variables explain more of the variation in use between people.

5.1.2 Benchmark factors

As discussed in section 4.3.2 the requirement for a suitable benchmark factor differs from that for a *variable.* Some of the 12 *variables* listed above are not suitable as benchmark *factors*. In our view the only three *variables* that are suitable for use as *factors* are:

1. Pool – whether there is a pool
2. C Load – whether the household has controlled load supply (i.e. off peak supply on a separate circuit)
3. Mains gas – whether the household has a reticulated gas supply for which they are billed directly (i.e. not through a strata account).

Therefore, as discussed in section 4.3.2, in each of the sections that follow we provide benchmarks distinguished by one or other of these factors (using the analysis behind Figure 5.1 to choose which). The exception is zones one and three, in which the sample of people with controlled load is too small to support independent benchmarks.

5.2 Electricity benchmarks outside South Australia

The following sections provide tables of benchmarks in each of the localised zones. In section 4.2, we described that the electricity benchmarks are produced based on variants of household size categories that best represent reliable benchmarks.

In each of the following sections we consider which of the factors identified as important in explaining variation in electricity consumption is most appropriate to use as the second benchmark factor (after household size). In reaching this view we consider the relative contribution each factor makes to explaining variation as well as the fact that retailers need to be able to know which benchmarks should be placed on which customer's bill.

5.2.1 Climate zone one

Climate zone one includes the Northern most parts of Australia. It extends from north of Mackay in Queensland along Australia's Northern coastline to approximately Exmouth in Western Australia. Major population centres in climate zone one include Townsville, Cairns, Darwin, Broome and Port Hedland.

Outside Western Australia there are approximately 300,000 households in climate zone one, about 80 per cent of which are in Queensland.[20]

The electricity benchmarks were developed using all of the data from respondents living in climate zone one and three in both Queensland and the Northern Territory – 254 respondents in total.

Four person and larger households in Queensland were pooled.

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

— C load – whether there is a controlled load supply
— Split – whether the household has (any) split system air conditioning
— Rent/ own – whether the household is rented or owned by its occupants

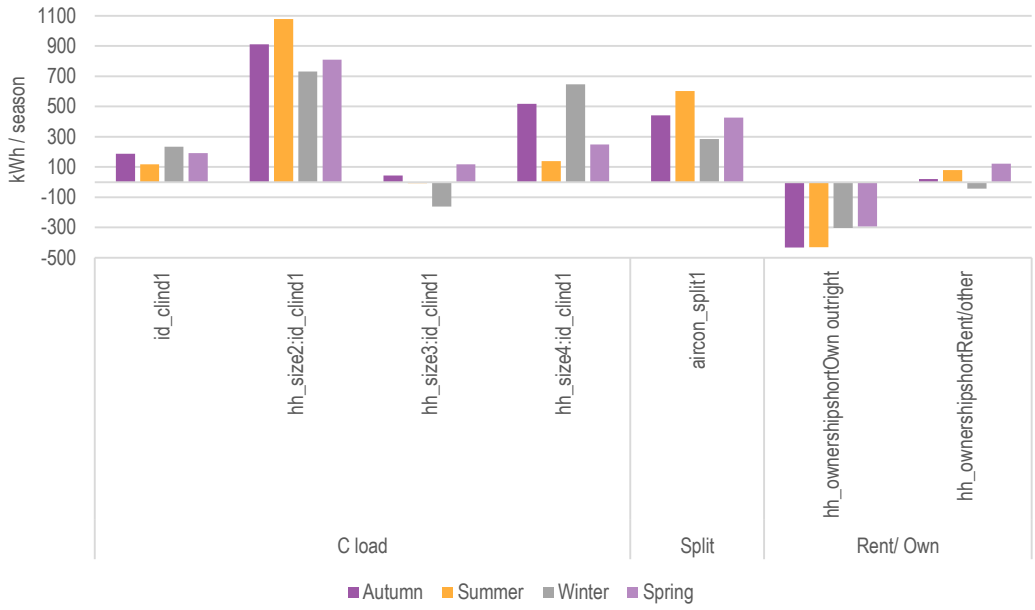
No other variable satisfied the requirements of the selection process.

The estimated coefficients on these variables are shown in Figure 5.2. This indicates that, on average:

— people in climate zone one with controlled loads use more electricity than those without, the exception being three-person households. The amount varies with the number of people living in the home
— people with split system air conditioning use more electricity that those without.

[20] ACIL Allen analysis of Australian Bureau of Statistics data.

FIGURE 5.2 CLIMATE ZONE ONE – ADDITIONAL VARIABLES



SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone one are provided in Table 5.1 for Northern Territory and Table 5.2 for Queensland. They are also summarised in Figure 5.3.

TABLE 5.1 ELECTRICITY BENCHMARKS – NORTHERN TERRITORY CLIMATE ZONE ONE

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
1 Person Household	1124	1049	969	977
2 Person Household	2280	2476	1854	2081
3 Person Household	2517	2568	2072	2486
4 Person Household	2516	2718	2204	2636
5+ Person Household	2826	2977	2416	2802

Note: the benchmark values for three and four person households in Autumn show a very small (1 kWh) 'backward step'. This is likely due to sampling.

SOURCE: ACIL ALLEN CONSULTING

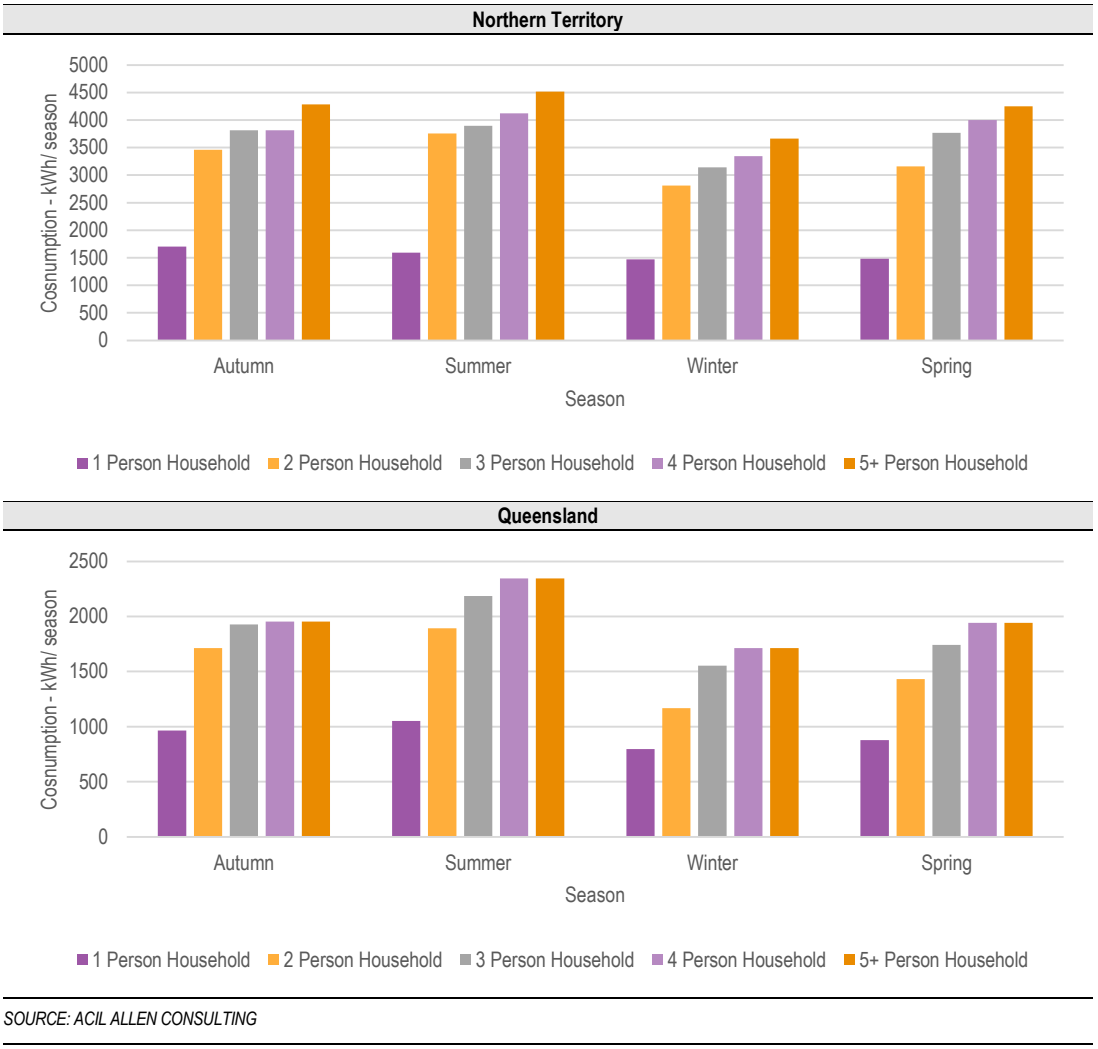
TABLE 5.2 ELECTRICITY BENCHMARKS - QUEENSLAND CLIMATE ZONE ONE

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
1 Person Household	967	1063	842	906
2 Person Household	1671	1857	1349	1525
3 Person Household	1906	2147	1543	1723
4 Person Household	1938	2312	1704	1927
5+ Person Household*	1938	2312	1704	1927

* As illustrated in Table 4.3 the number of four person households in climate zone one for Queensland was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three, and four or more person households.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.3 ELECTRICITY BENCHMARKS CLIMATE ZONE ONE



SOURCE: ACIL ALLEN CONSULTING

As noted in section 4.4, the Northern Territory benchmarks were scaled due to sample bias. Further, Table 4.3 illustrated that the sample size for climate zone three in Northern Territory is too small to support independent benchmarks there. We recommend that the benchmarks in Table 5.1 be used throughout Northern Territory.

5.2.2 Climate zone two

Climate zone two is on the East Coast of Australia. It runs from just north of Port Macquarie to the beginning of climate zone one north of Mackay. Major population centres in climate zone two include Brisbane, Mackay, Rockhampton, Maryborough and Coffs Harbour.

There are approximately 1,750,000 households in climate zone two, almost 90 per cent of which are in Queensland.[21]

The electricity benchmarks in climate zone two were developed using all of the data from respondents living in climate zone two in both Queensland and New South Wales – 1,483 respondents in total.

Two and three person households were pooled in New South Wales, with the relativities between these two sizes informed by the relativities (shape) between two and three person households in Queensland. A similar approach was applied for four person and larger households.

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

- Pool – whether there is a swimming pool
- C load – whether there is a controlled load supply.
- Unplugged –relating to how often appliances are turned off at the wall. We interpret this as a proxy for the attitude/ commitment to energy efficiency.

No other variable satisfied the requirements of the selection process.

As discussed above, either the presence of a pool, or controlled load, are suitable as benchmark factors. The factor that is recommended for the benchmarks is 'pool' based on the fact that this variable explains more of the variation in consumption than controlled load.

The estimated coefficients on these variables are shown in Figure 5.4. This indicates that:

- people in climate zone two with swimming pools use, on average, between approximately 540 and approximately 760 kWh more each season than people without swimming pools
- people in climate zone two with controlled loads use more electricity than those without. The amount varies with household size
- compared to people in climate zone two who reported turning appliances off at the wall sometimes, but less than half of the time:
  - people in climate zone two who turn appliances off at the wall more than half of the time use between approximately 225 and approximately 314 kWh less electricity each season
  - people in climate zone two who never turn their appliances off at the wall use between approximately 60 and approximately 101 kWh more electricity each season.

[21] ACIL Allen analysis of Australian Bureau of Statistics data.

FIGURE 5.4 CLIMATE ZONE TWO – ADDITIONAL VARIABLES

SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone two are provided in Table 5.3 for Queensland and Table 5.4 for New South Wales. They are also summarised in Figure 5.5.

TABLE 5.3 ELECTRICITY BENCHMARKS – QUEENSLAND CLIMATE ZONE TWO

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	765	817	786	747
2 Person Household	1156	1262	1124	1068
3 Person Household	1329	1462	1361	1266
4 Person Household	1683	1868	1583	1538
5+ Person Household	2019	2228	2008	1895
With swimming pool				
1 Person Household	1443	1608	1367	1332
2 Person Household	1833	2053	1705	1653
3 Person Household	2006	2253	1943	1851
4 Person Household	2361	2659	2165	2123
5+ Person Household	2697	3019	2589	2480

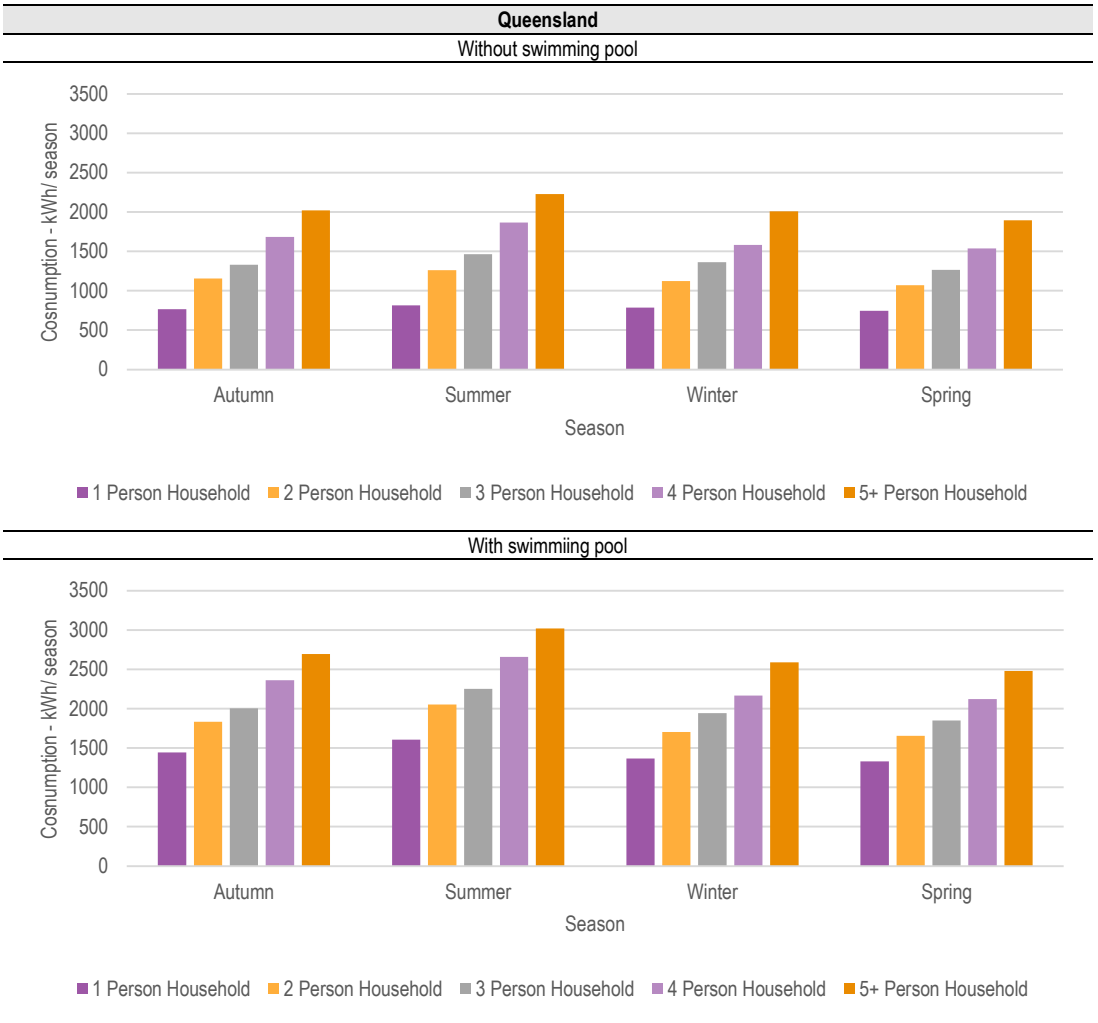
SOURCE: ACIL ALLEN CONSULTING

TABLE 5.4 ELECTRICITY BENCHMARKS - NEW SOUTH WALES CLIMATE ZONE TWO

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	868	825	908	815
2 Person Household	1028	1028	1096	1004
3 Person Household	1201	1229	1333	1202
4 Person Household	1513	1396	1761	1521
5+ Person Household	1849	1757	2186	1877
With swimming pool				
1 Person Household	1545	1616	1490	1400
2 Person Household	1706	1819	1677	1589
3 Person Household	1879	2020	1914	1787
4 Person Household	2190	2187	2343	2106
5+ Person Household	2526	2548	2767	2462

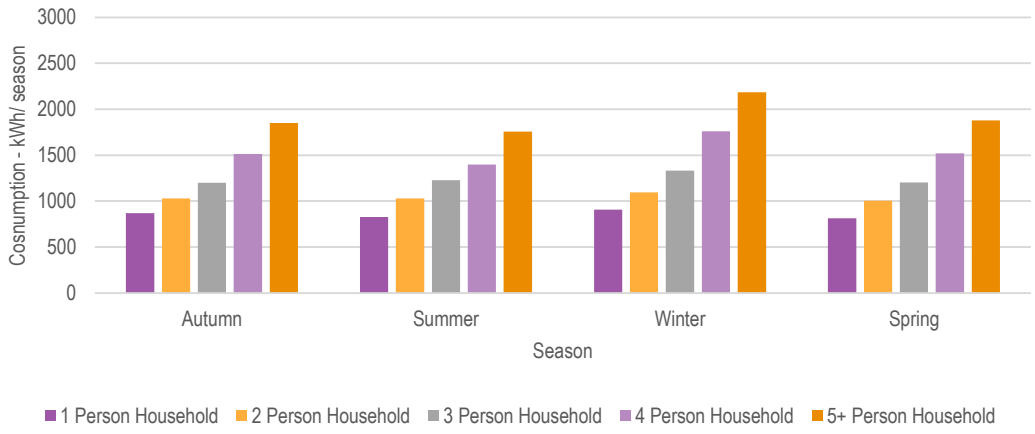
SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.5 ELECTRICITY BENCHMARKS CLIMATE ZONE TWO

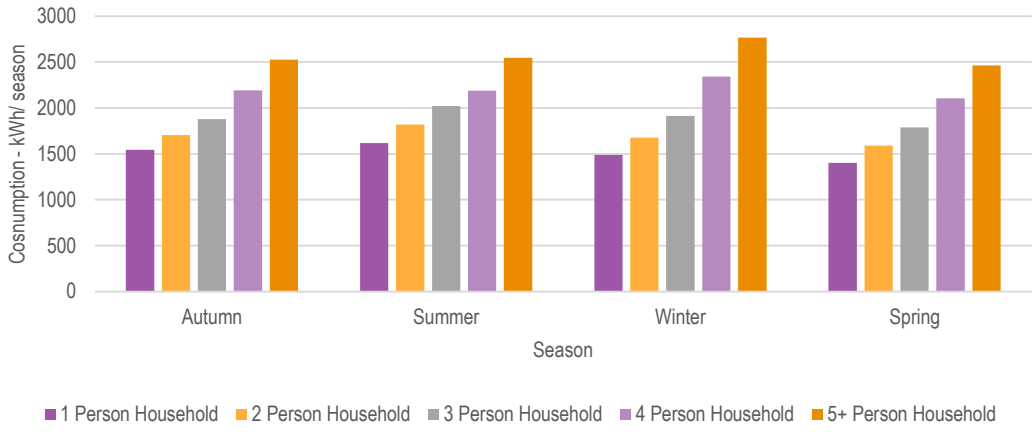


New South Wales

Without swimming pool



With swimming pool



SOURCE: ACIL ALLEN CONSULTING

5.2.3 Climate zone three

Climate zone three includes approximately the northern half of central Australia. It spans from the West coast almost to the east coast. Main population centres in climate zone three include Tennant Creek, Alice Springs and Mount Isa.

Outside Western Australia there are approximately 114,000 households in climate zone three, almost 90 per cent of which are in Queensland.[22]

The electricity benchmarks in climate zone three were developed using all of the data from respondents living in climate zone one and three in both Queensland and the Northern Territory – 256 respondents in total, but only six in the Northern Territory, and 29 in Queensland, within climate zone three.

Electricity benchmarks for climate zone three are provided in Table 5.5 for Queensland. They are also summarised in Figure 5.6. The relativities between benchmarks by household size are based on climate zone one, with adjustments for households with one or two people, and for households with three or more people.

The sample size in climate zone three in the Northern Territory was too small to develop meaningful benchmarks so these are not shown. Given that people living this part of the country are likely to have

[22] ACIL Allen analysis of Australian Bureau of Statistics data.

a strong affinity with the rest of the Northern Territory, we recommend that the benchmarks in Table 5.1 be applied throughout Northern Territory.

Benchmarks for Queensland climate zone three are summarised in Table 5.5.

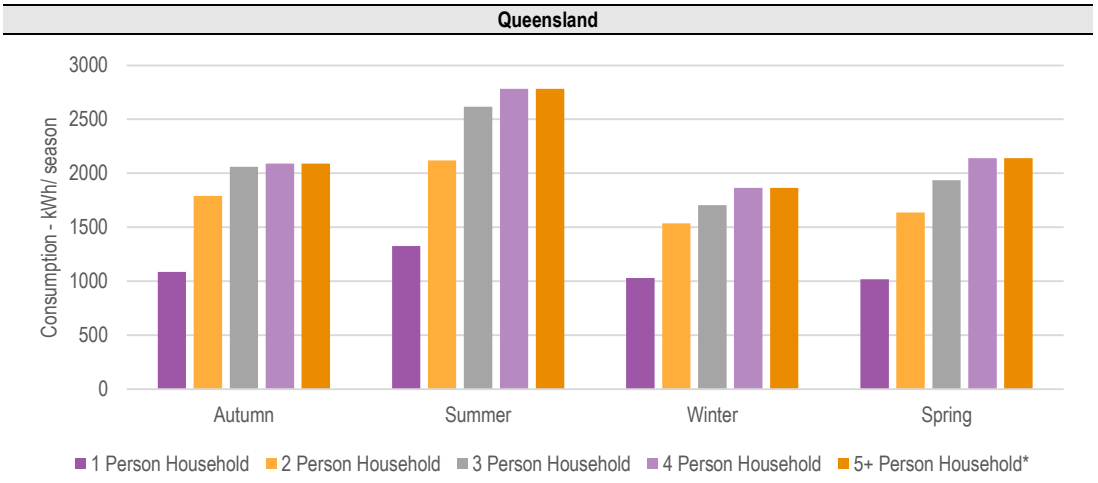
TABLE 5.5 ELECTRICITY BENCHMARKS - QUEENSLAND CLIMATE ZONE THREE

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
1 Person Household	1086	1325	1030	1019
2 Person Household	1790	2120	1537	1638
3 Person Household	2059	2617	1704	1935
4 Person Household	2090	2782	1865	2139
5+ Person Household*	2090	2782	1865	2139

* As illustrated in Table 4.3, the number of four person households in climate zone three was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three, and four or more person households.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.6 ELECTRICITY BENCHMARKS CLIMATE ZONE THREE



SOURCE: ACIL ALLEN CONSULTING

5.2.4 Climate zone four

Just as climate zone three is the northern half of central Australia, climate zone four is approximately the southern half of central Australia. It is defined in the north by the borders between South Australia and the Northern Territory and between New South Wales and Queensland and several local Government boundaries in Western Australia. In the south it reaches the coast on the Nullarbor Plain, but mainly stops some distance inland.

Major population centres in Climate zone four include Dubbo, Griffith, Mildura and Kalgoorlie Boulder.

Outside Western Australia there are approximately 380,000 households in climate zone four, more than half of which are in New South Wales.[23]

[23] ACIL Allen analysis of Australian Bureau of Statistics data.

The electricity benchmarks in climate zone four were developed using all of the data from respondents living in climate zone four – 340 respondents in total.

Benchmarks for Victoria and NSW were estimated separately, with two and three person households pooled in New South Wales, and four person and larger households pooled in Victoria. Although there were few households in the four person, and five or more person, categories for New South Wales, separate benchmarks were generated for these categories as the estimated consumption was viewed as plausible / consistent with expectations. The same could not be said for four person, and five and larger, households in Victoria.

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

- Gas – whether the household has access to gas, whether as reticulated or in bulk bottles
- Electric heating – whether there is electric heating of any kind in the home
- C load – whether there is a controlled load supply
- Rooms – dwelling size measured in number of rooms.

No other variable satisfied the requirements of the selection process.

The estimated coefficients on these variables are shown in Figure 5.7. This indicates that:

- people in climate zone four with gas use, on average, between approximately 234 kWh and approximately 959 kWh less electricity each season than people without gas
- people in climate zone four with electric heaters use, on average, between approximately 412 kWh and approximately 1370 kWh more electricity than people who do not have electric heaters
- people in climate zone four with controlled loads use a different amount of electricity than those without. The amount varies by household size
- on average, people living in larger homes in climate zone four use more electricity than people in smaller homes. These are relative to a home of up to four rooms.

The recommended benchmark factor is 'gas', which explains more of the variability in consumption than controlled load (C load).

FIGURE 5.7 CLIMATE ZONE FOUR – ADDITIONAL VARIABLES

SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone four are provided in Table 5.6 for New South Wales and Table 5.7 for Victoria. They are also summarised in Figure 5.8.

TABLE 5.6 ELECTRICITY BENCHMARKS – NEW SOUTH WALES CLIMATE ZONE FOUR

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without gas				
1 Person Household	1562	1310	2203	1852
2 Person Household	1966	1753	2695	2083
3 Person Household*	1966	1753	2695	2083
4 Person Household	2226	2113	2745	2412
5+ Person Household	3318	2852	4605	3827
With gas				
1 Person Household	935	983	1003	1027
2 Person Household	1339	1425	1495	1258
3 Person Household*	1339	1425	1495	1258
4 Person Household	1599	1785	1545	1587
5+ Person Household	2691	2524	3405	3003

* As illustrated in Table 4.3, the number of three, four and five or more person households in climate zone four were too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two and three, and four or more person households.

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.7 ELECTRICITY BENCHMARKS - VICTORIA CLIMATE ZONE FOUR

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without gas				
1 Person Household	1517	1346	2677	1754
2 Person Household	1855	1819	2887	2038
3 Person Household	2320	2321	3351	2400
4 Person Household	2599	2582	3928	2898
5+ Person Household*	2599	2582	3928	2898
With gas				
1 Person Household	889	1018	1477	929
2 Person Household	1228	1492	1688	1213
3 Person Household	1693	1994	2151	1575
4 Person Household	1972	2254	2728	2073
5+ Person Household*	1972	2254	2728	2073

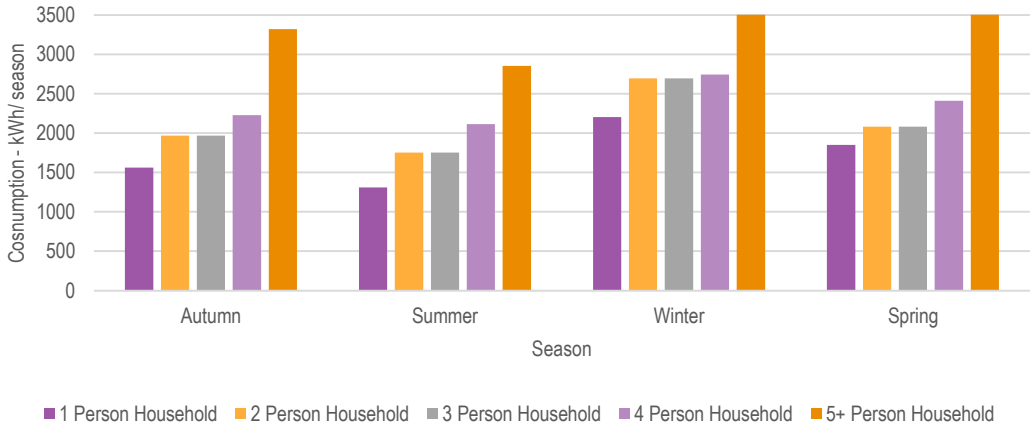
* As illustrated in Table 4.3, the number of five or more person households in climate zone four was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three, and four or more person households.

SOURCE: ACIL ALLEN CONSULTING

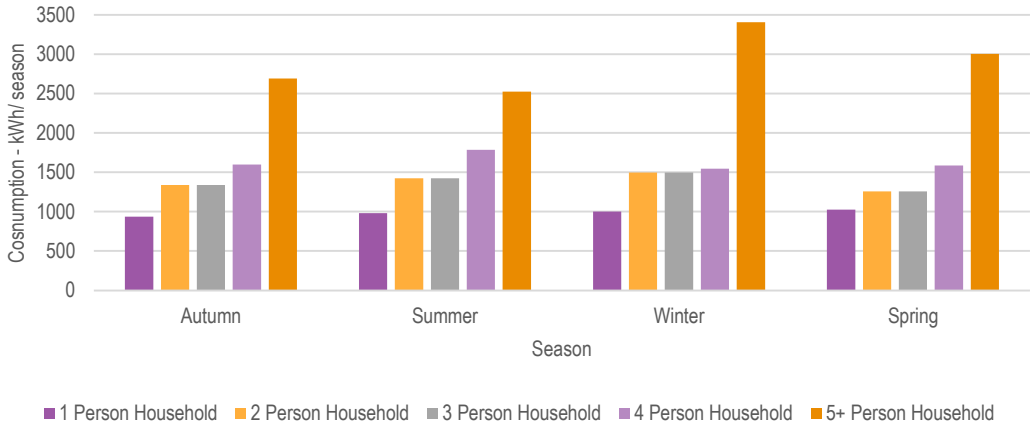
FIGURE 5.8 ELECTRICITY BENCHMARKS CLIMATE ZONE FOUR

New South Wales

Without gas

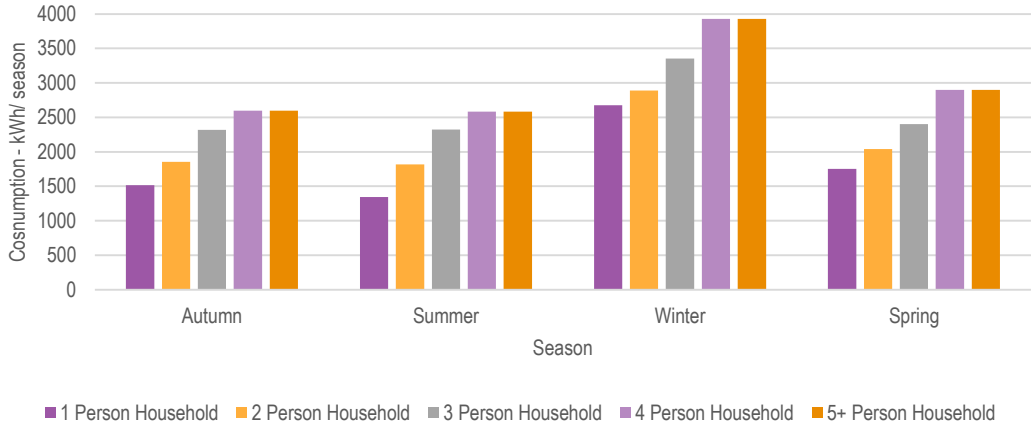


With gas

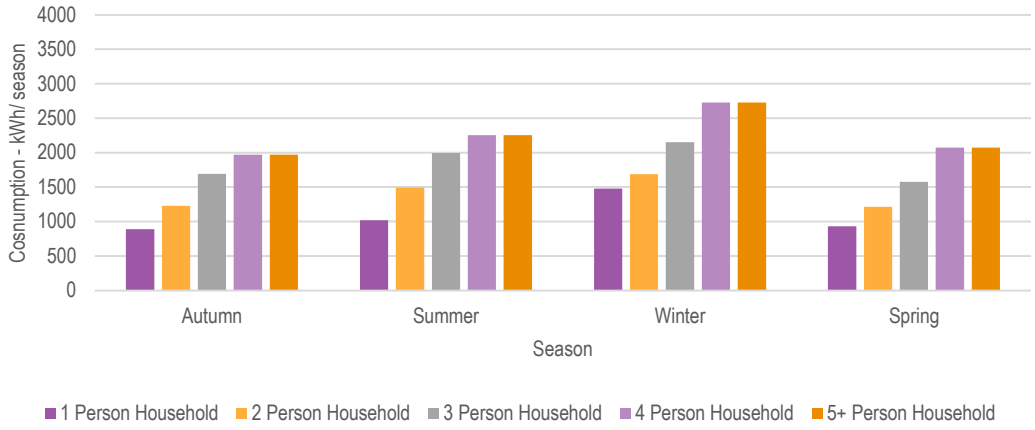


Victoria

Without gas



With gas



SOURCE: ACIL ALLEN CONSULTING

The climate zone four benchmarks appear broadly intuitive. In most cases the benchmark levels increase as there are additional people in the household, though not between four person and larger households in Victoria. As noted above, this is due to the structure of pooling households of four or more people due to the available sample size described in Table 4.3.

5.2.5 Climate zone five

Climate zone five is located in pockets in each mainland state of Australia except Victoria. There is a pocket inland from Brisbane, another on the New South Wales Coast surrounding Sydney and reaching north to Port Macquarie and a large pocket in South Australia. Major population centres in Climate zone five include Adelaide, Newcastle and Sydney.

Outside Western Australia there are approximately 2,250,000 households in climate zone five, about 70 per cent of which are in New South Wales.[24]

The electricity benchmarks in climate zone five were developed using all of the data from respondents living in climate zone five – 1,851 respondents in total.

Two and three person households were pooled in Queensland, with the relativities between these two sizes informed by the relativities between two and three person households in New South Wales. A similar approach was applied for four person and larger households.

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

[24] ACIL Allen analysis of Australian Bureau of Statistics data.

— Pool – whether there is a swimming pool
— Mains gas – whether the household has a reticulated gas connection
— Rooms – the number of rooms in the dwelling.

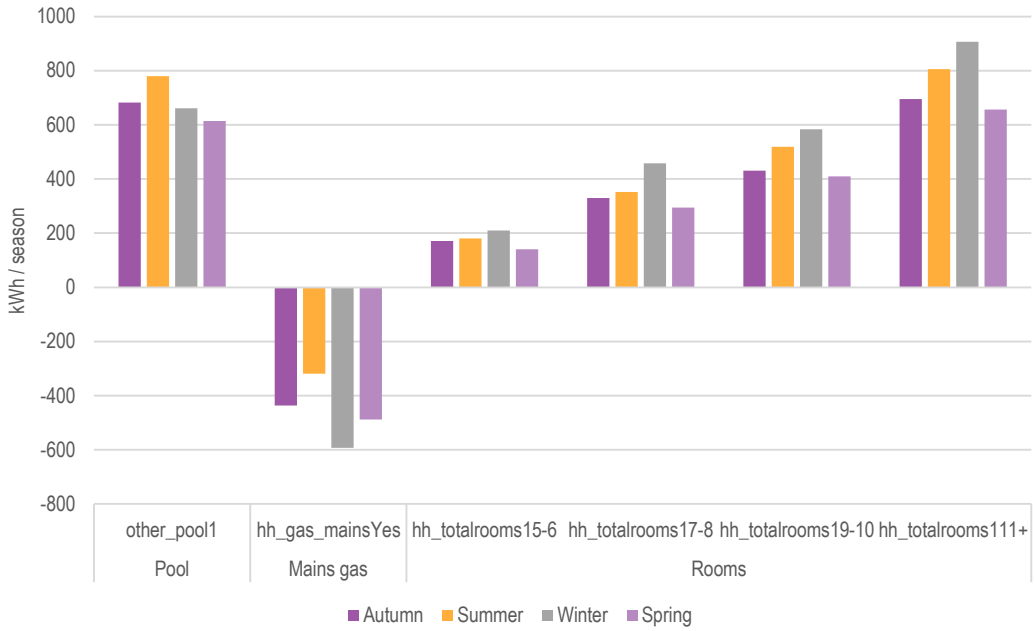
No other variable satisfied the requirements of the selection process.

The estimated coefficients on these variables are shown in Figure 5.9. This indicates that:

— people in climate zone five with swimming pools use, on average, between approximately 614 kWh and 780 kWh more electricity each season than those without
— people in climate zone five with mains gas use, on average, between approximately 320 kWh and 593 kWh less electricity each season than those without
— on average, people living in larger homes in climate zone five use more electricity than people in smaller homes. These are relative to a home of up to four rooms.

The recommended benchmark factor is 'pool', which explains more of the variability in consumption than 'gas'.

FIGURE 5.9 CLIMATE ZONE FIVE – ADDITIONAL VARIABLES



SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone five are provided in Table 5.8 for Queensland and Table 5.9 for New South Wales. They are also summarised in Figure 5.10.

TABLE 5.8 ELECTRICITY BENCHMARKS – QUEENSLAND CLIMATE ZONE FIVE

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	736	793	922	769
2 Person Household	1143	1205	1188	1074
3 Person Household	1216	1194	1290	1163
4 Person Household	1365	1380	1750	1361
5+ Person Household	1586	1585	2021	1564
With swimming pool				
1 Person Household	1592	1778	1812	1554
2 Person Household	2000	2190	2078	1859
3 Person Household	2073	2179	2180	1948
4 Person Household	2222	2365	2641	2146
5+ Person Household	2443	2569	2911	2348

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.9 ELECTRICITY BENCHMARKS – NEW SOUTH WALES CLIMATE ZONE FIVE

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	798	790	1011	789
2 Person Household	1195	1280	1520	1146
3 Person Household	1268	1270	1622	1236
4 Person Household	1574	1580	1959	1519
5+ Person Household	1795	1785	2229	1721
With swimming pool				
1 Person Household	1655	1775	1901	1574
2 Person Household	2052	2265	2410	1931
3 Person Household	2125	2254	2512	2021
4 Person Household	2431	2565	2849	2304
5+ Person Household	2652	2770	3120	2506

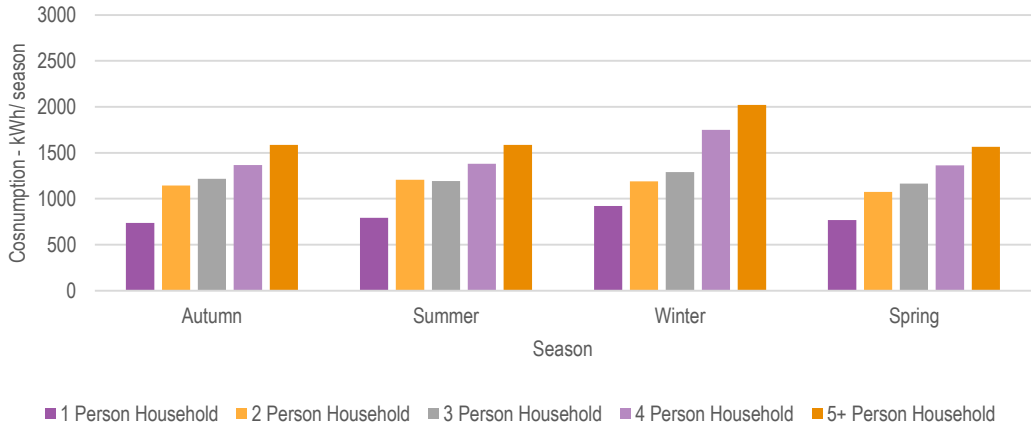
Note: Some of the summer benchmark values show small (~10 kWh) 'backward steps'. This is likely due to sampling or to characteristics of households of this size not captured by the benchmark model.

SOURCE: ACIL ALLEN CONSULTING

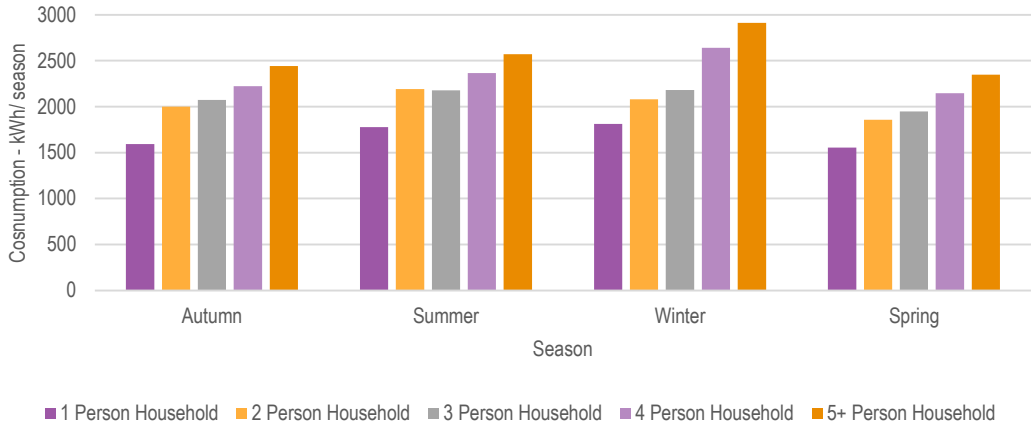
FIGURE 5.10 ELECTRICITY BENCHMARKS CLIMATE ZONE FIVE

Queensland

Without swimming pool

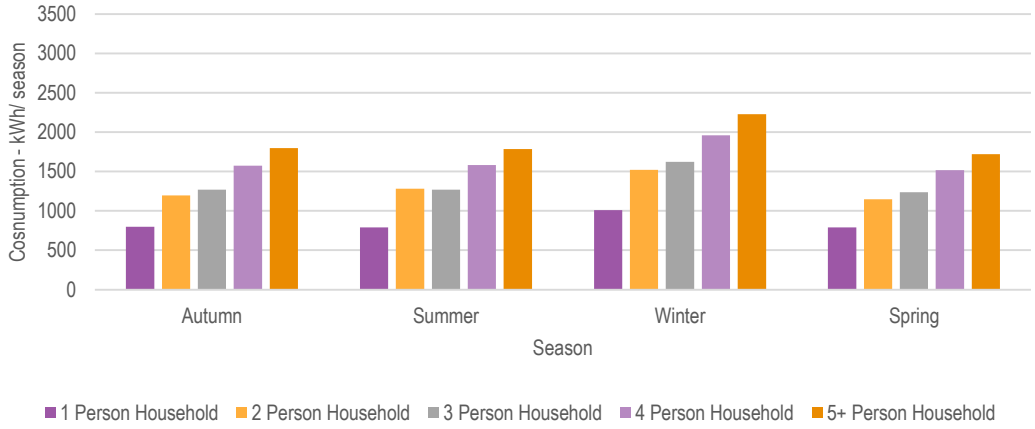


With swimming pool

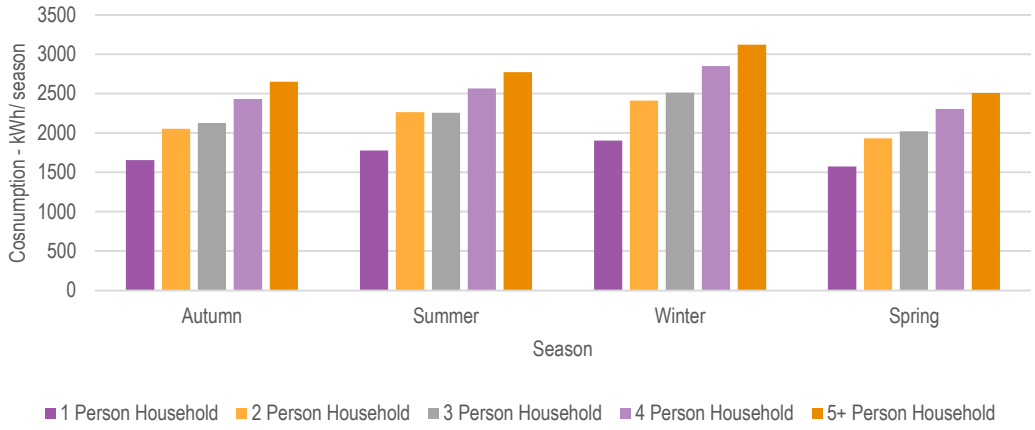


New South Wales

Without swimming pool



With swimming pool



SOURCE: ACIL ALLEN CONSULTING

5.2.6 Climate zone six

Climate zone six is also located in pockets in each mainland state of Australia, albeit with a very small pocket in Queensland. There is a pocket straddling the New South Wales, Queensland border and then a continuous stretch following the mountains down inner eastern New South Wales. South of Sydney climate zone six is on the coast, continuing around the Victorian coast into South Australia to Kangaroo Island and into the mid north. Major population centres in climate zone six include Melbourne, Mt Gambier and Albany (in Western Australia).

Outside Western Australia there are approximately 3,230,000 households in climate zone six, about 70 per cent of which are in Victoria.[25]

The electricity benchmarks in climate zone six were developed using all of the data from respondents living in climate zone six – 2,703 respondents in total.

Four person and larger households were pooled in New South Wales, so the same benchmark is applicable to both categories of household. Separate benchmarks are estimated for each household size in Victoria.

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

— Slab heat – whether there is electric underfloor heating

[25] ACIL Allen analysis of Australian Bureau of Statistics data.

— Pool – whether there is a swimming pool
— R/C – whether there is reverse cycle air conditioning
— C load – whether there is a controlled load supply.

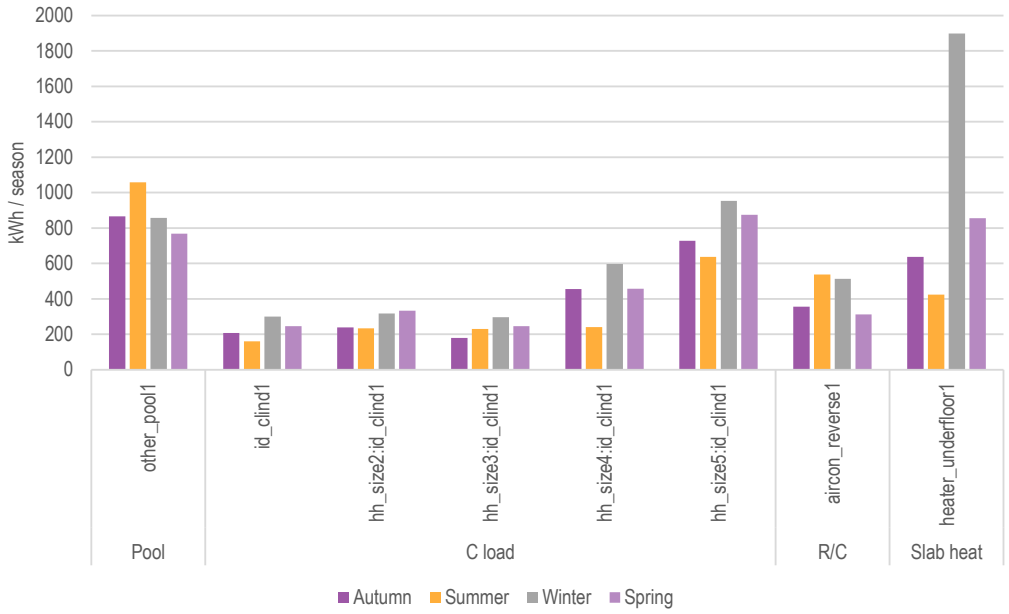
No other variable satisfied the requirements of the selection process.

The estimated coefficients on these variables are shown in Figure 5.11. This indicates that:

— people in climate zone six with swimming pools use, on average, between approximately 769 kWh and approximately 1,058 kWh more electricity than those without
— people in climate zone four with controlled loads use more electricity than those without. The amount varies by household size
— people in climate zone six with reverse cycle air conditioning use, on average, between approximately 311 kWh and approximately 538 kWh more electricity than those without
— people in climate zone six with underfloor electric heaters use, on average, between approximately 424 kWh and approximately 1,898 kWh more electricity than those without, most notably in winter.

The recommended benchmark factor is pool, which explains more of the variability in consumption than 'slab heat' and 'C load'.

FIGURE 5.11 CLIMATE ZONE SIX – ADDITIONAL VARIABLES



SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone six are provided in Table 5.10 for New South Wales and Table 5.11 for Victoria. They are also summarised in Figure 5.12.

TABLE 5.10 ELECTRICITY BENCHMARKS – NEW SOUTH WALES CLIMATE ZONE SIX

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	959	927	1168	943
2 Person Household	1229	1364	1550	1260
3 Person Household	1332	1432	1573	1336
4 Person Household	1642	1794	2078	1670
5+ Person Household*	1642	1794	2078	1670
With swimming pool				
1 Person Household	1933	2117	2198	1826
2 Person Household	2203	2554	2580	2144
3 Person Household	2305	2622	2603	2219
4 Person Household	2615	2984	3108	2554
5+ Person Household*	2615	2984	3108	2554

* As illustrated in Table 4.3, the number of five or more person households in climate zone six was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three, and four or more person households.

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.11 ELECTRICITY BENCHMARKS – VICTORIA CLIMATE ZONE SIX

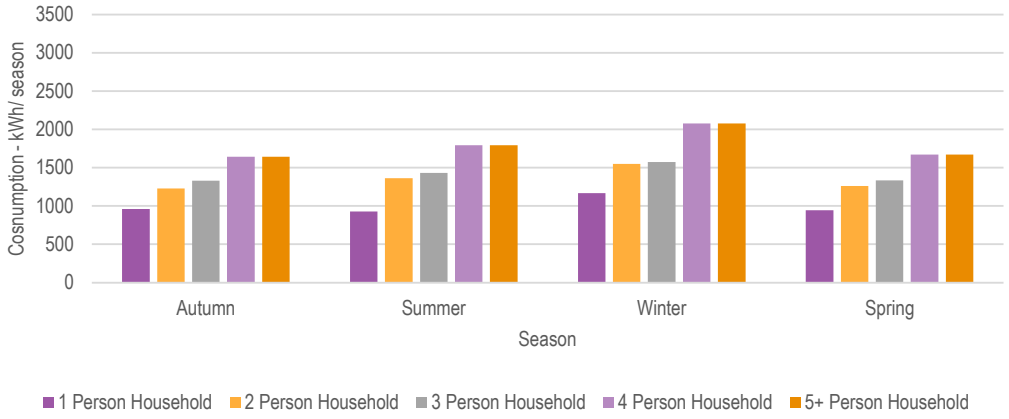
	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	737	671	958	720
2 Person Household	1077	1031	1340	1078
3 Person Household	1253	1176	1615	1218
4 Person Household	1402	1304	1738	1338
5+ Person Household	1508	1421	1911	1465
With swimming pool				
1 Person Household	1710	1861	1988	1604
2 Person Household	2050	2221	2370	1961
3 Person Household	2226	2365	2645	2102
4 Person Household	2375	2494	2768	2221
5+ Person Household	2481	2610	2941	2349

SOURCE: ACIL ALLEN CONSULTING

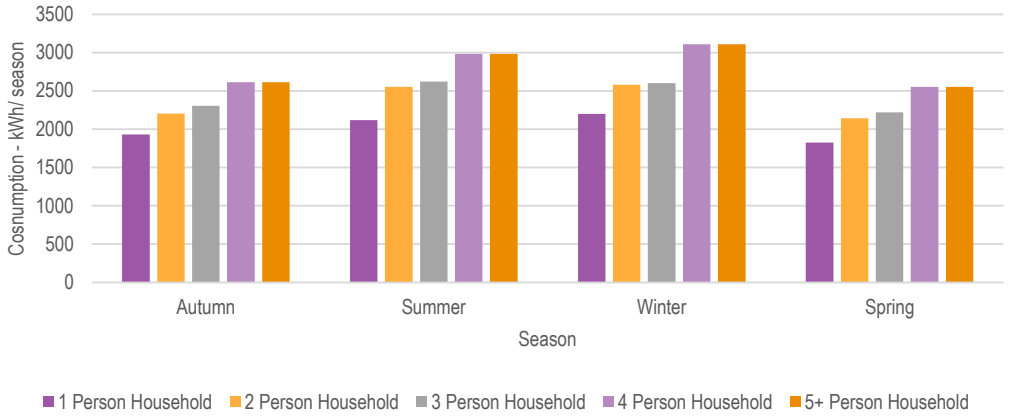
FIGURE 5.12 ELECTRICITY BENCHMARKS CLIMATE ZONE SIX

New South Wales

Without swimming pool

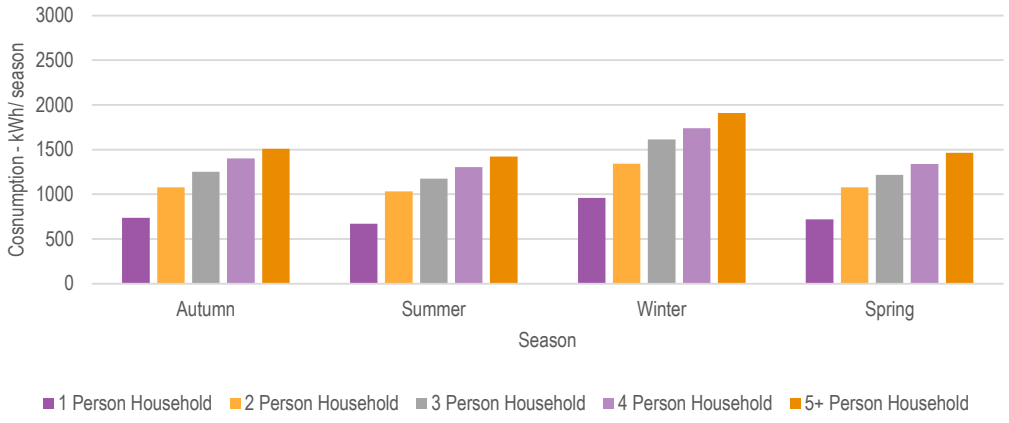


With swimming pool

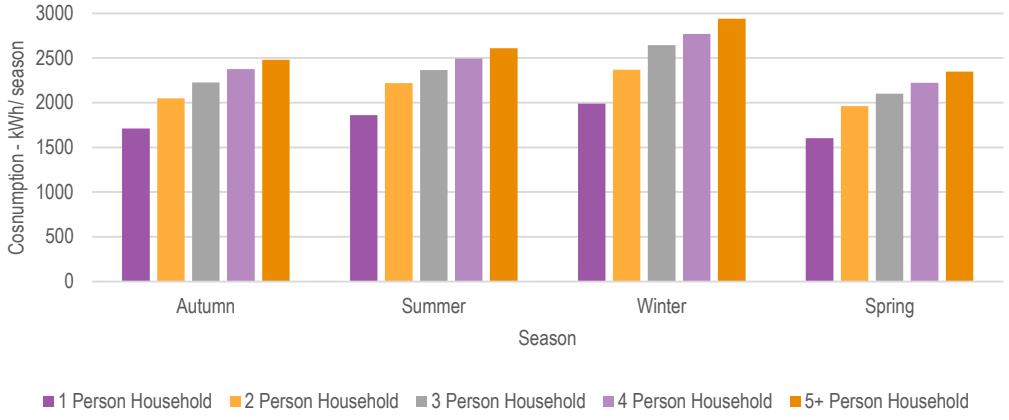


Victoria

Without swimming pool



With swimming pool



SOURCE: ACIL ALLEN CONSULTING

The climate zone six benchmarks appear broadly intuitive. In most cases the benchmark levels increase as there are additional people in the household, though some of the steps are small. As noted above, there is no change from four person to larger households in New South Wales due to pooling.

The benchmark levels for households with swimming pools are consistently above those for households without swimming pools.

5.2.7 Climate zone seven and eight

Climate zone seven is found in the mountainous regions of Victoria, New South Wales and Tasmania. It also includes much of the Australian Capital Territory. Climate zone eight encompasses the alpine regions of these same jurisdictions.

Major population centres in climate zone seven and eight include Canberra, Hobart, Launceston and Ballarat.

There are approximately 780,000 households in climate zone seven and eight, spread between the four jurisdictions.[26]

The electricity benchmarks in climate zone seven and eight were developed using all of the data from respondents living in climate zone seven, which includes those in climate zone eight – 847 respondents in total.

To estimate the benchmarks the households are pooled into two groups — Tasmania and Victoria, and New South Wales and the Australian Capital Territory.

[26] ACIL Allen analysis of Australian Bureau of Statistics data.

A uniform adjustment is made to consumption levels across all household sizes in different states within the two pools (e.g. households in Tasmania are assumed to have a consistent more consumption than households in Victoria, across all household sizes).

Within each of these groups, households with three or four people were also pooled together, resulting in the same benchmark being estimated for these household sizes (within each state and territory).

Through the process described in chapter 4 the explanatory variables chosen as 'best' from an empirical perspective were:

- Slab heat – whether there is electric underfloor heating
- Pool – whether there is a swimming pool
- Electric water – whether the household uses electricity for water heating.

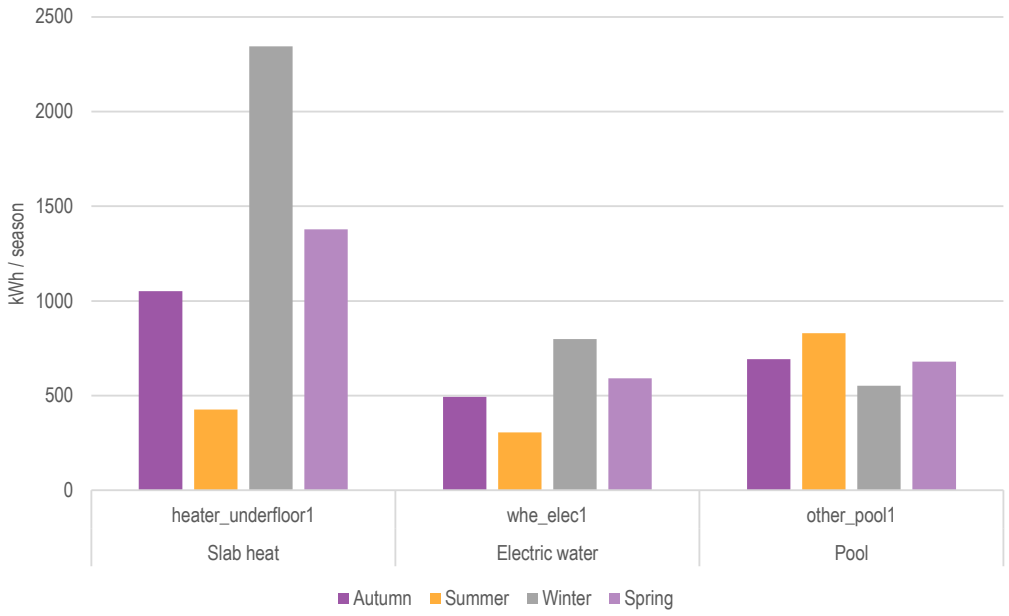
No other variable satisfied the requirements of the selection process.

The estimated coefficients on these variables are shown in Figure 5.13. This indicates that:

- people in climate zone seven and eight with underfloor electric heaters use, on average, between approximately 426 kWh and approximately 2,346 kWh more electricity than those without, especially in winter, but even in summer
- people in climate zone seven and eight with electric water heaters, on average, between approximately 305 kWh and approximately 798 kWh more electricity than those without
- people in climate zone seven and eight with swimming pool use, on average, between approximately 552 kWh and approximately 830 kWh more electricity than those without.

The recommended benchmark factor is 'slab heat', which explains more of the variability in consumption than 'pool'.

FIGURE 5.13 CLIMATE ZONE SEVEN AND EIGHT – ADDITIONAL VARIABLES



SOURCE: ACIL ALLEN CONSULTING

Electricity benchmarks for climate zone seven and eight are provided in

- Table 5.12 for New South Wales
- Table 5.13 for the Australian Capital Territory
- Table 5.14 for Victoria
- Table 5.15 for Tasmania.

They are also summarised in Figure 5.14.

TABLE 5.12 ELECTRICITY BENCHMARKS – NEW SOUTH WALES CLIMATE ZONE SEVEN AND EIGHT

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without underfloor heating				
1 Person Household	1003	734	1051	784
2 Person Household	1480	1285	1966	1596
3 Person Household	1573	1312	1993	1584
4 Person Household*	1573	1312	1993	1584
5+ Person Household	2114	1800	2742	2179
With underfloor heating				
1 Person Household	2087	1182	3445	2200
2 Person Household	2563	1733	4361	3012
3 Person Household	2656	1760	4388	2999
4 Person Household*	2656	1760	4388	2999
5+ Person Household	3197	2248	5136	3594

* As illustrated in Table 4.3, the number of four person households in climate zone six for was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three and four, and five or more person households.

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.13 ELECTRICITY BENCHMARKS – AUSTRALIAN CAPITAL TERRITORY CLIMATE ZONE SEVEN AND EIGHT

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without underfloor heating				
1 Person Household	990	714	1172	867
2 Person Household	1467	1265	2087	1680
3 Person Household	1560	1292	2114	1667
4 Person Household*	1560	1292	2114	1667
5+ Person Household	2101	1780	2863	2262
With underfloor heating				
1 Person Household	2073	1162	3566	2283
2 Person Household	2550	1713	4482	3095
3 Person Household	2643	1740	4509	3083
4 Person Household*	2643	1740	4509	3083
5+ Person Household	3184	2228	5257	3678

* As illustrated in Table 4.3, the number of four person households in climate zone six for was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three and four, and five or more person households.

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.14 ELECTRICITY BENCHMARKS - VICTORIA CLIMATE ZONE SEVEN AND EIGHT

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without underfloor heating				
1 Person Household	863	819	1176	880
2 Person Household	1270	1167	1637	1316
3 Person Household	1525	1463	1974	1564
4 Person Household*	1525	1463	1974	1564
5+ Person Household	2069	1811	2611	2054
With underfloor heating				
1 Person Household	1946	1267	3571	2295
2 Person Household	2353	1615	4031	2732
3 Person Household	2608	1911	4369	2980
4 Person Household*	2608	1911	4369	2980
5+ Person Household	3152	2259	5006	3470

* As illustrated in Table 4.3, the number of four person households in climate zone six for was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three and four, and five or more person households.

SOURCE: ACIL ALLEN CONSULTING

TABLE 5.15 ELECTRICITY BENCHMARKS – TASMANIA CLIMATE ZONE SEVEN AND EIGHT

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without underfloor heating				
1 Person Household	1410	1065	2060	1578
2 Person Household	1817	1414	2521	2014
3 Person Household	2072	1709	2858	2263
4 Person Household*	2072	1709	2858	2263
5+ Person Household	2616	2057	3495	2753
With underfloor heating				
1 Person Household	2494	1513	4454	2994
2 Person Household	2900	1862	4915	3430
3 Person Household	3155	2157	5252	3678
4 Person Household*	3155	2157	5252	3678
5+ Person Household	3699	2506	5889	4169

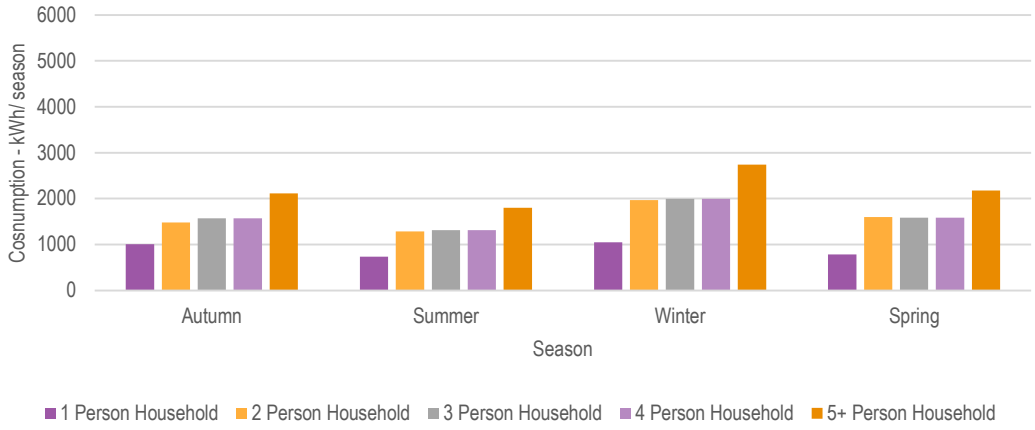
* As illustrated in Table 4.3, the number of four person households in climate zone six for was too small to produce reliable benchmarks. These benchmarks are therefore only distinguished by one, two, three and four, and five or more person households.

SOURCE: ACIL ALLEN CONSULTING

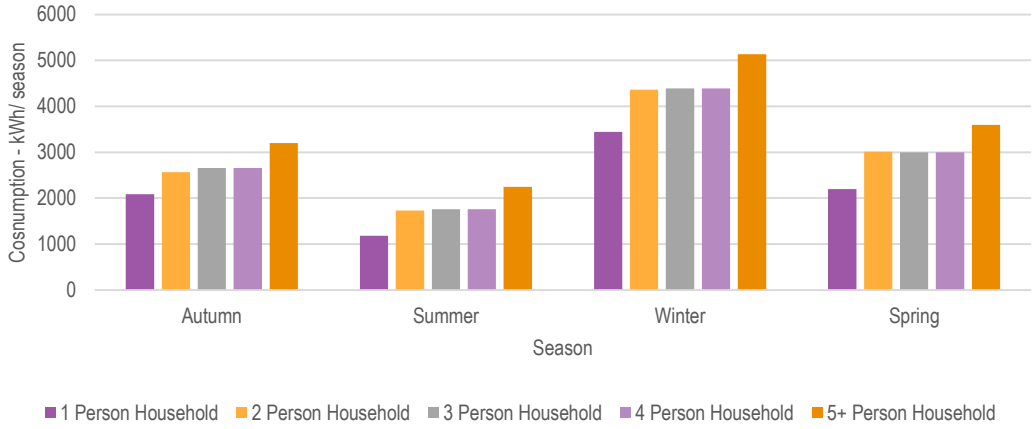
FIGURE 5.14 ELECTRICITY BENCHMARKS CLIMATE ZONE SEVEN AND EIGHT

New South Wales

Without underfloor heating

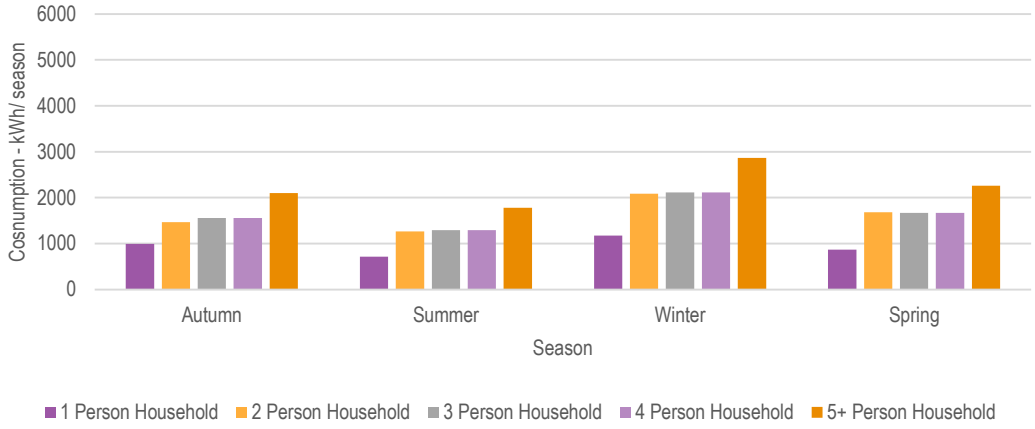


With underfloor heating

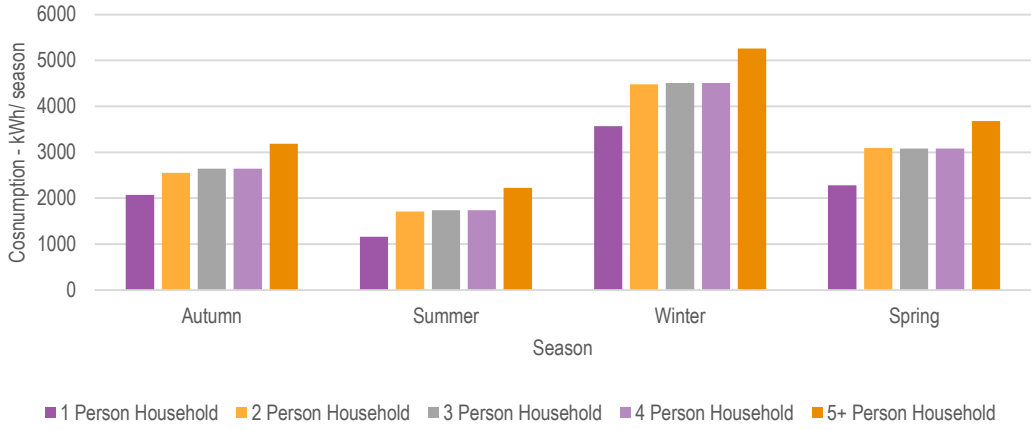


ACT

Without underfloor heating

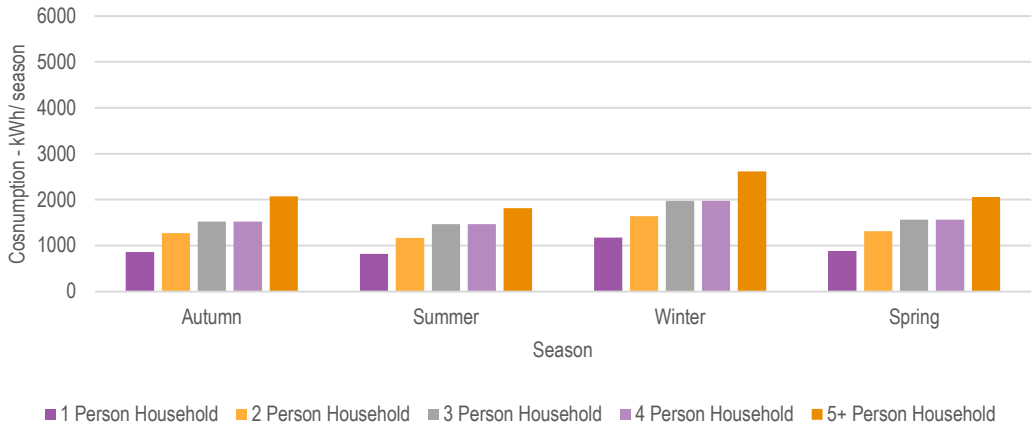


With underfloor heating

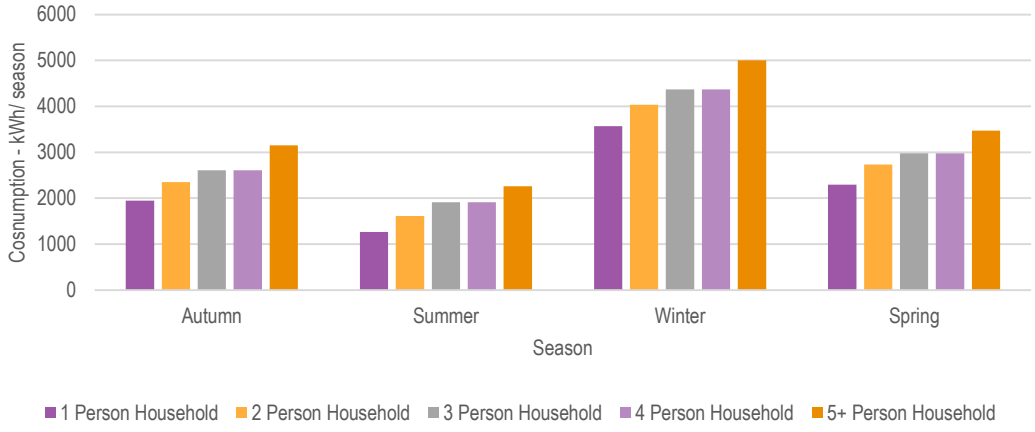


Victoria

Without underfloor heating

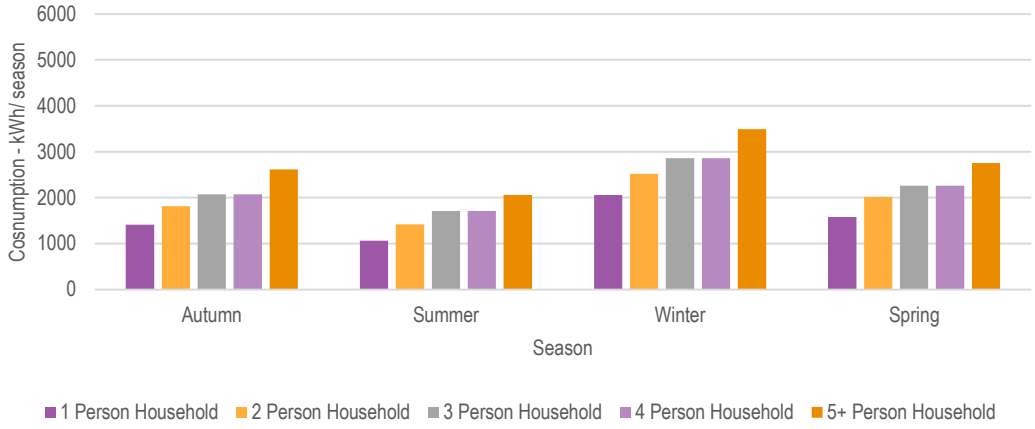


With underfloor heating

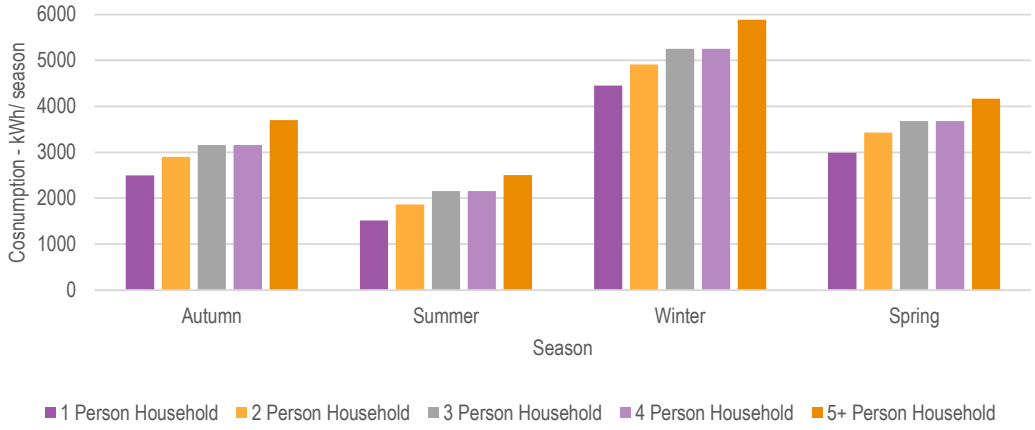


Tasmania

Without underfloor heating



With underfloor heating



SOURCE: ACIL ALLEN CONSULTING

The climate zone seven and eight benchmarks appear broadly intuitive. There are some examples of benchmarks that do not vary with household size, which is consistent with the structure used in this climate zone.

5.3 South Australian localised zone benchmarks

The following sections provide tables of benchmarks in each of South Australia's localised zones. These zones correspond to climate zone four, five and six based on our final correspondence of postcodes to climate zones.

As described above, benchmarks for each South Australian zone are based on benchmarks from the corresponding climate zones. Therefore, the choice of benchmark factors (and variables) is the same in South Australia as in other places. As discussed above, the presence of pools is a relevant benchmark factor for climate zone five and six but not four.

In estimating localised zone benchmarks for South Australia:

- for localised zones spanning climate zone four only:
  - there are no separate benchmarks for households with pools
  - because we understand there to be little or no reticulated gas in climate zone four of South Australia, benchmarks are not separated by gas as section 3.2.2.
- for localised zones spanning climate zone five only, the benchmarks for households with pools are uplifted by the impact of pools found in section 5.2.5

— for localised zones spanning climate zone six only, the benchmarks for households with pools are uplifted by the impact of pools found in section 5.2.6

— for localised zones spanning multiple climate zones, the benchmarks for households with pools are uplifted by the average impact of pools of the relevant climate zones weighted by the population in the relevant zones in South Australia.

5.3.1 Adelaide and Environs

Approximately 89 per cent of households in the Adelaide and Environs zone are in climate zone five. The remainder are in climate zone six. Therefore, the Adelaide and environs benchmarks, which are in Table 5.16 and Figure 5.15, are a weighted average of benchmarks for these two zones.

TABLE 5.16 ADELAIDE AND ENVIRONS ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	706	680	917	729
2 Person Household	1079	1029	1351	1055
3 Person Household	1245	1196	1525	1234
4 Person Household	1395	1412	1751	1461
5+ Person Household	1543	1475	1815	1523
With swimming pool				
1 Person Household	1575	1686	1822	1525
2 Person Household	1948	2035	2257	1851
3 Person Household	2114	2203	2430	2030
4 Person Household	2264	2418	2656	2257
5+ Person Household	2412	2482	2721	2319

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.15 ADELAIDE AND ENVIRONS ELECTRICITY BENCHMARKS

SOURCE: ACIL ALLEN CONSULTING

The Adelaide and Environs benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption is greater in larger households. The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.2 Mt Lofty ranges

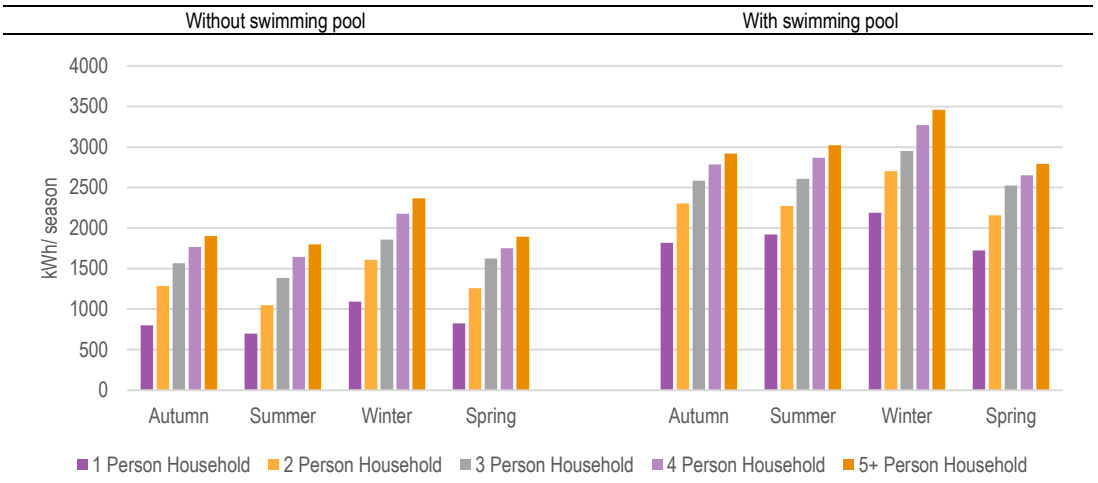
Approximately 99 per cent of households in the Mt Lofty ranges zone are in climate zone six. The remainder are in climate zone five. Therefore, the Mt Lofty ranges benchmarks, which are in Table 5.17 and Figure 5.16, are a weighted average of benchmarks for these two zones.

TABLE 5.17 MT LOFTY RANGES ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	802	699	1094	825
2 Person Household	1288	1051	1615	1259
3 Person Household	1551	1374	1836	1607
4 Person Household	1783	1664	2192	1759
5+ Person Household	1890	1780	2363	1886
With swimming pool				
1 Person Household	1774	1887	2123	1708
2 Person Household	2261	2239	2644	2142
3 Person Household	2524	2562	2865	2490
4 Person Household	2756	2852	3220	2642
5+ Person Household	2862	2968	3392	2769

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.16 MT LOFTY RANGES ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Mt Lofty ranges benchmarks show the same pattern as the climate zone six benchmarks described in section 5.2.6 above because they were estimated using the same model, though in this case the South Australian data also influence the results.

As with the other zone six benchmarks there is a downward step in benchmark consumption from households sizes four to 'more'. The benchmarks for households with swimming pools are consistently higher than those for households without.

5.3.3 Yorke Peninsula and Kangaroo Island

Approximately 85 per cent of households in the Yorke Peninsula and Kangaroo Island zone are in climate zone five. The remainder are in climate zone six. Therefore, the Yorke Peninsula and Kangaroo Island benchmarks, which are in Table 5.18 and Figure 5.17, are a weighted average of benchmarks for these two zones. It should be noted, though, that Kangaroo Island is entirely in climate zone six whereas the Yorke Peninsula is entirely in climate zone five.

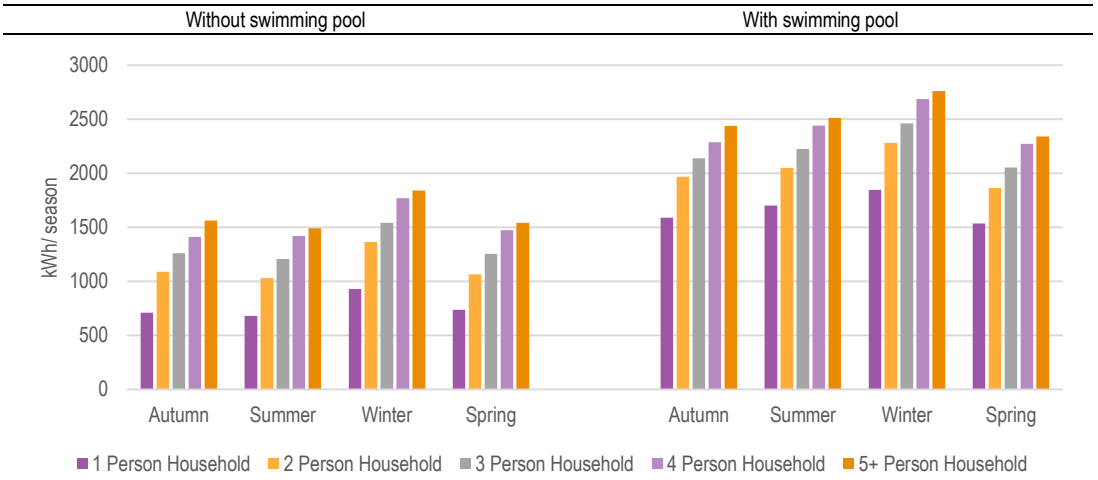
TABLE 5.18 YORKE PENINSULA AND KANGAROO ISLAND ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	710	680	925	734
2 Person Household	1089	1030	1364	1065
3 Person Household	1259	1204	1539	1252
4 Person Household	1413	1423	1772	1475
5+ Person Household	1559	1489	1841	1540
With swimming pool				
1 Person Household	1584	1696	1836	1533
2 Person Household	1963	2045	2275	1864
3 Person Household	2133	2219	2450	2051

	Autumn	Summer	Winter	Spring
4 Person Household	2287	2439	2683	2275
5+ Person Household	2433	2505	2752	2340

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.17 YORKE PENINSULA AND KANGAROO ISLAND ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Yorke Peninsula and Kangaroo Island benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.4 Murraylands and Riverland

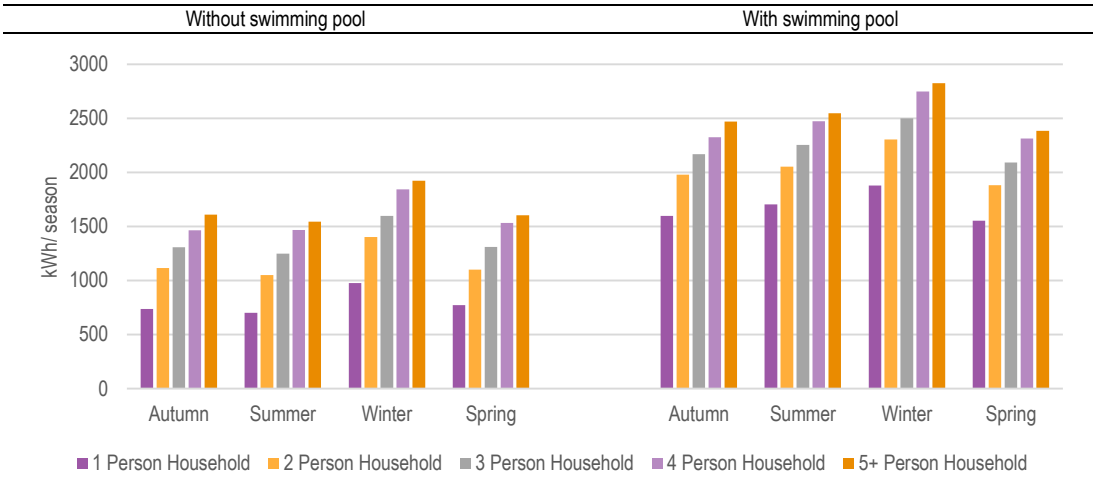
Approximately 77 per cent of households in the Murraylands and Riverland zone are in climate zone five. Twenty per cent are in climate zone six and the remaining three per cent are in climate zone four. Therefore, the Murraylands and Riverland benchmarks, which are in Table 5.19 and Figure 5.18, are a weighted average of benchmarks for these three zones.

TABLE 5.19 MURRAYLANDS AND RIVERLAND ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	735	700	973	768
2 Person Household	1117	1051	1404	1100
3 Person Household	1304	1247	1594	1306
4 Person Household	1469	1473	1848	1534
5+ Person Household	1608	1541	1923	1602
With swimming pool				
1 Person Household	1590	1697	1865	1549
2 Person Household	1972	2049	2296	1882
3 Person Household	2159	2244	2486	2087
4 Person Household	2324	2470	2741	2316
5+ Person Household	2463	2538	2815	2383

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.18 MURRAYLANDS AND RIVERLAND ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Murraylands and Riverland benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.5 South East

All of households in the South East zone are in climate zone six. Therefore, the South East benchmarks, which are in Table 5.20 and Figure 5.19, were estimated using the same equation as climate zone six.

TABLE 5.20 SOUTH EAST ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	803	699	1096	826
2 Person Household	1290	1051	1618	1261
3 Person Household	1554	1375	1839	1611
4 Person Household	1787	1667	2196	1762
5+ Person Household	1893	1783	2368	1889
With swimming pool				
1 Person Household	1776	1889	2126	1710
2 Person Household	2264	2241	2648	2144
3 Person Household	2528	2565	2869	2494
4 Person Household	2760	2856	3226	2646
5+ Person Household	2867	2973	3398	2773

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.19 SOUTH EAST ELECTRICITY BENCHMARKS

SOURCE: ACIL ALLEN CONSULTING

The South East benchmarks show the same pattern as the climate zone six benchmarks described in section 5.2.6 above because they were estimated using the same model, though in this case the South Australian data also influence the results.

5.3.6 Mid North

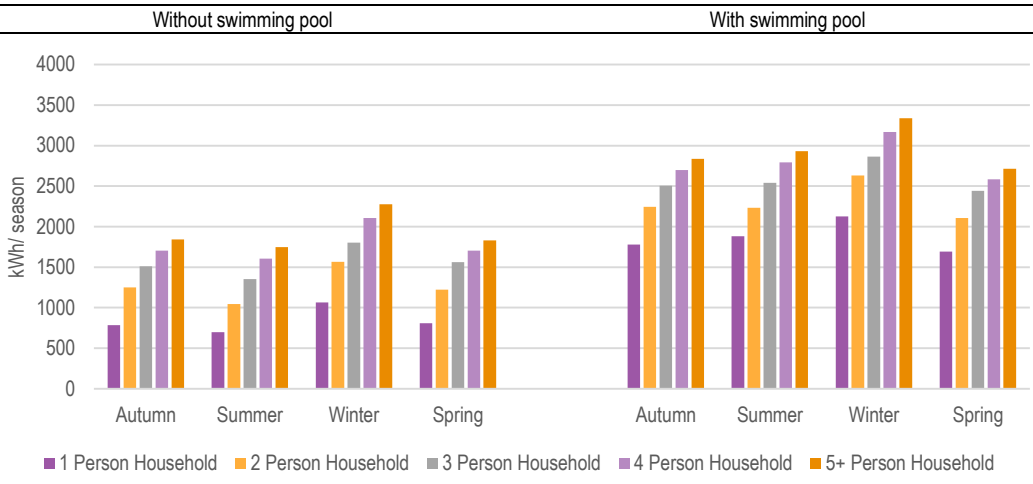
Approximately 85 per cent of the households in the Mid North zone are in climate zone six, with the remainder in climate zone five. Therefore, the Mid North benchmarks, which are in Table 5.21 and Figure 5.20, are a weighted average of benchmarks for these two zones.

TABLE 5.21 MID NORTH ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	786	696	1064	809
2 Person Household	1253	1047	1571	1225
3 Person Household	1500	1344	1784	1545
4 Person Household	1718	1622	2118	1710
5+ Person Household	1832	1729	2272	1825
With swimming pool				
1 Person Household	1741	1853	2072	1678
2 Person Household	2208	2205	2579	2093
3 Person Household	2455	2502	2792	2413
4 Person Household	2673	2780	3126	2578
5+ Person Household	2787	2887	3280	2694

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.20 MID NORTH ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Mid North ranges benchmarks show the same pattern as the climate zone six benchmarks described in section 5.2.6 above because they were estimated mainly using the same model with only 15 per cent impact from the zone five model, though in this case the South Australian data also influence the results.

5.3.7 Central North

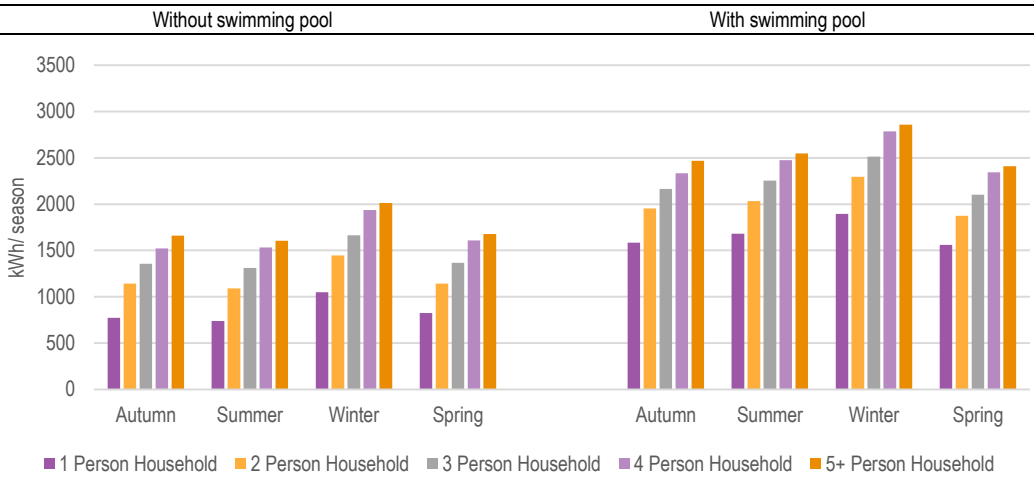
Approximately 72 per cent of households in the Central North zone are in climate zone five. Nineteen per cent are in climate zone six and the remaining nine per cent are in climate zone four. Therefore, the Central North benchmarks, which are in Table 5.22 and Figure 5.21, are a weighted average of benchmarks for these three zones.

TABLE 5.22 CENTRAL NORTH ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	772	736	1044	823
2 Person Household	1145	1091	1448	1143
3 Person Household	1352	1307	1660	1362
4 Person Household	1527	1538	1941	1611
5+ Person Household	1657	1601	2011	1675
With swimming pool				
1 Person Household	1575	1672	1882	1556
2 Person Household	1947	2027	2285	1876
3 Person Household	2154	2244	2497	2096
4 Person Household	2329	2474	2778	2345
5+ Person Household	2459	2538	2849	2408

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.21 CENTRAL NORTH ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Central North benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger

households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.8 Port Augusta and Pastoral

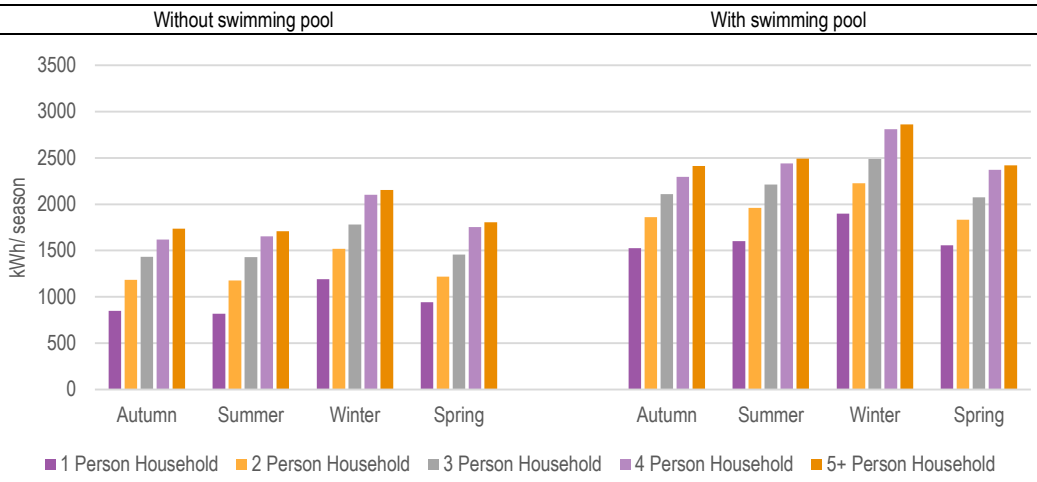
Approximately 69 per cent of households in the Port Augusta and Pastoral zone are in climate zone five. Twenty two per cent are in climate zone six and the remaining nine per cent are in climate zone four. Therefore, the Port Augusta and Pastoral benchmarks, which are in Table 5.23 and Figure 5.22, are a weighted average of benchmarks for these three zones.

TABLE 5.23 PORT AUGUSTA AND PASTORAL ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	846	815	1186	936
2 Person Household	1186	1178	1520	1218
3 Person Household	1428	1426	1777	1452
4 Person Household	1619	1658	2105	1754
5+ Person Household	1734	1707	2155	1803
With swimming pool				
1 Person Household	1521	1598	1890	1554
2 Person Household	1861	1961	2224	1837
3 Person Household	2104	2208	2481	2070
4 Person Household	2295	2441	2809	2373
5+ Person Household	2410	2490	2859	2421

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.22 PORT AUGUSTA AND PASTORAL ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Port Augusta and Pastoral benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.9 Eastern Eyre

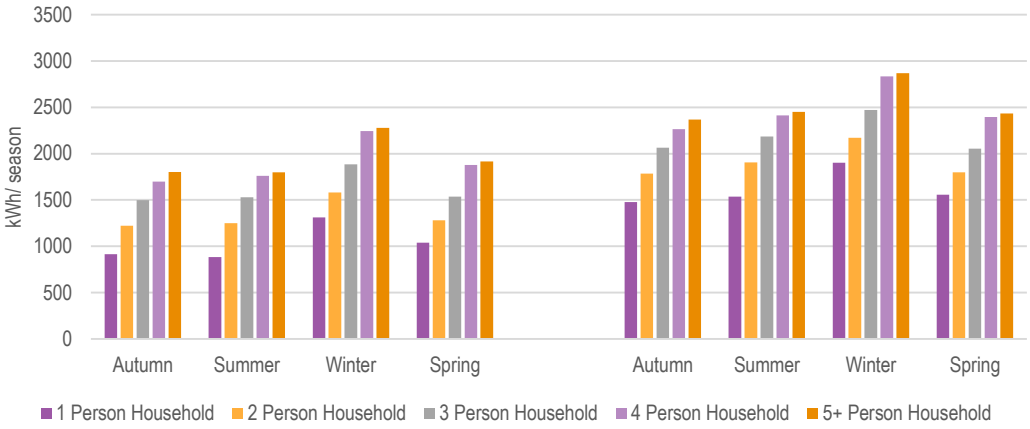
Approximately 66 per cent of the households in the Eastern Eyre zone are in climate zone five, with the remainder in climate zone four. Therefore, the Eastern Eyre benchmarks, which are in Table 5.24 and Figure 5.23, are a weighted average of benchmarks for these two zones.

TABLE 5.24 EASTERN EYRE ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	909	882	1308	1033
2 Person Household	1222	1252	1584	1284
3 Person Household	1496	1528	1880	1531
4 Person Household	1700	1762	2248	1878
5+ Person Household	1802	1800	2282	1914
With swimming pool				
1 Person Household	1477	1536	1899	1554
2 Person Household	1790	1906	2175	1805
3 Person Household	2064	2181	2471	2052
4 Person Household	2269	2415	2839	2399
5+ Person Household	2370	2453	2873	2435

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.23 EASTERN EYRE ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The Eastern Eyre benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

5.3.10 West Coast

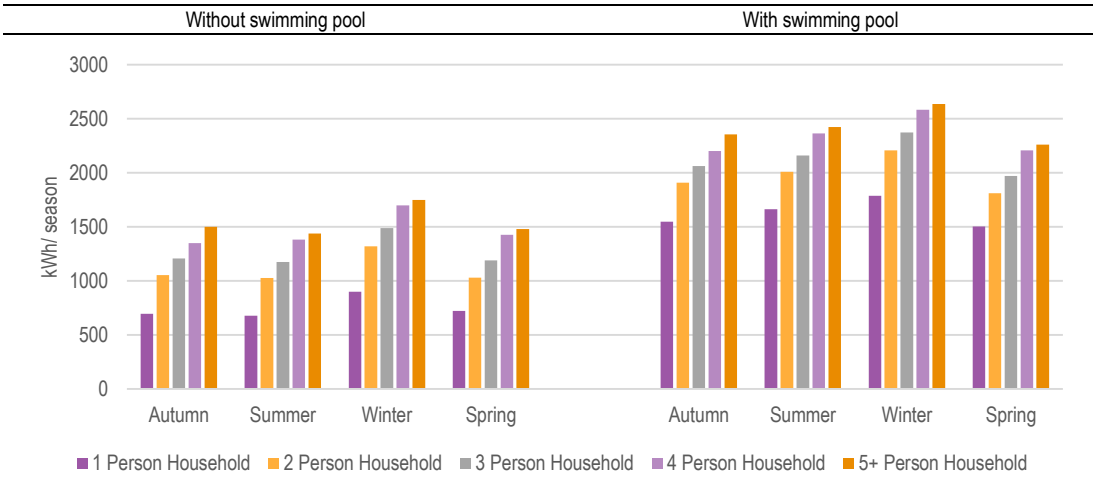
All of households in the West Coast zone are in climate zone five. Therefore, the West Coast benchmarks, which are in Table 5.25 and Figure 5.24.

TABLE 5.25 WEST COAST ELECTRICITY BENCHMARKS

	Autumn	Summer	Winter	Spring
	kWh/ season	kWh/ season	kWh/ season	kWh/ season
Without swimming pool				
1 Person Household	694	677	895	717
2 Person Household	1054	1026	1319	1030
3 Person Household	1208	1174	1487	1189
4 Person Household	1348	1381	1698	1425
5+ Person Household	1501	1438	1749	1479
With swimming pool				
1 Person Household	1550	1662	1786	1502
2 Person Household	1911	2011	2210	1815
3 Person Household	2064	2159	2378	1974
4 Person Household	2204	2366	2588	2210
5+ Person Household	2358	2423	2640	2264

SOURCE: ACIL ALLEN CONSULTING

FIGURE 5.24 WEST COAST ELECTRICITY BENCHMARKS



SOURCE: ACIL ALLEN CONSULTING

The West Coast benchmarks show the expected pattern. They increase from left to right across each pane of the chart, meaning that the benchmark level of consumption increases is larger in larger households, though there is a very small increase from 'four to more' due to the impact of the zone six model.

The benchmarks for households with swimming pools are all larger than corresponding benchmarks for households without swimming pools.

6 RESULTS – GAS

This chapter provides summary level results for gas. It is structured as follows:

— section 6.1 provides the results of the process we used to identify the relative importance of different benchmark factors for gas benchmarks

— section 6.2 provides a summary of the gas benchmarks themselves.

6.1 Overview

As discussed in in section 4.1, gas benchmarks are estimated at the jurisdiction level because this provided the best balance of good model fit and results consistent with theoretical expectations.

The analysis of the gas consumption data indicates that the 'best' variable in explaining differences in gas consumption in each jurisdiction is whether the household in question has gas heating (of any kind). This is likely to reflect that fact that, in the residential setting, gas is likely to be used for one or more of three things:

— space heating

— water heating

— cooking.

The analysis is consistent with a hypothesis that gas usage for water heating and cooking is proportional to household size – the more people living in a home the more gas is used for these things. Therefore, these two factors are not included separately in the models as doing so would amount to double counting.

The analysis also shows that the gas heating 'factor' is not statistically identifiable in some places as shown in Table 6.1. The issue here is likely to be whether the sample includes enough people both with and without gas heaters to identify differences. If the sample is overly 'concentrated' by people in one category or the other, the relevance of gas heating to the benchmark is unclear.

Note that this is not necessarily a shortcoming in the way the sample was collected — it is quite possible that the issue is that there are very few people in some categories. For example, only a handful of Tasmanians have reticulated gas. It is quite possible that the very large majority of people who do, also have gas heaters. If so, we would not expect to be able to identify the impact of gas heating in the benchmarks due to a lack of people *with* gas and *without* gas heating with whom to compare.

TABLE 6.1 INCLUSION OF GAS HEATER BY JURISDICTION

Jurisdiction	Gas Heater factor Included?
QLD	No
NSW	Yes
ACT	No
VIC	Yes
TAS	No
SA	Yes

NOTE: The Northern Territory is omitted as there are no gas benchmarks for the Northern Territory.
SOURCE: ACIL ALLEN CONSULTING

The result of our analysis of the data is that, in some places (shown in Table 6.1), the presence of a gas heater is recommended as a 'second' factor for gas benchmarks. In other places, no second factor is recommended.

The gas sample was not pooled between jurisdictions, but in some cases it was pooled across household sizes for the reasons explained in section 4.1. Specifically, pooling was applied as follows:

- two, three and four person households in the Australian Capital Territory, Tasmania and South Australia
- two and three person households in New South Wales
- four person and larger households in New South Wales.

This level of pooling suggests that the link between household size and gas consumption is tenuous. Our choice to produce them across household size is for consistency with electricity benchmarks. An area for potential future research is to explore alternatives. In particular, if our hypothesis as to the importance of gas space heating was borne out, there may be a link between gas consumption and house size, as distinct from household size.

6.2 Benchmarks

The following sections provide summary benchmarks in each of the jurisdictions.

6.2.1 Queensland

Out of the 1,423 survey responses from Queensland most do not have gas. 152 Queensland based respondents were matched into the gas sample. The gas benchmarks are summarised in Table 6.2 and Figure 6.1.

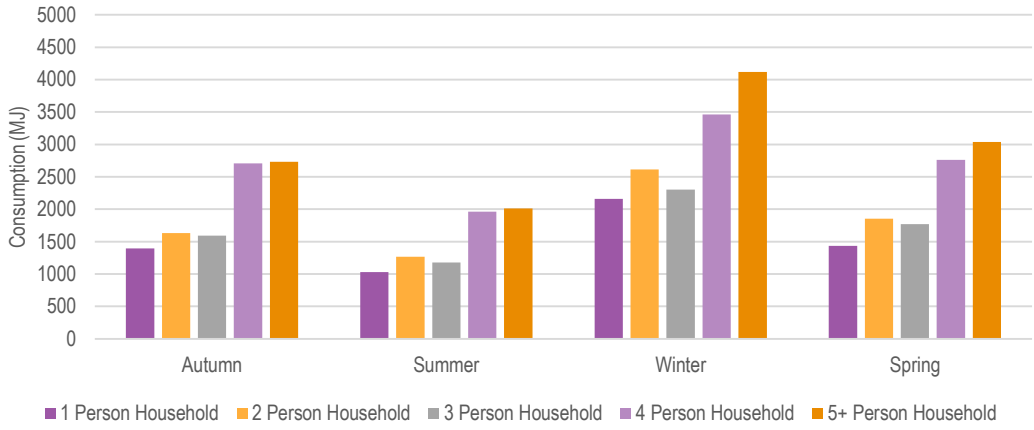
TABLE 6.2 GAS BENCHMARKS – QUEENSLAND

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
1 Person Household	1395	1030	2159	1434
2 Person Household	1632	1267	2615	1852
3 Person Household	1592	1180	2301	1769
4 Person Household	2708	1963	3461	2760
5+ Person Household	2730	2010	4118	3036

Note: There are backward steps between the two and three person household results.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.1 GAS BENCHMARKS QUEENSLAND



SOURCE: ACIL ALLEN CONSULTING

The Queensland gas benchmarks tend to increase by household size. The only exception is in the case of three person households, being marginally lower than that of two person households.

It is possible that this difference is due to the small representation of three-person households in Queensland though without a larger sample we cannot be sure.

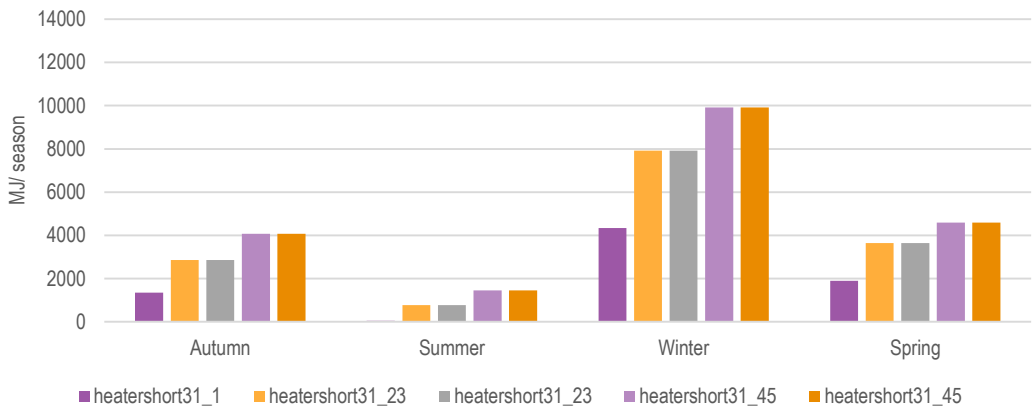
6.2.2 New South Wales

Out of the 2,780 survey responses from New South Wales, 845 were matched into the gas sample. In this case the gas heater factor was separately identifiable.

Two and three person households were pooled as were four person and larger households.

Figure 6.2 shows the impact gas heaters have on gas consumption. For those with gas heaters, larger households use more gas than smaller households in New South Wales, on average.

FIGURE 6.2 NEW SOUTH WALES – IMPACT OF GAS HEATER



SOURCE: ACIL ALLEN CONSULTING

The benchmarks for New South Wales are summarised in Table 6.3 and Figure 6.3.

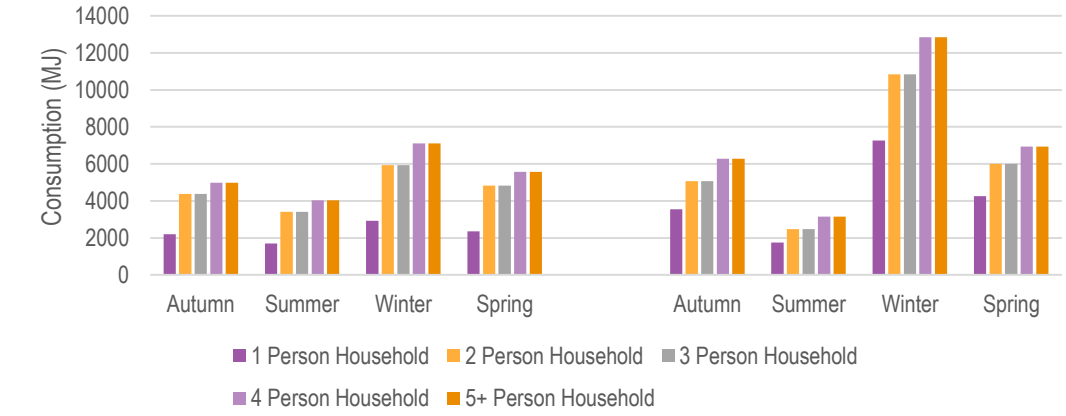
TABLE 6.3 GAS BENCHMARKS – NEW SOUTH WALES

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
Without gas heater				
1 Person Household	2204	1698	2922	2352
2 Person Household	4377	3409	5925	4831
3 Person Household*	4377	3409	5925	4831
4 Person Household	4990	4024	7101	5576
5+ Person Household*	4990	4024	7101	5576
With gas heater				
1 Person Household	3546	1744	7267	4255
2 Person Household	5068	2475	10848	5996
3 Person Household*	5068	2475	10848	5996
4 Person Household	6279	3145	12837	6934
5+ Person Household*	6279	3145	12837	6934

* Two and three person households were grouped for New South Wales. Similarly, four and five or more person households were also pooled to create benchmarks for New South Wales.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.3 GAS BENCHMARKS NEW SOUTH WALES



SOURCE: ACIL ALLEN CONSULTING

6.2.3 ACT

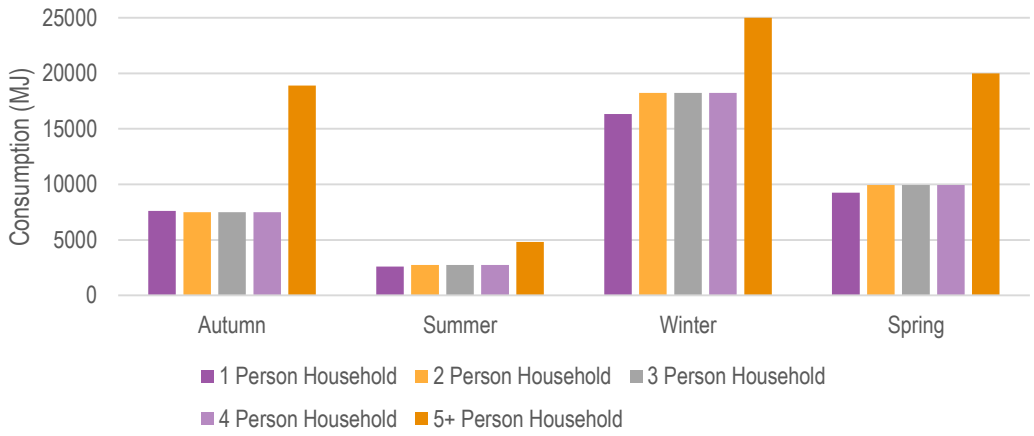
Out of the 131 survey responses from the ACT, 58 were matched into the gas sample. The benchmarks for ACT are summarised in Table 6.4 and Figure 6.4.

TABLE 6.4 GAS BENCHMARKS – ACT

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
1 Person Household	7613	2590	16335	9266
2 Person Household	7510	2742	18243	9956
3 Person Household*	7510	2742	18243	9956
4 Person Household*	7510	2742	18243	9956
5+ Person Household	18903	4805	37048	19990

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.4 GAS BENCHMARKS ACT



* Two, three and four person households were pooled to create benchmarks for ACT.

SOURCE: ACIL ALLEN CONSULTING

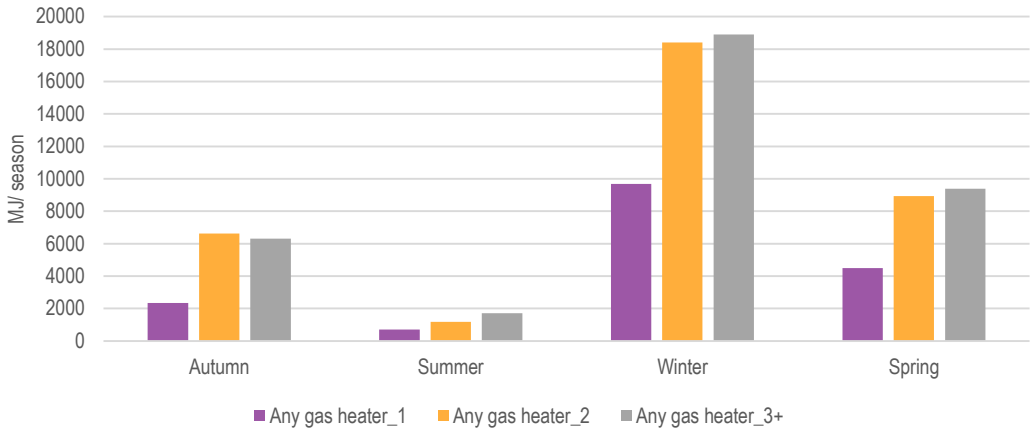
Low sample size may have influenced the volatility in the benchmarks for ACT. The benchmarks indicate that gas usage is highest in winter.

6.2.4 Victoria

Out of the 4,105 survey responses from Victoria, 1,076 were matched into the gas sample. In this case the impact of having a gas heater was separately identifiable.

The impact of having a gas heater is shown in Figure 6.5. For Victorian households with gas heaters, larger households consume more gas than smaller households, on average.

FIGURE 6.5 VICTORIA – IMPACT OF GAS HEATERS



SOURCE: ACIL ALLEN CONSULTING

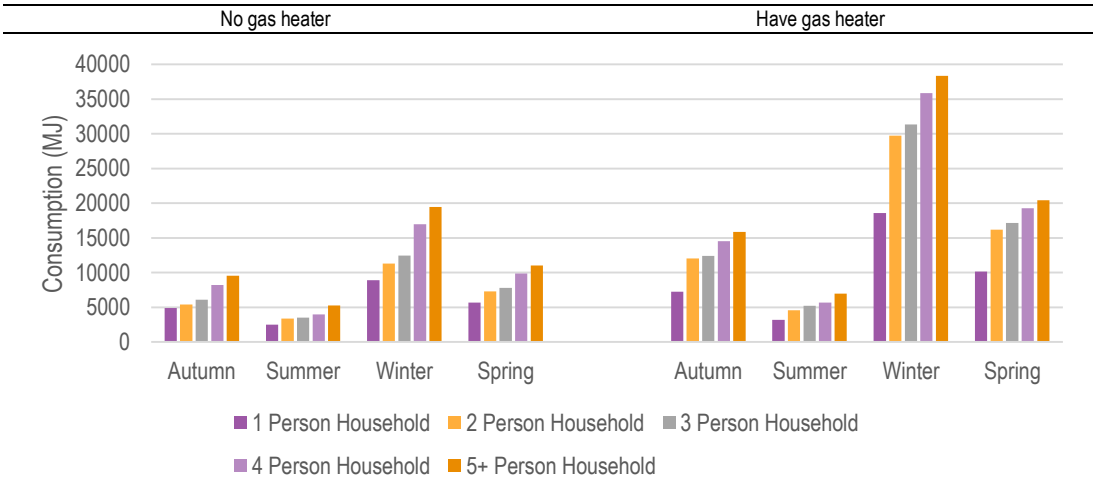
The benchmarks are summarised in Table 6.5 and Figure 6.5.

TABLE 6.5 GAS BENCHMARKS – VICTORIA

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
Without gas heater				
1 Person Household	4890	2490	8909	5662
2 Person Household	5406	3396	11317	7283
3 Person Household	6104	3511	12436	7779
4 Person Household	8229	3977	16951	9865
5+ Person Household	9547	5277	19442	11027
With gas heater				
1 Person Household	7232	3188	18590	10147
2 Person Household	12034	4564	29720	16210
3 Person Household	12418	5225	31332	17170
4 Person Household	14543	5691	35847	19256
5+ Person Household	15861	6991	38338	20417

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.6 GAS BENCHMARKS VICTORIA



SOURCE: ACIL ALLEN CONSULTING

The gas benchmarks in Victoria increase with household size. Regardless of whether or not households have gas heating, the benchmarks are highest in winter.

Households with gas heaters have benchmarks that are substantially higher in winter benchmark. This reflects the time of year which gas heating is predominantly used.

6.2.5 Tasmania

Out of the 298 survey responses from Tasmania, only 14 were matched into the gas sample. The benchmarks for Tasmania are summarised in Table 6.6 and Figure 6.7.

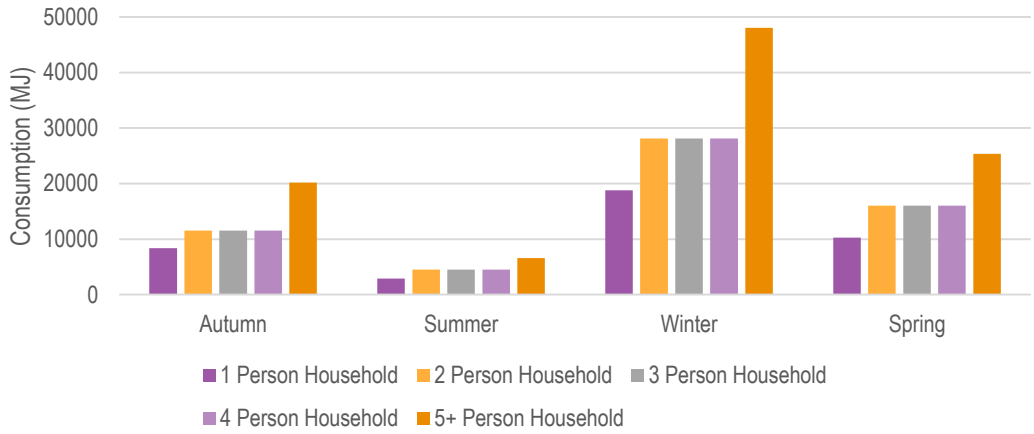
TABLE 6.6 GAS BENCHMARKS – TASMANIA

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
1 Person Household	8354	2926	18768	10255
2 Person Household	11530	4537	28100	16014
3 Person Household*	11530	4537	28100	16014
4 Person Household*	11530	4537	28100	16014
5+ Person Household	20177	6594	48072	25356

* Two, three and four person households were pooled to create benchmarks for Tasmania.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.7 GAS BENCHMARKS TASMANIA



SOURCE: ACIL ALLEN CONSULTING

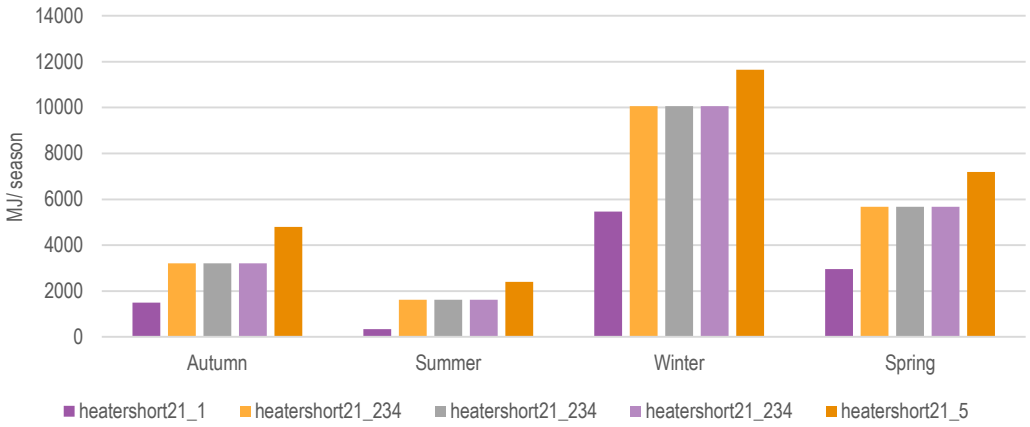
The benchmarks for five or more person households are substantially higher than the others. This may be reflective of the low number of large sized households in Tasmania though without a larger sample we cannot be sure.

6.2.6 South Australia

Out of the 800 survey responses from South Australia, 373 were matched into the gas sample.

The impact of having a gas heater is shown in Figure 6.8. This indicates that: for households with gas heaters, larger households consume more gas than smaller households, on average. Regardless of household size, having gas heating affects gas usage most predominantly in winter relative to other seasons.

FIGURE 6.8 SOUTH AUSTRALIA – IMPACT OF GAS HEATER



SOURCE: ACIL ALLEN CONSULTING

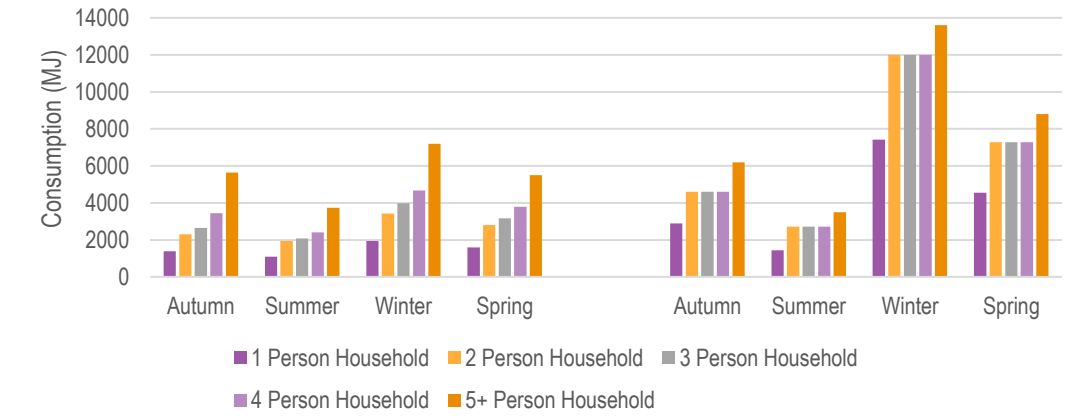
TABLE 6.7 GAS BENCHMARKS – SOUTH AUSTRALIA

	Autumn	Summer	Winter	Spring
	MJ/ season	MJ/ season	MJ/ season	MJ/ season
Without gas heater				
1 Person Household	1393	1092	1948	1604
2 Person Household	2305	1949	3424	2811
3 Person Household	2642	2072	3986	3175
4 Person Household	3442	2414	4673	3792
5+ Person Household	5644	3738	7188	5496
With gas heater				
1 Person Household	2885	1436	7419	4559
2 Person Household	4598	2713	12006	7285
3 Person Household*	4598	2713	12006	7285
4 Person Household*	4598	2713	12006	7285
5+ Person Household	6188	3498	13604	8799

* Two, three and four person households were pooled to create benchmarks for South Australia.

SOURCE: ACIL ALLEN CONSULTING

FIGURE 6.9 GAS BENCHMARKS SOUTH AUSTRALIA



SOURCE: ACIL ALLEN CONSULTING

Interestingly, gas benchmarks are largely similar across seasons for households without gas heating. Having a gas heater has a profound impact to benchmarks in winter relative to the other seasons.

A LOCALISED ZONES – POSTCODE CONCORDANCE

A.1 Localised (climate) zones – all jurisdictions but SA

All starred postcodes had multiple matching climate zones. In these instances, we have allocated the postcode to the smallest number (see section 4.1). For example, if postcode 4321 spans climate zones three, four and five, we have allocated to climate zone 3.

Postcode	State	CZ
800	NT	1
810	NT	1
812	NT	1
815	NT	1
820	NT	1
822	NT	1
828	NT	1
829	NT	1
830	NT	1
832	NT	1
834	NT	1
835	NT	1
836	NT	1
837	NT	1
838	NT	1
839	NT	1
840	NT	1
841	NT	1
845	NT	1
846	NT	1
847	NT	1
850	NT	1
852	NT	3

Postcode	State	CZ
853	NT	1
854	NT	3
860	NT	3
862	NT	3
870	NT	3
872	NT	3
873	NT	3
874	NT	3
875	NT	3
880	NT	1
885	NT	1
886	NT	1
909	NT	1
2000	NSW	5
2006	NSW	5
2007	NSW	5
2008	NSW	5
2009	NSW	5
2010	NSW	5
2011	NSW	5
2015	NSW	5
2016	NSW	5
2017	NSW	5

Postcode	State	CZ
2018	NSW	5
2019	NSW	5
2020*	NSW	5
2021	NSW	5
2022	NSW	5
2023	NSW	5
2024	NSW	5
2025	NSW	5
2026	NSW	5
2027	NSW	5
2028	NSW	5
2029	NSW	5
2030	NSW	5
2031	NSW	5
2032	NSW	5
2033	NSW	5
2034	NSW	5
2035	NSW	5
2036	NSW	5
2037	NSW	5
2038	NSW	5
2039	NSW	5
2040	NSW	5
2041	NSW	5
2042	NSW	5
2043	NSW	5
2044	NSW	5
2045	NSW	5
2046	NSW	5
2047	NSW	5
2048	NSW	5
2049	NSW	5
2050	NSW	5
2052	NSW	5
2060	NSW	5
2061	NSW	5
2062	NSW	5
2063	NSW	5
2064	NSW	5
2065	NSW	5
2066	NSW	5
2067	NSW	5
2068	NSW	5

Postcode	State	CZ
2069	NSW	5
2070	NSW	5
2071	NSW	5
2072	NSW	5
2073	NSW	5
2074	NSW	5
2075	NSW	5
2076	NSW	5
2077	NSW	5
2079	NSW	5
2080	NSW	5
2081	NSW	5
2082	NSW	5
2083	NSW	5
2084	NSW	5
2085	NSW	5
2086	NSW	5
2087	NSW	5
2088	NSW	5
2089	NSW	5
2090	NSW	5
2092	NSW	5
2093	NSW	5
2094	NSW	5
2095	NSW	5
2096	NSW	5
2097	NSW	5
2099	NSW	5
2100	NSW	5
2101	NSW	5
2102	NSW	5
2103	NSW	5
2104	NSW	5
2105	NSW	5
2106	NSW	5
2107	NSW	5
2108	NSW	5
2109	NSW	5
2110	NSW	5
2111	NSW	5
2112	NSW	5
2113	NSW	5
2114*	NSW	5

Postcode	State	CZ
2115	NSW	6
2116	NSW	6
2117	NSW	6
2118	NSW	6
2119*	NSW	6
2120	NSW	5
2121*	NSW	6
2122*	NSW	6
2123	NSW	6
2125*	NSW	5
2126	NSW	5
2127	NSW	6
2128	NSW	6
2129	NSW	5
2130	NSW	5
2131	NSW	5
2132	NSW	5
2133	NSW	5
2134	NSW	5
2135	NSW	5
2136	NSW	5
2137	NSW	5
2138	NSW	5
2139	NSW	5
2140	NSW	5
2141	NSW	6
2142	NSW	6
2143	NSW	6
2144	NSW	6
2145	NSW	6
2146	NSW	6
2147	NSW	6
2148	NSW	6
2150	NSW	6
2151	NSW	6
2152	NSW	6
2153	NSW	6
2154*	NSW	6
2155	NSW	6
2156	NSW	6
2157*	NSW	6
2158	NSW	6
2159*	NSW	6

Postcode	State	CZ
2160	NSW	6
2161	NSW	6
2162	NSW	6
2163	NSW	6
2164	NSW	6
2165	NSW	6
2166	NSW	6
2167	NSW	6
2168	NSW	6
2170	NSW	6
2171	NSW	6
2172	NSW	6
2173	NSW	6
2174	NSW	6
2175	NSW	6
2176	NSW	6
2177	NSW	6
2178	NSW	6
2179	NSW	6
2190	NSW	6
2191	NSW	5
2192	NSW	5
2193	NSW	5
2194	NSW	5
2195	NSW	5
2196*	NSW	6
2197	NSW	6
2198	NSW	6
2199	NSW	6
2200*	NSW	6
2203	NSW	5
2204	NSW	5
2205	NSW	5
2206	NSW	5
2207	NSW	5
2208	NSW	5
2209	NSW	5
2210	NSW	5
2211	NSW	6
2212	NSW	6
2213	NSW	6
2214	NSW	6
2216	NSW	5

Postcode	State	CZ
2217	NSW	5
2218	NSW	5
2219	NSW	5
2220	NSW	5
2221	NSW	5
2222	NSW	5
2223	NSW	5
2224	NSW	5
2225	NSW	5
2226	NSW	5
2227	NSW	5
2228	NSW	5
2229	NSW	5
2230	NSW	5
2231	NSW	5
2232	NSW	5
2233	NSW	5
2234	NSW	5
2250	NSW	5
2251	NSW	5
2256	NSW	5
2257	NSW	5
2258	NSW	5
2259	NSW	5
2260	NSW	5
2261	NSW	5
2262	NSW	5
2263	NSW	5
2264	NSW	5
2265	NSW	5
2267	NSW	5
2278	NSW	5
2280	NSW	5
2281	NSW	5
2282	NSW	5
2283	NSW	5
2284	NSW	5
2285	NSW	5
2286	NSW	5
2287	NSW	5
2289	NSW	5
2290	NSW	5
2291	NSW	5

Postcode	State	CZ
2292	NSW	5
2293	NSW	5
2294	NSW	5
2295	NSW	5
2296	NSW	5
2297	NSW	5
2298	NSW	5
2299	NSW	5
2300	NSW	5
2302	NSW	5
2303	NSW	5
2304	NSW	5
2305	NSW	5
2306	NSW	5
2307	NSW	5
2308	NSW	5
2311*	NSW	5
2312	NSW	5
2314	NSW	5
2315	NSW	5
2316	NSW	5
2317	NSW	5
2318	NSW	5
2319	NSW	5
2320	NSW	5
2321	NSW	5
2322	NSW	5
2323	NSW	5
2324	NSW	5
2325*	NSW	5
2326	NSW	5
2327	NSW	5
2328	NSW	6
2329	NSW	6
2330	NSW	6
2331	NSW	6
2333	NSW	6
2334	NSW	5
2335*	NSW	5
2336	NSW	6
2337	NSW	6
2338*	NSW	4
2339	NSW	4

Postcode	State	CZ
2340	NSW	4
2341	NSW	4
2342	NSW	4
2343	NSW	4
2344	NSW	4
2345	NSW	4
2346	NSW	4
2347	NSW	4
2350*	NSW	7
2351	NSW	7
2352	NSW	4
2353	NSW	4
2354	NSW	6
2355*	NSW	6
2356	NSW	4
2357	NSW	4
2358	NSW	6
2359*	NSW	6
2360	NSW	4
2361	NSW	4
2365*	NSW	7
2369	NSW	4
2370*	NSW	6
2371*	NSW	6
2372*	NSW	5
2379	NSW	4
2380	NSW	4
2381	NSW	4
2382	NSW	4
2386	NSW	4
2387	NSW	4
2388	NSW	4
2390	NSW	4
2395	NSW	4
2396	NSW	4
2397	NSW	4
2398	NSW	4
2399	NSW	4
2400	NSW	4
2401	NSW	4
2402	NSW	4
2403	NSW	4
2404	NSW	4

Postcode	State	CZ
2405	NSW	4
2406*	NSW	4
2408	NSW	4
2409	NSW	4
2410	NSW	4
2411	NSW	4
2415	NSW	5
2420	NSW	5
2421	NSW	5
2422*	NSW	5
2423	NSW	5
2424*	NSW	6
2425	NSW	5
2426	NSW	5
2427	NSW	5
2428	NSW	5
2429	NSW	5
2430	NSW	5
2431	NSW	2
2439	NSW	5
2440	NSW	2
2441*	NSW	2
2443	NSW	5
2444	NSW	5
2445	NSW	5
2446	NSW	5
2447	NSW	2
2448	NSW	2
2449	NSW	2
2450	NSW	2
2452	NSW	2
2453*	NSW	7
2454	NSW	2
2455	NSW	2
2456	NSW	2
2460	NSW	2
2462	NSW	2
2463	NSW	2
2464	NSW	2
2465	NSW	2
2466	NSW	2
2469*	NSW	2
2470	NSW	2

Postcode	State	CZ
2471	NSW	2
2472	NSW	2
2473	NSW	2
2474	NSW	2
2475*	NSW	2
2476*	NSW	2
2477	NSW	2
2478	NSW	2
2479	NSW	2
2480	NSW	2
2481	NSW	2
2482	NSW	2
2483	NSW	2
2484	NSW	2
2485	NSW	2
2486	NSW	2
2487	NSW	2
2488	NSW	2
2489	NSW	2
2490	NSW	2
2500	NSW	5
2502	NSW	5
2505	NSW	5
2506	NSW	5
2508	NSW	5
2515	NSW	5
2516	NSW	5
2517	NSW	5
2518	NSW	5
2519	NSW	5
2522	NSW	5
2525	NSW	5
2526	NSW	5
2527	NSW	5
2528	NSW	5
2529	NSW	5
2530	NSW	5
2533*	NSW	5
2534	NSW	5
2535*	NSW	6
2536	NSW	6
2537	NSW	6
2538	NSW	6

Postcode	State	CZ
2539	NSW	6
2540	NSW	6
2541	NSW	6
2545	NSW	6
2546	NSW	6
2548	NSW	6
2549	NSW	6
2550	NSW	6
2551	NSW	6
2555	NSW	6
2556	NSW	6
2557	NSW	6
2558	NSW	6
2559	NSW	6
2560	NSW	6
2563	NSW	6
2564	NSW	6
2565	NSW	6
2566	NSW	6
2567	NSW	6
2568	NSW	6
2569	NSW	6
2570	NSW	6
2571	NSW	6
2572	NSW	6
2573	NSW	6
2574	NSW	6
2575	NSW	6
2576	NSW	6
2577*	NSW	5
2578	NSW	6
2579*	NSW	7
2580	NSW	7
2581*	NSW	7
2582	NSW	6
2583*	NSW	7
2584	NSW	6
2585	NSW	4
2586*	NSW	6
2587	NSW	4
2588	NSW	4
2590	NSW	4
2594	NSW	4

Postcode	State	CZ
2600	ACT	7
2601	ACT	7
2602	ACT	7
2603	ACT	7
2604	ACT	7
2605	ACT	7
2606	ACT	7
2607	ACT	7
2609	ACT	7
2611	ACT	7
2612	ACT	7
2614	ACT	7
2615	ACT	7
2617	ACT	7
2618	ACT	7
2619	ACT	7
2620	NSW	7
2621*	NSW	7
2622*	NSW	7
2623	NSW	7
2624	NSW	7
2625	NSW	7
2626	NSW	7
2627	NSW	7
2628	NSW	7
2629	NSW	7
2630	NSW	7
2631	NSW	7
2632*	NSW	6
2633	NSW	7
2640*	NSW	4
2641	NSW	4
2642*	NSW	4
2643	NSW	4
2644*	NSW	4
2645	NSW	4
2646	NSW	4
2647	NSW	4
2648	NSW	4
2649	NSW	7
2650	NSW	4
2651	NSW	4
2652*	NSW	4

Postcode	State	CZ
2653	NSW	7
2655	NSW	4
2656	NSW	4
2658	NSW	4
2659	NSW	4
2660	NSW	4
2661	NSW	4
2663	NSW	4
2665	NSW	4
2666	NSW	4
2668	NSW	4
2669	NSW	4
2671	NSW	4
2672	NSW	4
2675	NSW	4
2678	NSW	4
2680	NSW	4
2681	NSW	4
2700	NSW	4
2701	NSW	4
2702	NSW	4
2703	NSW	4
2705	NSW	4
2706	NSW	4
2707	NSW	4
2710	NSW	4
2711	NSW	4
2712	NSW	4
2713	NSW	4
2714	NSW	4
2715	NSW	4
2716	NSW	4
2717	NSW	4
2720	NSW	7
2721	NSW	4
2722*	NSW	4
2725	NSW	4
2726	NSW	6
2727	NSW	4
2729*	NSW	4
2730	NSW	7
2731	NSW	4
2732	NSW	4

Postcode	State	CZ
2733	NSW	4
2734	NSW	4
2735	NSW	4
2736	NSW	4
2737	NSW	4
2738	NSW	4
2739	NSW	4
2745	NSW	6
2747	NSW	6
2748	NSW	6
2749	NSW	6
2750	NSW	6
2752	NSW	6
2753	NSW	6
2754	NSW	6
2755	NSW	6
2756	NSW	6
2757	NSW	6
2758	NSW	6
2759	NSW	6
2760	NSW	6
2761	NSW	6
2762	NSW	6
2763	NSW	6
2765	NSW	6
2766	NSW	6
2767	NSW	6
2768	NSW	6
2769	NSW	6
2770	NSW	6
2773	NSW	6
2774	NSW	6
2775*	NSW	6
2776	NSW	6
2777	NSW	6
2778	NSW	6
2779	NSW	6
2780	NSW	6
2782	NSW	6
2783	NSW	6
2784	NSW	6
2785*	NSW	6
2786*	NSW	6

Postcode	State	CZ
2787*	NSW	7
2790*	NSW	6
2791	NSW	7
2792*	NSW	7
2793	NSW	4
2794	NSW	4
2795*	NSW	7
2797	NSW	7
2798*	NSW	7
2799*	NSW	7
2800*	NSW	7
2803	NSW	4
2804	NSW	4
2805	NSW	4
2806	NSW	4
2807	NSW	4
2808*	NSW	4
2809	NSW	4
2810	NSW	4
2817	NSW	4
2818	NSW	4
2820	NSW	4
2821	NSW	4
2822	NSW	4
2823	NSW	4
2824	NSW	4
2825	NSW	4
2826	NSW	4
2827	NSW	4
2828	NSW	4
2829	NSW	4
2830	NSW	4
2831	NSW	4
2832	NSW	4
2833	NSW	4
2834	NSW	4
2835	NSW	4
2836	NSW	4
2838	NSW	4
2839	NSW	4
2840	NSW	4
2842	NSW	4
2843	NSW	4

Postcode	State	CZ
2844	NSW	6
2845	NSW	7
2846*	NSW	7
2847	NSW	7
2848	NSW	6
2849*	NSW	7
2850*	NSW	7
2852*	NSW	4
2864	NSW	4
2865	NSW	4
2866	NSW	4
2867	NSW	4
2868	NSW	4
2869	NSW	4
2870	NSW	4
2871	NSW	4
2873	NSW	4
2874	NSW	4
2875	NSW	4
2876	NSW	4
2877	NSW	4
2878	NSW	4
2879	NSW	4
2880	NSW	4
2898	NSW	5
2899	NSW	5
2900	ACT	7
2902	ACT	7
2903	ACT	7
2904	ACT	7
2905	ACT	7
2906	ACT	7
2911	ACT	7
2912	ACT	7
2913	ACT	7
2914	ACT	7
3000	VIC	6
3002	VIC	6
3003	VIC	6
3004	VIC	6
3005	VIC	6
3006	VIC	6
3008	VIC	6

Postcode	State	CZ
3010	VIC	6
3011	VIC	6
3012	VIC	6
3013	VIC	6
3015	VIC	6
3016	VIC	6
3018	VIC	6
3019	VIC	6
3020	VIC	6
3021	VIC	6
3022	VIC	6
3023	VIC	6
3024	VIC	6
3025	VIC	6
3026	VIC	6
3027	VIC	6
3028	VIC	6
3029	VIC	6
3030	VIC	6
3031	VIC	6
3032	VIC	6
3033	VIC	6
3034	VIC	6
3036	VIC	6
3037	VIC	6
3038	VIC	6
3039	VIC	6
3040	VIC	6
3041	VIC	6
3042	VIC	6
3043	VIC	6
3044	VIC	6
3045	VIC	6
3046	VIC	6
3047	VIC	6
3048	VIC	6
3049	VIC	6
3050	VIC	6
3051	VIC	6
3052	VIC	6
3053	VIC	6
3054	VIC	6
3055	VIC	6

Postcode	State	CZ
3056	VIC	6
3057	VIC	6
3058	VIC	6
3059	VIC	6
3060	VIC	6
3061	VIC	6
3062	VIC	6
3063	VIC	6
3064	VIC	6
3065	VIC	6
3066	VIC	6
3067	VIC	6
3068	VIC	6
3070	VIC	6
3071	VIC	6
3072	VIC	6
3073	VIC	6
3074	VIC	6
3075	VIC	6
3076	VIC	6
3078	VIC	6
3079	VIC	6
3081	VIC	6
3082	VIC	6
3083	VIC	6
3084	VIC	6
3085	VIC	6
3086	VIC	6
3087	VIC	6
3088	VIC	6
3089	VIC	6
3090	VIC	6
3091	VIC	6
3093	VIC	6
3094	VIC	6
3095	VIC	6
3096	VIC	6
3097	VIC	6
3099	VIC	6
3101	VIC	6
3102	VIC	6
3103	VIC	6
3104	VIC	6

Postcode	State	CZ
3105	VIC	6
3106	VIC	6
3107	VIC	6
3108	VIC	6
3109	VIC	6
3111	VIC	6
3113	VIC	6
3114	VIC	6
3115	VIC	6
3116*	VIC	7
3121	VIC	6
3122	VIC	6
3123	VIC	6
3124	VIC	6
3125	VIC	6
3126	VIC	6
3127	VIC	6
3128	VIC	6
3129	VIC	6
3130	VIC	6
3131	VIC	6
3132	VIC	6
3133	VIC	6
3134	VIC	6
3135	VIC	6
3136	VIC	6
3137*	VIC	6
3138	VIC	7
3139*	VIC	6
3140	VIC	7
3141	VIC	6
3142	VIC	6
3143	VIC	6
3144	VIC	6
3145	VIC	6
3146	VIC	6
3147	VIC	6
3148	VIC	6
3149	VIC	6
3150	VIC	6
3151	VIC	6
3152	VIC	6
3153	VIC	6

Postcode	State	CZ
3154	VIC	6
3155	VIC	6
3156*	VIC	7
3158	VIC	7
3159	VIC	7
3160	VIC	7
3161	VIC	6
3162	VIC	6
3163	VIC	6
3165	VIC	6
3166	VIC	6
3167	VIC	6
3168	VIC	6
3169	VIC	6
3170	VIC	6
3171	VIC	6
3172	VIC	6
3173	VIC	6
3174	VIC	6
3175	VIC	6
3177	VIC	6
3178	VIC	6
3179	VIC	6
3180	VIC	6
3181	VIC	6
3182	VIC	6
3183	VIC	6
3184	VIC	6
3185	VIC	6
3186	VIC	6
3187	VIC	6
3188	VIC	6
3189	VIC	6
3190	VIC	6
3191	VIC	6
3192	VIC	6
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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3381*	VIC	7
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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Postcode	State	CZ
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4720	QLD	3
4721*	QLD	3
4722	QLD	3
4723	QLD	3
4724	QLD	3
4725	QLD	3
4726	QLD	3
4727	QLD	3
4728	QLD	3
4730	QLD	3
4731	QLD	3
4732	QLD	3
4733	QLD	3
4735	QLD	3
4736	QLD	3
4737	QLD	2
4738	QLD	2
4739	QLD	2
4740	QLD	2
4741*	QLD	1
4742	QLD	2
4743	QLD	2
4744	QLD	2
4745*	QLD	2
4746	QLD	2
4750	QLD	2
4751	QLD	2
4753	QLD	2
4754	QLD	2
4756	QLD	2
4757	QLD	2
4798	QLD	2
4799	QLD	2
4800*	QLD	1
4801	QLD	1
4802	QLD	1
4803	QLD	1

Postcode	State	CZ
4804	QLD	1
4805	QLD	1
4806	QLD	1
4807	QLD	1
4808	QLD	1
4809	QLD	1
4810	QLD	1
4811	QLD	1
4812	QLD	1
4813	QLD	1
4814	QLD	1
4815	QLD	1
4816*	QLD	3
4817*	QLD	1
4818	QLD	1
4819	QLD	1
4820*	QLD	3
4821	QLD	3
4822*	QLD	1
4823*	QLD	1
4824*	QLD	1
4825	QLD	3
4828	QLD	3
4829	QLD	3
4830	QLD	1
4849	QLD	1
4850*	QLD	3
4852	QLD	1
4854	QLD	1
4855	QLD	1
4856	QLD	1
4857	QLD	1
4858	QLD	1
4859	QLD	1
4860	QLD	1
4861	QLD	1
4865	QLD	1
4868	QLD	1
4869	QLD	1
4870	QLD	1
4871	QLD	1
4872	QLD	1
4873	QLD	1

Postcode	State	CZ
4874	QLD	1
4875	QLD	1
4876	QLD	1
4877	QLD	1
4878	QLD	1
4879	QLD	1
4880	QLD	1
4881	QLD	1
4882	QLD	1
4883	QLD	1
4884	QLD	1
4885	QLD	1
4886	QLD	1
4887	QLD	1
4888	QLD	1
4890	QLD	1
4891	QLD	1
4892	QLD	1
4895	QLD	1
7000	TAS	7
7001	TAS	7
7004	TAS	7
7005	TAS	7
7007	TAS	7
7008	TAS	7
7009	TAS	7
7010	TAS	7
7011	TAS	7
7012	TAS	7
7015	TAS	7
7016	TAS	7
7017	TAS	7
7018	TAS	7
7019	TAS	7
7020	TAS	7
7021	TAS	7
7022	TAS	7
7023	TAS	7
7024	TAS	7
7025	TAS	7
7026	TAS	7
7027	TAS	7
7030	TAS	7

Postcode	State	CZ
7050	TAS	7
7052	TAS	7
7053	TAS	7
7054	TAS	7
7055	TAS	7
7109	TAS	7
7112	TAS	7
7113	TAS	7
7116	TAS	7
7117	TAS	7
7119	TAS	7
7120	TAS	7
7139	TAS	7
7140	TAS	7
7150	TAS	7
7155	TAS	7
7162	TAS	7
7163	TAS	7
7170	TAS	7
7171	TAS	7
7172	TAS	7
7173	TAS	7
7174	TAS	7
7175	TAS	7
7176	TAS	7
7177	TAS	7
7178	TAS	7
7179	TAS	7
7180	TAS	7
7182	TAS	7
7183	TAS	7
7184	TAS	7
7185	TAS	7
7186	TAS	7
7187	TAS	7
7190	TAS	7
7209	TAS	7
7210	TAS	7
7211	TAS	7
7212	TAS	7
7213	TAS	7
7214	TAS	7
7215	TAS	7

Postcode	State	CZ
7216	TAS	7
7248	TAS	7
7249	TAS	7
7250	TAS	7
7252	TAS	7
7253	TAS	7
7254	TAS	7
7255	TAS	7
7256	TAS	7
7257	TAS	7
7258	TAS	7
7259	TAS	7
7260	TAS	7
7261	TAS	7
7262	TAS	7
7263	TAS	7
7264	TAS	7
7265	TAS	7
7267	TAS	7
7268	TAS	7
7270	TAS	7
7275	TAS	7
7276	TAS	7
7277	TAS	7
7290	TAS	7
7291	TAS	7
7292	TAS	7
7300	TAS	7
7301	TAS	7
7302	TAS	7
7303	TAS	7
7304	TAS	7
7305	TAS	7
7306	TAS	7
7307	TAS	7
7310	TAS	7
7315	TAS	7
7316	TAS	7
7320	TAS	7
7321	TAS	7
7322	TAS	7
7325	TAS	7
7330	TAS	7

Postcode	State	CZ
7331	TAS	7
7466	TAS	7
7467	TAS	7

Postcode	State	CZ
7468	TAS	7
7469	TAS	7
7470	TAS	7

A.2 Localised zones for SA

Postcode	Localised zone	CZ
5000	Adelaide & Environs	5
5005	Adelaide & Environs	5
5006	Adelaide & Environs	5
5007	Adelaide & Environs	5
5008	Adelaide & Environs	5
5009	Adelaide & Environs	5
5010	Adelaide & Environs	5
5011	Adelaide & Environs	5
5012	Adelaide & Environs	5
5013	Adelaide & Environs	5
5014	Adelaide & Environs	5
5015	Adelaide & Environs	5
5016	Adelaide & Environs	5
5017	Adelaide & Environs	5
5018	Adelaide & Environs	5
5019	Adelaide & Environs	5
5020	Adelaide & Environs	5
5021	Adelaide & Environs	5

Postcode	Localised zone	CZ
5022	Adelaide & Environs	5
5023	Adelaide & Environs	5
5024	Adelaide & Environs	5
5025	Adelaide & Environs	5
5031	Adelaide & Environs	5
5032	Adelaide & Environs	5
5033	Adelaide & Environs	5
5034	Adelaide & Environs	5
5035	Adelaide & Environs	5
5037	Adelaide & Environs	5
5038	Adelaide & Environs	5
5039	Adelaide & Environs	5
5040	Adelaide & Environs	5
5041	Adelaide & Environs	5
5042	Adelaide & Environs	5
5043	Adelaide & Environs	5
5044	Adelaide & Environs	5
5045	Adelaide & Environs	5

Postcode	Localised zone	CZ
5046	Adelaide & Environs	5
5047	Adelaide & Environs	5
5048	Adelaide & Environs	5
5049	Adelaide & Environs	5
5050	Adelaide & Environs	5
5051	Adelaide & Environs	5
5052	Adelaide & Environs	5
5061	Adelaide & Environs	5
5062	Adelaide & Environs	5
5063	Adelaide & Environs	5
5064	Adelaide & Environs	5
5065	Adelaide & Environs	5
5066	Adelaide & Environs	5
5067	Adelaide & Environs	5
5068	Adelaide & Environs	5
5069	Adelaide & Environs	5
5070	Adelaide & Environs	5
5072	Adelaide & Environs	5
5073	Adelaide & Environs	5
5074	Adelaide & Environs	5
5075	Adelaide & Environs	5
5076	Adelaide & Environs	5
5081	Adelaide & Environs	5
5082	Adelaide & Environs	5

Postcode	Localised zone	CZ
5083	Adelaide & Environs	5
5084	Adelaide & Environs	5
5085	Adelaide & Environs	5
5086	Adelaide & Environs	5
5087	Adelaide & Environs	5
5088	Adelaide & Environs	5
5089	Adelaide & Environs	5
5090	Adelaide & Environs	5
5091	Adelaide & Environs	5
5092	Adelaide & Environs	5
5093	Adelaide & Environs	5
5094	Adelaide & Environs	5
5095	Adelaide & Environs	5
5096	Adelaide & Environs	5
5097	Adelaide & Environs	5
5098	Adelaide & Environs	5
5106	Adelaide & Environs	5
5107	Adelaide & Environs	5
5108	Adelaide & Environs	5
5109	Adelaide & Environs	5
5110	Adelaide & Environs	5
5111	Adelaide & Environs	5
5112	Adelaide & Environs	5
5113	Adelaide & Environs	5

Postcode	Localised zone	CZ
5114	Adelaide & Environs	5
5115	Adelaide & Environs	5
5116	Adelaide & Environs	5
5117	Adelaide & Environs	5
5118	Adelaide & Environs	5
5120	Adelaide & Environs	5
5121	Adelaide & Environs	5
5125	Adelaide & Environs	5
5126	Adelaide & Environs	5
5127	Adelaide & Environs	5
5131	Adelaide & Environs	5
5132	Adelaide & Environs	6
5133	Adelaide & Environs	6
5134	Adelaide & Environs	6
5136	Adelaide & Environs	6
5137	Mt Lofty Ranges	6
5138	Mt Lofty Ranges	6
5139	Mt Lofty Ranges	6
5140	Mt Lofty Ranges	6
5141	Mt Lofty Ranges	6
5142	Mt Lofty Ranges	6
5144	Mt Lofty Ranges	6
5150	Mt Lofty Ranges	5
5151	Mt Lofty Ranges	6
5152	Mt Lofty Ranges	5
5153	Mt Lofty Ranges	5
5154	Mt Lofty Ranges	6
5155	Mt Lofty Ranges	6
5156	Mt Lofty Ranges	5
5157	Adelaide & Environs	5
5158	Adelaide & Environs	5
5159	Adelaide & Environs	5
5160	Adelaide & Environs	5
5161	Adelaide & Environs	5
5162	Adelaide & Environs	5
5163	Adelaide & Environs	5
5164	Adelaide & Environs	5
5165	Adelaide & Environs	5
5166	Adelaide & Environs	5
5167	Adelaide & Environs	5
5168	Adelaide & Environs	5
5169	Adelaide & Environs	5
5170	Adelaide & Environs	5
5171	Adelaide & Environs	5
5172	Adelaide & Environs	5
5173	Adelaide & Environs	5
5174	Adelaide & Environs	5
5201	Adelaide & Environs	6

Postcode	Localised zone	CZ
5202	Adelaide & Environs	6
5203	Adelaide & Environs	6
5204	Adelaide & Environs	6
5210	Adelaide & Environs	6
5211	Adelaide & Environs	6
5212	Adelaide & Environs	6
5213	Adelaide & Environs	6
5214	Adelaide & Environs	6
5220	Yorke Peninsula & Kangaroo Island	6
5221	Yorke Peninsula & Kangaroo Island	6
5222	Yorke Peninsula & Kangaroo Island	6
5223	Yorke Peninsula & Kangaroo Island	6
5231	Adelaide & Environs	6
5232	Adelaide & Environs	6
5233	Mt Lofty Ranges	6
5234	Mt Lofty Ranges	5
5235	Mt Lofty Ranges	5
5236	Mt Lofty Ranges	5
5237	Mt Lofty Ranges	5
5238	Murraylands & Riverland	5
5240	Mt Lofty Ranges	6

Postcode	Localised zone	CZ
5241	Mt Lofty Ranges	6
5242	Mt Lofty Ranges	6
5243	Mt Lofty Ranges	6
5244	Mt Lofty Ranges	5
5245	Mt Lofty Ranges	6
5250	Mt Lofty Ranges	6
5251	Mt Lofty Ranges	6
5252	Mt Lofty Ranges	6
5253	Adelaide & Environs	6
5254	Adelaide & Environs	5
5255	Mt Lofty Ranges	6
5256	Mt Lofty Ranges	6
5259	Murraylands & Riverland	6
5260	Murraylands & Riverland	6
5261	South East	6
5262	South East	6
5263	South East	6
5264	South East	6
5265	South East	6
5266	South East	6
5267	South East	6
5268	South East	6
5269	South East	6
5270	South East	6
5271	South East	6
5272	South East	6
5273	South East	6
5275	South East	6
5276	South East	6
5277	South East	6
5278	South East	6
5279	South East	6

Postcode	Localised zone	CZ
5280	South East	6
5290	South East	6
5291	South East	6
5301	Murraylands & Riverland	6
5302	Murraylands & Riverland	6
5303	Murraylands & Riverland	6
5304	Murraylands & Riverland	5
5306	Murraylands & Riverland	6
5307	Murraylands & Riverland	6
5308	Murraylands & Riverland	5
5309	Murraylands & Riverland	6
5310	Murraylands & Riverland	5
5311	Murraylands & Riverland	5
5320	Murraylands & Riverland	5
5321	Murraylands & Riverland	5
5322	Murraylands & Riverland	5
5330	Murraylands & Riverland	5
5331	Murraylands & Riverland	5
5332	Murraylands & Riverland	5
5333	Murraylands & Riverland	5
5340	Murraylands & Riverland	4
5341	Murraylands & Riverland	5
5342	Murraylands & Riverland	5
5343	Murraylands & Riverland	5
5344	Murraylands & Riverland	5
5345	Murraylands & Riverland	5
5346	Murraylands & Riverland	5
5350	Adelaide & Environs	6
5351	Adelaide & Environs	6
5352	Adelaide & Environs	6
5353	Mt Lofty Ranges	5
5354	Murraylands & Riverland	5
5355	Mt Lofty Ranges	6
5356	Mt Lofty Ranges	5
5357	Murraylands & Riverland	5
5360	Adelaide & Environs	6
5371	Adelaide & Environs	6
5372	Adelaide & Environs	6
5373	Mid North	6
5374	Mid North	5
5381	Central North	6
5400	Adelaide & Environs	6
5401	Mid North	5
5410	Mid North	6
5411	Mid North	6
5412	Mid North	6
5413	Mid North	6
5414	Mid North	6
5415	Mid North	6
5416	Mid North	6
5417	Mid North	6
5418	Central North	6
5419	Central North	6
5420	Central North	6
5421	Central North	6
5422	Port Augusta & Pastoral	5
5431	Mid North	5
5432	Mid North	5

Postcode	Localised zone	CZ
5433	Port Augusta & Pastoral	5
5434	Port Augusta & Pastoral	5
5440	Port Augusta & Pastoral	4
5451	Mid North	6
5452	Mid North	6
5453	Mid North	5
5454	Mid North	6
5455	Mid North	6
5460	Mid North	5
5461	Mid North	5
5462	Mid North	5
5464	Mid North	4
5470	Mid North	6
5471	Mid North	6
5472	Mid North	6
5473	Mid North	6
5480	Central North	5
5481	Central North	5
5482	Central North	5
5483	Central North	5
5485	Central North	5
5490	Central North	6
5491	Central North	6
5493	Central North	5
5495	Central North	5
5501	Central North	5
5502	Central North	5
5510	Central North	5
5520	Central North	5
5521	Central North	4
5522	Central North	4
5523	Central North	4
5540	Central North	4
5550	Central North	5
5552	Central North	5
5554	Yorke Peninsula & Kangaroo Island	5
5555	Central North	4
5556	Yorke Peninsula & Kangaroo Island	5
5558	Yorke Peninsula & Kangaroo Island	5
5560	Central North	5
5570	Yorke Peninsula & Kangaroo Island	5
5571	Yorke Peninsula & Kangaroo Island	5
5572	Yorke Peninsula & Kangaroo Island	5
5573	Yorke Peninsula & Kangaroo Island	5
5575	Yorke Peninsula & Kangaroo Island	5
5576	Yorke Peninsula & Kangaroo Island	5
5577	Yorke Peninsula & Kangaroo Island	5
5580	Yorke Peninsula & Kangaroo Island	5
5581	Yorke Peninsula & Kangaroo Island	5
5582	Yorke Peninsula & Kangaroo Island	5
5583	Yorke Peninsula & Kangaroo Island	5
5600	Eastern Eyre	4

Postcode	Localised zone	CZ
5601	Eastern Eyre	5
5602	Eastern Eyre	5
5603	Eastern Eyre	5
5604	Eastern Eyre	5
5605	Eastern Eyre	5
5606	Eastern Eyre	5
5607	Eastern Eyre	5
5608	Eastern Eyre	4
5609	Eastern Eyre	4
5630	West Coast	5
5631	West Coast	5
5632	West Coast	5
5633	West Coast	5
5640	West Coast	5
5641	West Coast	5
5642	West Coast	5
5650	Port Augusta & Pastoral	5
5651	Port Augusta & Pastoral	5
5652	Port Augusta & Pastoral	5
5653	Port Augusta & Pastoral	5
5654	Port Augusta & Pastoral	5
5655	Port Augusta & Pastoral	5
5660	Port Augusta & Pastoral	5
5661	West Coast	5
5670	West Coast	5
5671	West Coast	5
5680	West Coast	5
5690	West Coast	4

Postcode	Localised zone	CZ
5700	Port Augusta & Pastoral	4
5701	Central North	5
5710	Port Augusta & Pastoral	4
5713	Port Augusta & Pastoral	4
5715	Port Augusta & Pastoral	4
5717	Port Augusta & Pastoral	4
5719	Port Augusta & Pastoral	4
5720	Port Augusta & Pastoral	4
5722	Port Augusta & Pastoral	4
5725	Port Augusta & Pastoral	4
5730	Port Augusta & Pastoral	4
5950	Adelaide & Environs	5
5000	Adelaide & Environs	5
5005	Adelaide & Environs	5
5006	Adelaide & Environs	5
5007	Adelaide & Environs	5
5008	Adelaide & Environs	5
5009	Adelaide & Environs	5
5010	Adelaide & Environs	5

B DETAILED BENCHMARK MODELS

This appendix contains the initial model specification for each climate zone model, to which additional variables were tested and added (in line with the methodology described in chapter 4.

B.1 Electricity benchmarks

The baseline household size and geographic models used in each of the climate zone equations for electricity are shown below.

— In climate zones 1 and 3, including Northern Territory and Queensland:

$$Cons_i = \beta_1 \times QLDhh_{1,i} + \beta_2 \times QLDhh_{2,i} + \beta_3 \times QLDhh_{3,i} + \beta_4 \times QLDhh_{4,5i} + \beta_5 \times hh_{4,i} + \beta_6 \times hh_{5,i} + \beta_7 \times QLD_i \times CZ_3 \times hh_{1,2,i} + \epsilon_i \quad (4)$$

— In climate zone two, including New South Wales and Victoria:

$$Cons_i = \beta_1 * hh_1 + \beta_2 * hh_2 + \beta_3 * hh_3 + \beta_4 * hh_4 + \beta_5 * hh_5 + \beta_6 * NSWhh_1 + \beta_7 * NSWhh_2 + \beta_8 * NSWhh_3 + \beta_9 * NSWhh_{4,5} + \epsilon_i \quad (5)$$

— In climate zone four, including New South Wales, South Australia and Victoria:

$$Cons_i = \beta_1 * hh_1 + \beta_2 * hh_2 + \beta_3 * hh_3 + \beta_4 * hh_4 + \beta_5 * hh_5 + \beta_6 * NSWhh_1 + \beta_7 * NSWhh_2 + \beta_8 * NSWhh_3 + \beta_9 * NSWhh_{4,5} + \beta_{11} * SA_i + \epsilon_i \quad (6)$$

— In climate zone five, including New South Wales, South Australia and Queensland:

$$Cons_i = \beta_1 * hh_1 + \beta_2 * hh_2 + \beta_3 * hh_3 + \beta_4 * hh_4 + \beta_5 * hh_5 + \beta_6 * SAhh_1 + \beta_7 * SAhh_2 + \beta_8 * SAhh_3 + \beta_9 * SAhh_4 + \beta_{10} * SAhh_5 + \beta_{11} * QLDhh_1 + \beta_{12} * QLDhh_2 + \beta_{13} * QLDhh_{3,4,5} + \epsilon_i \quad (7)$$

— In climate zone six, including New South Wales, South Australia and Victoria:

$$Cons_i = \beta_1 * hh_1 + \beta_2 * hh_2 + \beta_3 * hh_3 + \beta_4 * hh_4 + \beta_5 * hh_5 + \beta_6 * SAhh_1 + \beta_7 * SAhh_2 + \beta_8 * SAhh_3 + \beta_9 * SAhh_{4,5} + \beta_{10} * NSWhh_1 + \beta_{11} * NSWhh_2 + \beta_{12} * NSWhh_3 + \beta_{13} * NSWhh_4 + \beta_{14} * NSWhh_5 + \epsilon_i \quad (8)$$

— In climate zone seven, including New South Wales, Australian Capital Territory, Tasmania and Victoria:

$$Cons_i = \beta_1 * hh_1 + \beta_2 * hh_2 + \beta_3 * hh_3 + \beta_4 * hh_4 + \beta_5 * hh_5 + \beta_6 * TAShh_1 + \beta_7 * TAShh_2 + \beta_8 * TAShh_3 + \beta_9 * TAShh_4 + \beta_{10} * TAShh_5 * \beta_{11} * NSWACThh_1 + \beta_{12} * NSWACThh_2 + \beta_{13} * NSWACThh_3 + \beta_{14} * NSWACThh_4 + \beta_{15} * NSWACThh_5 + \beta_{16} * ACThh_1 + \beta_{17} * ACThh_2 + \beta_{18} * ACThh_{3,4,5} + \epsilon_i \quad (9)$$

Where:

— hh_k is an indicator variable for households of size k

— $XXhh_k$ is an indicator variable for households of size k in jurisdiction XX

— CZn_i is an indicator variable denoting that person *I* lives in Climate Zone *n*

— β_l are parameters estimating using weighted least squares regression.

B.2 Gas benchmarks

The baseline household size and geographic models used for each of the jurisdictional gas equations are shown below.

— Queensland:

$$Cons_i = hh_1 * \beta_1 + hh_2 * \beta_2 + hh_3 * \beta_3 + hh_4 * \beta_4 + hh_5 * \beta_5 + \epsilon_i$$

— New South Wales:

$$Cons_i = hh_1 * \beta_1 + hh_{2,3} * \beta_2 + hh_{4,5} * \beta_3 + \epsilon_i$$

— Australian Capital Territory:

$$Cons_i = hh_1 * \beta_1 + hh_2 * \beta_2 + hh_{3,4} * \beta_3 + \epsilon_i$$

— Victoria:

$$Cons_i = hh_1 * \beta_1 + hh_2 * \beta_2 + hh_3 * \beta_3 + hh_4 * \beta_4 + hh_5 * \beta_5 + \epsilon_i$$

— Tasmania:

$$Cons_i = hh_1 * \beta_1 + hh_2 * \beta_2 + hh_{3,4} * \beta_3 + \epsilon_i$$

— South Australia

$$Cons_i = hh_1 * \beta_1 + hh_2 * \beta_2 + hh_3 * \beta_3 + hh_4 * \beta_4 + hh_5 * \beta_5 + \epsilon_i$$

Where:

— hh_k is an indicator variable for households of size k

— β_l are parameters estimating using weighted least squares regression.

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